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Grower Summary

Headline

- Over the two years of the trial to evaluate fungicides to control apple canker Bavistin (carbendazim) and Octave (prochloraz) were the most effective fungicides.
- Elvaron Multi (tollyfluanid) and Folicur (tebuconazole) were also effective but not as consistent in controlling canker in the trial.

Background and expected deliverables

Canker, caused by the fungus *Nectria galligena*, is one of the most important diseases of apple and pear. The fungus attacks trees in the orchard, causing cankers and die back of young shoots, resulting in loss of fruiting wood and increasing pruning costs. Apple canker can be particularly damaging in young orchards where, in some years, up to 10% of trees can be lost annually in the first few years of orchard establishment as a result of trunk cankers. *Nectria* also causes a fruit rot that can result in significant losses as high as 10% or more in stored fruit. *Nectria* rot, which is often at the fruit stalk end, is also difficult to spot on the grading line but becomes obvious during marketing leading to rejection of fruit consignments.

The fungus produces two spore types, conidia in the spring and summer and ascospores in the autumn and winter. These enter shoots and branches on the tree through wounds, either natural such as bud-scale scars, leaf scars, fruit scars or artificial such as pruning wounds. Thus inoculum and points of entry on the tree are available all year round and the only limiting factor is rain, which is essential for spore production, spread, germination and infection. Autumn leaf fall is usually the main infection period and wet autumns are usually followed by a high incidence of shoot dieback due to canker the following spring and summer.

Currently canker is controlled by a combination of cultural methods to remove canker lesions and the use of protectant fungicides. Effective fungicides are limited. Generally copper fungicides are used at autumn leaf fall and before budburst to protect leaf scars and bud-scale scars whereas carbendazim is applied during the spring and summer. Both products are effective but have undesirable side effects on earthworms and there are also public concerns about their safety. Other products such the scab fungicides captan, dithianon and dodine are known to give some control of canker, but are not as effective as carbendazim.

Recent research funded by Defra has confirmed that *Nectria* spores can spread from orchard to orchard and initiate new canker outbreaks in young orchards. However, it also showed that the nursery could be a source of canker in new orchards, the significance of this source being dependent on the nursery supplying the trees and the weather conditions in the year in which the trees were raised. This research may eventually lead to new solutions for canker but there is a need in the short term to identify other fungicides that may be effective against canker.

The expected deliverables from this work include:

- An evaluation of the efficacy of new fungicides for control of *Nectria* canker.
- An indication of whether these treatments are likely to provide a viable alternative to existing fungicides for control of *Nectria* and are therefore worth pursuing with PSD for registration or Off label Approval.
- More successful control of *Nectria* canker, particularly in the autumn. This may lead to reduced fungicide inputs in the growing season, particularly during the post blossom period when, in high canker risk orchards, fungicides are applied to protect fruit from *Nectria* infection.

Summary of project and main conclusions

In 2002 in a replicated small plot orchard experiment in a cankered orchard of Gala apples the efficacy of seven fungicides in controlling canker was compared (Table 1). Cuprokylt FL and Bavistin and an untreated control were included as standards. Treatments were applied post harvest in the autumn on three occasions, at 10%, 50% and 90% leaf fall. The number of new cankers on the trees was recorded the following autumn (2003). Despite favourable wet weather for the spread and infection of *Nectria* canker in autumn 2002 the incidence of new cankers on extension growth in 2003 was very low and sporadic, with a mean of less than 3 new cankers per plot being recorded in untreated control plots (Table 1). Bavistin (carbendazim), Octave (prochloraz) and Unix (cyprodonil) were the most effective fungicides in controlling canker, with significantly fewer new cankers recorded in plots treated with these products compared to the untreated control.

The trial was repeated in autumn 2003 in the same Gala orchard but using different plots. Canker incidence was assessed in autumn 2004. Weather was again favourable for canker spread, infection and development and the incidence of new cankers in the plots much greater than in 2003, with a mean of 15 cankers recorded in untreated plots (Table 1). Bavistin (carbendazim) and Octave (prochloraz) were the most effective fungicides in controlling canker, with significantly fewer cankers recorded in plots treated with these products. Elvaron Multi (tolylfluanid) and Folicur (tebuconazole) were also effective. Unix (cyprodonil), which had been effective in 2003, was completely ineffective.

