AGRO-RESEARCH

Independent Horticultural Consultants

J.A.R. GEELEN RESEARCH LTD

P.O. Box 8264, Havelock North 4230, New Zealand.
Telephone: (64-6) 876-5950. Facsimile: (64-6) 877-4869
Street Address: 422 St George's Road, Havelock North.
Email: geelen@inhb.co.nz

27 October 2000

The Research Manager
Yates New Zealand Limited
20 Poutama Street
Richmond
NELSON.

Attention Mr P. de Jong.

Dear Peter,

Please find enclosed one copy of the final report for both of the pear Fireblight trials: one on Packham pears (Project # 798) and the other on process pears (Project # 800). A summary of the results is outlined below:

1. Project # 798 (Packam Pears) - moderately high disease pressure

Excellent season-long control of fresh Fireblight strikes with
CIT 30, @ 750 mls per 100 litres
KeyStrepto, @ 60 grams per 100 litres
Kocide DF, @ 75 grams per 100 litres
Kocide 2000, @ 64.3 grams per 100 litres

Excellent control of fresh Fireblight strikes for four weeks with
Yates Protector, @ 2.0 litres per 100 litres

None of the treatments showed any significant reduction in Fireblight shoot infection on previously infected wood.

Kocide DF and Mankocide reduced clean fruit levels at harvest, but all three copper products gave very high export packouts levels, similar to KeyStrepto and the unsprayed control. Export levels were greatly reduced with CIT 30. No signs of foliage phytotoxicity were found with any of the treatments, except CIT 30. This product caused obvious foliage phytotoxicity with the leaves being reduced in size, having pronounced upward cupping and some marginal leaf necrosis. The shoots had shortened internodes resulting in reduced shoot length with symptoms still evident four months later at harvest.

2. Project # 800 (WBC Pears) – Low disease pressure

The standard Keystrepto (streptomycin) gave complete control of fresh strikes on new seasons shoots whereas all other treatments, including Kocide, had similar levels to the unsprayed control. None of the treatments controlled the disease in shoots on previously diseased wood where systemic movement of the pathogen was present.

Export quality fruit was reduced with the copper-based sprays by 30% but it was more apparent with CGA 245704 and even worse with CIT 30. CIT 30 also caused leaf phytotoxicity, reduced leaf size and reduced shoot length.

We apologise for the delay in getting these final reports to you but realise that the Interim reports covered the disease control and that the general conclusions were published in the ENZA led "The latest in Fireblight Management" Seminar held in June of this year.

Our two invoices for the balance of the costs associated with these two trials are also enclosed. No payment due.

Kind regards,

J.A. Geelen
Managing Director

AGRO-RESEARCH

Independent Horticultural Consultants

J.A.R. GEELEN RESEARCH LTD

P.O. Box 8264, Havelock North 4230, New Zealand.
Telephone: (64-6) 876-5950. Facsimile: (64-6) 877-4869
Street Address: 422 St George's Road, Havelock North.
Email: geelen@inhb.co.nz

AN EVALUATION OF SEVERAL PRODUCTS FOR THE CONTROL OF FIREBLIGHT CONTROL IN PACKHAM PEARS IN HAWKE'S BAY

30/10 Karen → Alan → Pete (file annual report)
Worth spending 15 minutes reading.
Reasonable result for Protector but it could have been better if earlier applications (1 → 4) were applied to build up the plants natural defense to fireblight earlier).
Please return
Pete.

CLIENT : Yates New Zealand Limited

FOR ATTENTION OF : P. de Jong

PROJECT No : 798

TRIAL LOCATION : Hawke's Bay, New Zealand

TRIAL INVESTIGATOR : J.A. Geelen

STUDY DIRECTOR : J.A. Geelen

DATE : 27 October 2000

EXECUTIVE SUMMARY

In a fully replicated trial in heavily Fireblight (*Erwinia amylovora*) infected Packham pear trees several known and potential control agents were applied regularly over the critical flowering period resulting in:

1. Control of Fresh Fireblight Infections with streptomycin, Kocide and CIT 30

Excellent season-long control of Fireblight obtained with
- CIT 30, @ 750 mls per 100 litres
- KeyStrepto (streptomycin sulphate), @ 60 grams per 100 litres
- Kocide DF (copper hydroxide), @ 75 grams per 100 litres
- Kocide 2000 (copper hydroxide), @ 64.3 grams per 100 litres