- Over the two seasons of the trial Bavistin and Octave were the most consistently effective products in controlling canker, resulting in the least numbers of new cankers.
- Elvaron Multi and Folicur were also effective.
- Cuprokylt FL (copper oxychloride), which is the standard product used for canker control at autumn leaf fall, appeared to be only partially effective in these two trials. However, following commercial practise all treatments were applied at 500L/ha spray volume and the Cuprokylt was therefore only applied to plots at 50% of the recommended dose of 5L/1000L/ha.

- Serenade (*Bacillus subtilis*) was ineffective in controlling canker in both years.
- Bavistin is no longer available but other carbendazim products are still recommended for use on apples eg Occidor.
- Octave and Folicur are not recommended for use on apple. Octave would require a SOLA. A SOLA application for use of Folicur on apple is in progress.
- Elvaron Multi is recommended for use on apple.

Table 1: Fungicide treatments evaluated for canker control in 2003 and 2004 and mean numbers of new cankers per plot recorded (adjusted for numbers of existing cankers in the plots) in the autumn following treatment

Fungicide product	Active Ingredient	Product rate/ha	Trial 1 Mean no new cankers per plot Oct 2003	Trial 2 Mean no new cankers per plot Oct 2004
1 Untreated	-	-	2.8	15.1
2 Bavistin	carbendazim	1.1kg	<0.01	0.2
3 Cuprokylt FL	copper oxychloride	5L/1000L water	0.7	5.5
4 Elvaron Multi	tolylfluanid	2.25kg	1.0	3.6
5 Folicur	tebuconazole	1.0L	0.4	3.7
6 Unix	cyprodonil	0.5kg	<0.01	19.4
7 Flamenco	fluquinconazole	1.25L	2.3	-
8 Octave	prochloraz Mn	1kg	0	1.2
9 Serenade	*Bacillus subtilis*	8.8kg	2.6	15.4
10 Leaf Fall + Cuprokylt FL	copper masquolate + copper oxychloride	10L/1000Lwater + 5L/1000Lwater	1.1	9.7
11 Indar	fenbuconazole	1.4 L	-	9.6
12 Stroby	kresoxim-methyl	0.2kg	-	11.0

Financial benefits of the project

- Canker reduces tree vigour, increases pruning costs and, as the fruit rot, results in significant losses in long-term stored fruit. The disease also increases costs for the establishment of new orchards due to the need to replace trees killed by canker.
- The current control programme based on a combination of copper fungicides applied at leaf fall and pre bud burst and carbendazim products during critical times in the growing season, combined with cultural control mainly cutting out cankers, varies in efficacy from very effective to minimal effectiveness depending on orchard site, canker incidence and seasonal weather conditions. Much of the problem with canker control relates to spray timing and rainfall.
- This project has identified that Octave, Elvaron Multi and Folicur are as effective or almost as effective in controlling canker as the standard carbendazim product and therefore could be used as an alternative. However, these products are not significantly better than the best current product carbendazim but are potential

replacements for existing products that may lose their approval for use on apples. These alternative products are therefore unlikely to revolutionise canker control but simply maintain current levels of control.
- Carbendazim and copper products are relatively cheap compared to more recently introduced fungicides. The cost of fungicide control of canker may therefore increase if carbendazim and copper fungicides are no longer used.

Action points for growers

- This project has not identified products for canker control that are more effective than existing fungicides. Therefore the current control programme based on a combination of copper fungicides applied at leaf fall and pre bud burst and carbendazim products during critical times in the growing season, combined with cultural control mainly cutting out cankers remains the most effective programme.
- However, the trials did indicate the efficacy of carbendazim at leaf fall for canker control and use of this product in addition to copper fungicides at this time may improve control.
- Of the other effective products identified, Elvaron Multi is recommended for use on apples and could be used post blossom for canker control on the tree and fruit as part of a programme with carbendazim.

Science Section

Introduction

Canker, caused by the fungus *Nectria galligena*, is one of the most important diseases of apple and pear. The fungus attacks trees in the orchard, causing cankers and die-back of young shoots, resulting in loss of fruiting wood and increasing pruning costs. Apple canker can be particularly damaging in young orchards where, in some years, up to 10% of trees can be lost annually in the first few years of orchard establishment as a result of trunk cankers (McCracken et al 2003). *Nectria* also causes a fruit rot that can result in significant losses as high as 10% or more in stored fruit (Berrie, 1989). *Nectria* rot, which is often at the fruit stalk end, is also difficult to spot on the grading line but becomes obvious during marketing leading to rejection of fruit consignments.

The fungus produces two spore types, conidia in the spring and summer and ascospores in the autumn and winter. These enter shoots and branches on the tree through wounds, either natural such as bud-scale scars, leaf scars, fruit scars or artificial such as pruning wounds. Thus inoculum and points of entry on the tree are available all year round and the only limiting factor is rain, which is essential for spore production, spread, germination and infection. Autumn leaf fall is usually the main infection period and wet autumns are usually followed by a high incidence of shoot die-back due to canker the following spring and summer.

Currently canker is controlled by a combination of cultural methods to remove canker lesions and the use of protectant fungicides. Effective fungicides are limited. Generally copper fungicides are used at autumn leaf fall and before budburst to protect leaf scars and bud-scale scars and carbendazim is applied during the spring and summer. Both products are effective but have undesirable side effects on earthworms and there are also public concerns about their safety. Other products such as the scab fungicides captan, dithianon and dodine are known to give some control of canker, but are not as effective as carbendazim.

Recent research funded by Defra has confirmed that *Nectria* spores can spread from orchard to orchard and initiate new canker outbreaks in young orchards (McCracken *et al*, 2003). However, it also showed that the nursery could be a source of canker in new orchards, the significance of this source being dependent on the nursery supplying the trees and the weather conditions in the year in which the trees were raised. This research may eventually lead to new solutions for canker but there is a need in the short term to identify other fungicides that may be effective against canker.

Objective

To evaluate new fungicides for control of *Nectria* canker.

Materials and Methods

Test fungicides were evaluated in a small plot field trial done to GEP standards.

Orchard site

The same orchard (TL 161) was used for both years of the trial and was located at Rocks Farm, East Malling. It was a solid planting of cv Gala on M9 rootstock planted in March 1998. Tree rows were 3.9m apart with 2.0m separating trees within the rows. The orchard had a high incidence of *Nectria* canker on the trees and was separated by an alder windbreak from a Cox, Spartan and Discovery orchard, also with a high incidence of *Nectria* canker.

Plots

In year one each plot consisted of at least 4 trees. Trees with large cankers on the trunk were excluded (unlikely to survive to assessment) from the trial ie not assessed, but all trees in each plot were treated. Each plot was separated from adjacent plots within the row by two trees and from plots in adjacent rows by a single tree guard row. Each treatment was replicated 4 times in a randomised block design. The trial blocks were located in the centre of the orchard to give maximum benefit of any canker spread from the adjacent infected orchard (TL109). The same design was used in year two but the trial plots were relocated to the tree rows that had formed the guard rows of the previous year.

Treatments

The treatments applied in years one and two are shown in Table 2. Cuprokylt FL and Bavistin were included as standards. In year one all treatments except treatment 10 (Leaf Fall + Cuprokylt) were applied to the plots on three occasions, at 10% (5 November), 50% (13 November) and 90% (28 November) leaf fall. Treatment 10 was applied once, at 10% leaf fall. In year two treatments were applied only twice at 20% leaf fall (6 November) and 80% leaf fall (18 November). A storm on 13-14 November 2003 resulted in accelerated leaf fall such that the trial orchard progressed from 20% leaf fall on 6 November to 70% or more after 13-14 November. Therefore the spray at 50% leaf fall was missed. In 2003 treatment 10 was again applied once, at 20% leaf fall.