Four weeks control of Fireblight with
- Yates Protector (fatty acid), @ 2.0 litres per 100 litres

No obvious control with
- CGA 245704, @ 14 grams per 100 litres
- Kendal, @ 500 mls per 100 litres
- Mankocide (copper hydroxide/mancozeb), @ 1.5 kg per hectare
- Serenade (*Bacillus subtilis*), @ 11.0 kg per hectare
- Surround (kaolin), @ 55 kg per hectare

2. No Control of Systemic Infections of Fireblight on Previously Diseased Wood

None of the treatments evaluated showed any obvious efficacy against Fireblight infections occurring on shoots on previously diseased wood where systemic movement of the pathogen was the obvious way the disease infection had occurred.

3. CIT 30 the Only Product to Obviously Reduce Export Packout Levels

No significant increase in initial fruit damage was found with any of the copper-based products but both Kocide DF and Mankocide reduced clean fruit levels at harvest whereas Kocide 2000 was quite reasonable. All three gave very high export packouts levels, similar to KeyStrepto and the unsprayed control, but export levels were significantly lower with CIT 30.

4. Obvious Phytotoxicity and Growth Retardation with CIT 30

CIT 30 was the only product to show any phytotoxicity and reduced leaf size, caused pronounced upward cupping and some marginal leaf necrosis while the shoots had shortened internodes resulting in reduced shoot length. The symptoms still evident four months after application at harvest.

DISCLAIMER

All information presented has been checked for accuracy and published in good faith, whereas corroborative data has not been verified. No responsibility, expressed or implied, is accepted for use or misuse of the information contained herein.

INTRODUCTION

Fireblight, caused by the bacterium *Erwinia amylovora*, is one of the major diseases of pipfruit, especially pears. It usually enters through the flowers colonising the stigma. It can destroy whole limbs and even trees within one season and can spread very rapidly. The name Fireblight relates to the blackening of the shoot tips but the rapidity of disease spread also justifies the name. For infection to occur climatic conditions must be favourable (temperatures above 15.5°C and high accumulative heat units and water) as well as the presence of an infection source and a susceptible host (during the flowering period). Wind, rain and insects distribute the bacteria.

Disease control has been centred for many years on the use of the antibiotic streptomycin, which has resulted in disease resistance in several Hawke's Bay orchards, although its reduced use over the past two seasons has allowed the re-establishment of sensitive strains. Copper-based sprays have been the other major products used but their application over flowering, the main timing for disease control, has resulted in fruit injury. The appearance of several candidate products potentially active against Fireblight prompted a trial to be established. An orchard with a history of Fireblight infection was chosen and the products evaluated in a full replicated trial at rates recommended by the sponsor Company, but with spray timing designed to give maximum opportunity for disease control. This was done so that every product could be given the maximum chance for success with future work then looking at reduced rates or fewer sprays. This trial was undertaken in the Hastings area of Hawke's Bay on the previously a common Packham Triumph cultivar. An identical comparative trial was carried out in William Bon Chretian process pears (see JAR Geelen Research Project # 800), a cultivar with a different (earlier) flowering period, but also being russet-sensitive and very susceptible to Fireblight.

SCHEDULE OF EXPERIMENTAL DETAILS

1. SITE:

LOCATION: O. Lowes, Ruahapia Road, Hastings (GR 427694, NZMS 260 V21, Napier, 1981), Hawke's Bay, New Zealand.

2. CROP: European Pear cv Packham Triumph (mature trees).

3. APPLICATION:

TREATMENTS: Details of test treatments are given in Tables I and II. The elicitor type products (CGA 245704, CIT 30, Kendal, Yates Protector) were first applied prior to flowering, and then all products were sprayed at 3-7 day intervals from the commencement of bloom until petalfall and immediately prior to, or after, a forecasted (by Crop Health Services, Hastings) Fireblight infection period.
Details of each treatments spray programme are outlined in Table IV.
A standard mancozeb-based fungicide and insecticide programme was then applied by the grower through until harvest.

DETAILS: Information of each application is given in Table III.

EQUIPMENT: All applications were made using a hand lance with one D2 nozzle and operating at a pressure of 1200 kPa. Trees were sprayed to incipient run-off with water rates (around 2000 litres per hectare), equivalent to full dilute spraying.