Fungicide application

All treatments were applied at 500 l/ha using a self-propelled small plot orchard sprayer (Solo).

Assessments

The numbers of existing cankers on each tree in the plot, including trees in the plot excluded from the trial due to trunk cankers, were recorded at the beginning of each trial to give a measure of the background incidence of canker at the start of the trial. Existing cankers were marked with yellow or pink paint so that new cankers developing following treatment could be easily identified. The number of existing cankers was taken into account in the statistical analysis. The plots were regularly inspected for the appearance of new cankers throughout the summer. Numbers of new cankers on the trunk, scaffold branches and extension growth were separately recorded for each of the four recorded trees in the plot in October 2003 for trial 1 and October 2004 for trial 2.

Statistical analysis

For the analyses, a square root transformation of the data was required to improve variance homogeneity. The background record of canker at the start of the experiment was used as a covariate, also on the square root scale.

Table 2: Fungicide treatments for evaluation for canker control in 2002 and 2003

Fungicide product	Active Ingredient	Rate/ha	Year evaluated
1 Untreated	-	-	2002, 2003
2 Bavistin	carbendazim	1.1kg	2002, 2003
3 Cuprokylt FL	copper oxychloride	5L/1000L water	2002, 2003
4 Elvaron Multi	tolylfluanid	2.25kg	2002, 2003
5 Folicur	tebuconazole	1.0L	2002, 2003
6 Unix	cyprodonil	0.5kg	2002, 2003
7 Flamenco	fluquinconazole	1.25L	2002
8 Octave	prochloraz Mn	1kg	2002, 2003
9 Serenade	*Bacillus subtilis*	8.8kg	2002, 2003
10 Leaf Fall + Cuprokylt FL	copper masquolate + copper oxychloride	10L/1000Lwater + 5L/1000Lwater	2002, 2003
11 Indar	fenbuconazole	1.4L/ha	2003
12 Stroby	kresoxim-methyl	0.2kg/ha	2003

Results and Discussion

Weather
2002/2003
The rainfall for the period of the experiment is shown in Table 3. 2002 was in general a wet season and favourable for *Nectria* canker. Observations in the trial orchard TL161 and in the adjacent orchard TL 109 indicated that *Nectria* cankers on the trees were actively sporulating in October and November 2002 with both cream coloured conidial pustules and the red fruiting bodies (perithecia) present on many of the existing cankers on the trees. There was therefore an adequate supply of inoculum of *Nectria galligena* present in the trial area. Leaf fall in the Gala orchard started at the end of October 2002 and continued until early December. This leaf fall period coincided with heavy and frequent rainfall (Table 3). The weather conditions were therefore highly favourable throughout leaf fall for the spread of *Nectria* spores and for subsequent infection through leaf scars. Weather conditions the following spring and summer in 2003, apart from May, were exceptionally hot and dry (Table 3).

Table 3 Rainfall recorded at East Malling from October 2002 – September 2003

Month 2002/2003	Total rain mm	% 50 year mean	No. rain days
October	57.8	88.2	18
November	138.6	200.9	26
December	129.6	195.2	25
January	67.4	107.5	22
February	31.4	73.9	14
March	20.2	45.6	14
April	29.0	65.2	9
May	59.6	130.1	20
June	35.8	72.0	10
July	34.6	74.6	14
August	18.6	35.2	4
September	24.2	38.0	15

2003/2004

The rainfall for the period of the experiment is shown in Table 4. Prior to the start of the experiment temperatures in June, July, August, September and October 2003 had been relatively high and rainfall relatively low especially in August (Table 3). Consequently the existing cankers on the trees in TL161 were rather dry and shrivelled with very little evidence of sporulation. However rainfall in November, during the main period of leaf fall, was above average and cankers on trees in the orchard soon revived and numerous fruiting bodies, both conidial pustules and perithecia, were observed by mid November. There was therefore an adequate supply of inoculum of *Nectria galligena* present in the trial area. Leaf fall in the Gala orchard started at the end of October 2003 and was complete by late November, mainly due to a storm on 13 and 14 November. This leaf fall period coincided with heavy and frequent rainfall (Table 4). The weather conditions were therefore very favourable throughout the short leaf fall period for the spread of *Nectria* spores and for subsequent infection through leaf scars. Weather conditions the following spring and summer in 2004 were generally wetter than in 2003 and favourable for canker (Tables 3 and 4).

Nectria canker

2002/2003

The number of new cankers (ie those not marked with yellow paint) on each tree in the plot was recorded on 27 October. Cankers on extension growth were recorded separately from those on the trunk and main scaffold branches. Cankers on the extension growth are those most likely to have arisen from *Nectria* spores infecting the tree at the time of leaf fall and therefore to have been influenced by the treatments applied. The new cankers appearing on the trunk and scaffold branches are more likely to have arisen from infection already present in the tree (McCracken *et al*, 2003).

Table 4 Rainfall recorded at East Malling from October 2003 – September 2004

Month 2003/2004	Total rain mm	% 50 year mean	No. rain days
October	36.0	54.9	16
November	106.4	154.2	23
December	67.2	101.2	21
January	85.2	135.9	24
February	21.6	50.8	16
March	33.0	74.5	22
April	52.0	116.9	21
May	43.6	95.2	13
June	34.8	70.0	12
July	44.2	95.3	16
August	88.2	166.9	19
September	22.4	35.2	15

The incidence of new cankers in the plots was low (Table 5), with no cankers recorded in some plots, including the untreated. There was a positive correlation between the background incidence of canker at the start of the trial and the number of new cankers, i.e. the greater the background incidence of canker, the higher the number of new cankers in the plot. The analysis of the transformed data, adjusted for background canker, showed that the numbers of new cankers were significantly reduced by Bavistin, Unix and Octave compared to the untreated plots (Table 5). The number of new cankers found was also reduced by Cuprokylt FL, Elvaron Multi and Folicur, but these reductions were not statistically significant. Flamenco and Serenade appeared to be ineffective.

It is surprising that the incidence of new cankers on extension growth is low since the weather conditions at leaf fall were very favourable for canker spread and infection. It is possible that the hot dry weather conditions during the following spring and summer influenced canker development. It is known that canker expression can occur on trees some time after infection has occurred (McCracken et al, 2003). Factors affecting canker expression are not really understood but high temperatures and lack of moisture could be involved. It was expected that more cankers might appear in spring 2004 and it was planned to reassess the plots in 2004. However, observation of the plots during Summer 2004 did not indicate the development of large numbers of additional cankers and therefore it was considered not worthwhile to reassess the plots.

The untransformed canker records for each plot are included in the appendix.

Table 5 Mean numbers of new cankers (adjusted for background canker inoculum in the plot) on apple trees cv Royal Gala recorded in October 2003 following various treatments applied in November 2002

Treatment	Active ingredient	Mean number of new cankers per plot (square root transformed) adjusted for background numbers of cankers (figures in brackets are back-transformed adjusted means)
Untreated	**-**	1.68 (2.82)
Bavistin	Carbendazim	0.03 (<0.01)
Cuprokylt FL	Copper oxychloride	0.83 (0.69)
Elvaron Multi	Tolylfluanid	1.01 (1.02)
Folicur	Tebuconazole	0.60 (0.36)
Unix	Cyprodonil	0.09 (<0.01)
Flamenco	Fluquinconazole	1.53 (2.34)
Octave	Prochloraz	0 (0.00)
Serenade	*Bacillus subtilis*	1.62 (2.62)
Leaf Fall + Cuprokylt FL	copper masquolate + copper oxychloride	1.05 (1.10)
SED (26 df)		**0.56**
LSD (P=0.05)		**1.14**