4. TRIAL DESIGN:

TYPE: Fully replicated (6x) randomised block design.

PLOT SIZE: Single mature tree.

5. METHODOLOGY: Prior to treatment replication being finalised, trees were individually inspected for carry-over levels of Fireblight so that this was evenly distributed between the various treatments. When Fireblight was first evident in the field, on 29 October (10 days after the last spray was applied), the number of infected shoots was counted on each tree at regular intervals until one month later, when new strikes were no longer evident. Fireblight strikes were separated into those occurring on shoots on limbs entirely free of Fireblight from previous seasons (called fresh strikes) and those that occurred on the tips of limbs that were already obviously diseased the previous season (called strikes on old infected wood).

Midway during the season (22 December 1999) some 100 fruitlets on each tree were visually evaluated by two assessors and the fruit categorised into those that were completely free of russet, those that were mildly affected and those that showed severe russet. A foliage phytotoxicity score was undertaken at the same time.

At the first harvest (22 February 2000) 100 mature fruit were removed, counted and weighed from each tree in all 66 trees in the trial. They were then individually

assessed by grading into fruit with less than 20% of the surface area russetted; those with 20-50% russet and those with over 50% russet.

6. RESULTS: For detailed results see Appendix I, Tables V - IX.
Statistical analyses were carried out using Duncan's Modified Multiple Range Test and square root transformation of the data applied where appropriate.

7. WEATHER DETAILS: Details on weather conditions and infection periods over the spraying period can be seen in Appendices II, III and IV.
Two Gemini Tinytag data loggers were placed within the trial block and these recorded temperature, relative humidity and leaf wetness at 10 minute intervals from the commencement of the trial until the last Fireblight assessment (for results see Appendix II).

8. PHOTOGRAPHS: Photographs were taken at trial commencement and at various stages during the trial and shown in Appendix V.

RESULTS AND DISCUSSION

The 1999-2000 season began with a warm and relatively dry September and October while November and December had moderate temperatures with regular rainfall. January was warm and quite dry, while for only the second time since records began no rain fell in February. March was cool and wet. Growing conditions were excellent but the block suffered from previous serious Fireblight attacks by having far fewer flowers than normal and hence a much lighter crop at harvest. The external quality of the pear crop was generally very good.

1. Effect on Fireblight

1.1. Infection Periods and Spray Timing

Actual Fireblight infection periods occurred on four occasions at the following dates:

1. 5 October (early white tip) – high risk
2. 23 October (98% petalfall) – high risk
3. 28/29 October (petalfall) – extreme risk
4. 2-4 November (post petalfall) – severe risk

In the trial the spray applications were made:
Four days prior to and again the day after the first infection period;
Four days prior to the second infection period, nine days prior to the third infection period and two weeks prior to the fourth infection period.

1.2. Disease Control of Fresh Infections

The reduction in the number of fresh strikes (those unaffected by cankers from the previous season) on new seasons shoots is the most accurate way of assessing treatment efficacy. Disease infection was already evident 10 days after the final spray was applied indicating that the most likely infection period was 5th October, when trees were at early flowering. All treatments had been sprayed at least one prior to this date and then again immediately after the infection period was recorded. CGA 245704 was far worse than unsprayed trees, which was due to one tree being particularly badly infected. Mankocide and Serenade were also showing some disease while the other sprayed treatments were clean.

Further regular assessments showed CGA 245704 getting progressively worse and also other treatments succumbing to the disease (see Table IV). By 17 November, one month after the last spray, it was clear that Kendal, Mankocide, Serenade and Surround were ineffective whereas CIT 30, Kocide DF and Kocide 2000 as well as the standard KeyStrepto were performing well. Yates Protector was also keeping the disease at bay but by 10 days later was badly infected. It is possible that with this product the elicitor action meant that further applications needed to be made after the infection pressure was over.

The final assessment in early December, six weeks after the last spray, showed CIT 30, Kocide DF and Kocide 2000 as well as Keystrepto as being the only effective products. Kocide 2000, applying 75% less active copper as Kocide DF, was the most effective with only one Fireblight strike on one of the six trees in the trial. This compared with two strikes in two of the six trees with Kocide DF and almost two strikes per tree in half the KeyStrepto treated trees. It was unfortunate that the unsprayed trees did not go down at lot more with the disease as one would have expected but nevertheless the levels were sufficiently high in the trial to differentiate between those treatments obviously working and those that were ineffective or giving only mediocre control.