Nectria canker – 2003/2004

The number of new cankers (ie those not marked with pink paint) on each tree in the plot was recorded on 18 October. Cankers on extension growth were recorded separately from those on the trunk and main scaffold branches. The incidence of new cankers in the plots was much higher than in 2003 (0-19 compared to 0-3 in 2003) (Table 6). Again, as expected, there was a positive correlation between the background incidence of canker at the start of the trial and the number of new cankers, i.e. the greater the background incidence of canker, the higher the number of new cankers in the plot. The analysis of the transformed data, adjusted for background canker showed that the number of new cankers was significantly reduced by Bavistin, Octave, Elvaron Multi and Folicur compared to the untreated plots (Table 6). Unix, Serenade, Stroby and Indar appeared to be ineffective. Bavistin and Octave also gave significant reductions in 2003, but Unix. which appeared to be effective in year one, was the worst treatment in year two. The reductions in new cankers for Elvaron Multi and Folicur in year one were not significant in 2002/3 but were statistically significant in year two of the trial.

The untransformed canker records for each plot are included in the appendix.

Table 6 Mean numbers of new cankers (adjusted for background canker inoculum in the plot) on apple trees cv Royal Gala recorded in October 2004 following various treatments applied in November 2003

Treatment	Active ingredient	Mean number of new cankers per plot (square root transformed) adjusted for background numbers of cankers (figures in brackets are back-transformed adjusted means)
Untreated	-	3.89 (15.13)
Bavistin	carbendazim	0.49 (0.24)
Cuprokylt FL	copper oxychloride	2.34 (5.48)
Elvaron Multi	tolylfluanid	1.89 (3.57)
Folicur	tebuconazole	1.92 (3.69)
Unix	cyprodonil	4.40 (19.36)
Octave	prochloraz	1.11 (1.23)
Serenade	*Bacillus subtilis*	3.93 (15.44)
Leaf Fall + Cuprokylt FL	copper masquolate + copper oxychloride	3.12 (9.73)
Indar	fenbuconazole	3.09 (9.55)
Stroby	kresoxim-methyl	3.32 (11.02)
SED (29 df)		**0.84**
LSD (P=0.05)		**1.72**

Discussion and conclusions

- Over the two seasons of the trial Bavistin and Octave were the most consistently effective products in controlling canker, resulting in the least numbers of new cankers. Bavistin is no longer available but other carbendazim products are still recommended for use on apples eg Occidor. Octave is not recommended for use on apple and would require a SOLA.
- Elvaron Multi and Folicur were also effective. Elvaron Multi is recommended for use on apple. Folicur is not approved for use on apple, but a SOLA application has been made.
- Cuprokylt FL (copper oxychloride), which is the standard product used for canker control at autumn leaf fall, appeared to be only partially effective in these two trials. However, all treatments were applied at 500L/ha spray volume and the Cuprokylt was therefore only applied to plots at 50% of the recommended dose of 5L/1000L/ha. This probably accounts for its reduced efficacy.
- Leaf Fall mixed with Cuprokylt FL failed to significantly reduce canker in either year. Leaf Fall is a product used in tree nurseries to encourage rapid early leaf fall. It was used in the trial to encourage rapid leaf fall so that copper fungicide could be better targeted to protect leaf scars. In both years of the trial application of the Leaf Fall product did not result in accelerated leaf fall compared to other treatments. It is possible that the product was used too late, since leaves had already started to senesce at the time of treatment. The product may be more

effective when used on green leaves earlier in the autumn, but early defoliation may have other undesirable effects on fruit yield and quality the following season.

- The biocontrol agent Serenade (*Bacillus subtilis*) was ineffective in controlling canker in both years.
- Stroby, Indar, Flamenco and Unix had limited efficacy in controlling canker.
- This project has identified that Octave, Elvaron Multi and Folicur are as effective or almost as effective in controlling canker as the standard carbendazim product and therefore could be used as an alternative. However, these products are not significantly better than the best current product carbendazim but are potential replacements for existing products that may lose their approval for use on apples. These alternative products are therefore unlikely to revolutionise canker control but simply maintain current levels of control.

Future work

- There is a need to continue to evaluate potential new products such as Signum (boscalid + pyraclostrobin) for control of canker. Evaluation of product mixtures or combinations of products in programmes would also be appropriate.
- Evaluation of the use of Folicur earlier in the autumn on canker control may also be relevant as preliminary studies suggest that earlier use may result in wood hardening and hence reduce tree susceptibility to canker infection.
- An assessment of the contribution of orchard and nursery cultural practices, particularly canker removal, to canker control is also needed. These cultural practices are costly and if their impact on canker control is limited they may not be cost effective.