1.3. Disease Control of Infections on Previously Infected Wood

Given the high disease carry-over level and the lack of detailed winter pruning to remove diseased wood, one would have expected much higher levels in the spring, especially on old infected wood. This infection most likely came from systemic movement of the bacteria within the branch of the tree, which then slowly killed the new season's developing shoots. None of the treatments showed any significant reduction compared to the untreated control trees. As none of the products are systemic within the plant and none are bactericidal (actually kill the bacteria) but at best bacteriostatic (protecting the tree from infection), this result is

not surprising. The low number of strikes made it difficult to determine treatment efficacy but all products were ineffective, even the standard Keystrepto.

Details of effects on Fireblight are provided in Appendix I, Tables V to VII.

2. Crop Damage Effects

2.1. Mid-season Fruit Russet Levels

This pear variety is prone to spray damage and with the three sprays being applied over the particularly russet-sensitive blossom to petalfall period the effect on skin quality needed careful evaluation. At this initial stage in mid December almost all fruit was free of russet in all treatments. Unsprayed control fruit had completely russet-free fruit, as did CGA 245704, KeyStrepto, Surround and Yates Protector. The copper-based sprays were slightly poorer, but not statistically significant compared to either the standard KeyStrepto or untreated fruit. CIT 30 had clearly the worst fruitfinish with obviously fewer clean fruit and correspondingly more mild and severe russet.

The standard Kocide DF at the rates required for Fireblight control had 3.3% severe russet at this stage whereas none was present where Kocide 2000 was applied. This is in keeping with the manufacturer's claims that, not only is Kocide equally effective at lower rates, but it also less damaging to the crop.

2.2. Fruitfinish at Harvest

The highest levels of clean (russet-free) fruit were found in trees sprayed with Kendal, Keystrepto, and Surround as well as untreated fruit. Repeated sprays of the copper compounds, Kocide DF and Mankocide, over flowering, resulted in reduced levels of clean fruit whereas Kocide 2000 was reasonable. The worst product was still CIT 30. This treatment had by far the highest level of fruit with over 50% russet and along with Kocide DF, the most fruit with 20-50% russet. CGA 245704 showed up a problem in the Bon Chretian pears (see Project # 800) but there was no fruit phytotoxicity problem in this equally sensitive cultivar.

Fruit with less than 20% russet was regarded as being of export quality. Combining clean fruit with those having less than 20% russet resulted in over 98% export in both the untreated control and the standard KeyStrepto. Levels were over 95% where both Kocide products and Mankocide were applied as well as with all other treatments, except CIT 30, which was significantly worse than all other treatments with only 72% export fruit.

2.3. Fruit Size at Harvest

Although Fireblight infection levels were moderately high there were no differences in fruit size between any of the applied treatments and the untreated control.

2.4. Foliage Phytotoxicity

CIT 30 was the only treatment to show any obvious foliage phytotoxicity. Leaves were clearly reduced in size, had pronounced upward cupping of the leaves and showed some marginal leaf necrosis. The shoots had shortened internodes and this resulted in reduced shoot length. The symptoms were very obvious and were still evident at harvest, four months after the final spray.

Spraying the trees with Surround did not cause any obvious phytotoxicity but did totally whiten the trees giving them a "White Christmas" look.

Details of fruit injury levels midway during the season and at harvest are presented in Tables VIII and IX.

ACKNOWLEDGEMENTS

J.A.R Geelen Research Ltd is indebted to Mr Owen Lowes for provision of the trial block and the overall maintenance of the trial. Details of the Fireblight risks and warnings in the Table in Appendix I are reprinted from the proceedings of "The latest in Fireblight Management", ENZA 2000.