Technology transfer

The results of the canker trials were presented at the EMRA members day in November 2004 and published in the members day report. The trial and results have also been presented in an HDC News article in July 2003 and discussed with individual fruit growers.

References

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APPENDIX

Table 7 Total numbers of cankers (untransformed data) recorded per plot before (October 2002) and after treatment (October 2003)

Treatment	Block 1			Block 2			Block 3			Block 4			Mean		
	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c
Untreated	3	3	3	4	0	2	3	2	2	3	8	10	**3.25**	**3.25**	**4.25**
Bavistin	19	0	5	5	0	1	1	0	0	5	0	2	**7.5**	**0**	**2.0**
Cuprokylt FL	7	1	2	13	1	1	2	0	2	2	1	2	**6.0**	**0.75**	**1.75**
Elvaron Multi	15	2	3	10	4	4	9	0	1	3	1	4	**9.25**	**1.75**	**3.0**
Folicur	2	0	4	9	0	1	6	0	2	4	0	1	**5.25**	**0**	**2.0**
Unix	4	1	1	29	13	18	2	1	2	12	1	2	**11.75**	**4.0**	**5.75**
Flamenco	9	0	2	9	0	3	6	1	2	4	2	4	**7.0**	**0.75**	**2.75**
Octave	7	0	3	20	0	2	5	0	1	1	0	0	**8.25**	**0**	**1.5**
Serenade	5	5	6	12	1	3	8	1	1	3	5	7	**7.0**	**3.0**	**4.25**
Leaf Fall + CuprokyltFL	11	0	3	26	6	10	4	2	2	7	1	2	**12.0**	**2.25**	**4.25**

Notes

a = Total number of cankers existing on the trees in each plot prior to treatment
b = Total number of new cankers on extension growth on the trees in the plot assessed in autumn 2003
c= Total number of cankers on the trees in the plot including cankers on extension growth, on scaffold branches and on the trunk.

Table 8 Total numbers of cankers (untransformed data) recorded per plot before (October 2003) and after treatment (October 2004)

Treatment	Block 1			Block 2			Block 3			Block 4			Mean		
	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c	Total existing cankers a	New cankers extension growth b	Total new cankers c
Untreated	11	22	23	18	22	23	4	6	6	8	16	16	**10.3**	**16.5**	**17.0**
Bavistin	19	0	0	5	3	3	1	0	0	14	0	0	**9.8**	**0.8**	**0.8**
Cuprokylt FL	13	3	3	20	14	14	2	7	8	11	3	3	**11.5**	**6.8**	**7.0**
Elvaron Multi	8	0	0	8	1	2	0	4	4	5	7	7	**5.3**	**3.0**	**3.3**
Folicur	19	8	10	23	12	14	3	5	5	7	0	1	**13.0**	**6.3**	**7.5**
Unix	11	10	13	20	49	49	9	11	11	8	25	25	**12.0**	**23.8**	**24.5**
Octave	4	0	0	4	0	0	5	2	2	19	6	8	**8**	**2.0**	**2.5**
Serenade	6	20	20	14	10	10	10	9	9	7	27	27	**9.3**	**16.5**	**16.5**
Leaf Fall + CuprokyltFL	10	5	5	17	18	18	5	8	8	12	14	14	**11.0**	**11.3**	**11.3**
Indar	3	3	3	8	15	16	2	1	2	24	28	28	**9.3**	**11.8**	**12.3**
Stroby	6	7	8	18	30	31	8	14	14	5	2	2	**9.3**	**13.3**	**13.8**

Notes

a = Total number of cankers existing on the trees in each plot prior to treatment

b = Total number of new cankers on extension growth on the trees in the plot assessed in autumn 2003

c= Total number of cankers on the trees in the plot including cankers on extension growth, on scaffold branches and on the trunk.