We are also indebted to the following sponsors:

Elliott Chemicals Limited
ENZA Limited
FruitFed Supplies Limited
Heinz Wattie's Limited
Pacific Growers Supplies Limited
Yates New Zealand Limited

CONCLUSIONS

The results obtained from this trial enable the following conclusions to be made:-

- Regular applications both before and after Fireblight infection periods over the critical flowering period to previously heavily infected Packham pear trees showed that under moderately high disease pressure:

Excellent control of fresh Fireblight strikes with
CIT 30, @ 750 mls per 100 litres
KeyStrepto, @ 60 grams per 100 litres
Kocide DF, @ 75 grams per 100 litres
Kocide 2000, @ 64.3 grams per 100 litres

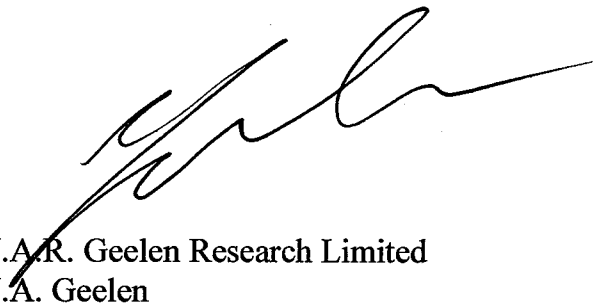
Excellent control of fresh Fireblight strikes for four weeks with
Yates Protector, @ 2.0 litres per 100 litres

No obvious Fireblight control with
CGA 245704, @ 14 grams per 100 litres
Kendal, @ 500 mls per 100 litres
Mankocide, @ 1.5 kg per hectare
Serenade, @ 11.0 kg per hectare
Surround, @ 55 kg per hectare

- None of the treatments showed any significant reduction in Fireblight shoot infection on previously infected wood compared to the untreated control trees. This was no doubt due to the fact that none of the products were systemic within the plant and none had bactericidal activity.

- Applying four sprays over the critical fruit russetting period showed no significant increase in initial fruit damage from any of the copper-based sprays or any other product, except CIT 30, compared to the standard KeyStrepto treatment. Both Kocide DF and Mankocide reduced clean fruit levels at harvest whereas Kocide 2000 was quite reasonable, but all three gave very high export packouts levels, similar to KeyStrepto and the unsprayed control. Export levels were only 72% with CIT 30, significantly inferior to all other treatments.

- No signs of foliage phytotoxicity were found with any of the treatments, except CIT 30. This product caused obvious foliage phytotoxicity with the leaves being reduced in size, having pronounced upward cupping and some marginal leaf necrosis. The shoots had shortened internodes resulting in reduced shoot length with symptoms still evident four months later at harvest.



J.A.R. Geelen Research Limited
J.A. Geelen
27 October 2000

APPENDIX I

Tables

TABLE I - PRODUCT DETAILS

No.	TREATMENT	ACTIVE INGREDIENT	CHEMICAL GROUP	MODE OF ACTION	DISTRIBUTOR
1.	UNTREATED CONTROL	-	-	-	-
2.	CGA 245704	unknown	Unknown	Elicitor	Fruitfed Supplies Ltd
3.	CIT 30	unknown	Unknown	Elicitor	Elliott Chemicals Ltd
4.	KENDAL	unknown	Unknown	Biostimulant	Pacific Growers Ltd
5.	KEYSTREPTO	streptomycin sulphate	Bactericide	Fungistat	Key Industries Ltd
6.	KOCIDE DF	copper hydroxide	Inorganic copper	Fungistat	Elliott Chemicals Ltd
7.	KOCIDE 2000	copper hydroxide	Inorganic copper	Protectant	Elliott Chemicals Ltd
8.	MANKOCIDE	copper hydroxide + mancozeb	Inorganic copper + Dithiocarbamate	Protectant	Elliott Chemicals Ltd
9.	SERENADE 70WP	Bacillus subtilis	Bactericide	Fungistat	Elliott Chemicals Ltd
10.	SURROUND	kaolin	Clay	Protectant	Elliott Chemicals Ltd
11.	YATES PROTECTOR	fatty acid	Fatty acid	Elicitor	Yates New Zealand Ltd

TABLE II - DETAILS OF TREATMENTS

No.	TREATMENT	FORM	% A.I.	No. APPLNs	APPLN No.	RATE PER 100 LITRES		RATE PER HECTARE	
						ACTUAL (g or ml)	ACTIVE (g)	ACTUAL (kg or L)	ACTIVE (kg)
1.	UNTREATED CONTROL	-	-	-	-	-	-	-	-
2.	CGA 245704	WG	50.0	5	4	14.00	7.00	0.280	0.140
					5, 6	14.00	7.00	0.294	0.147
					7, 8	14.00	7.00	0.322	0.161
3.	CIT 30	EC	-	5	4	75.00	-	15.000	-
					5, 6	75.00	-	15.750	-
					7, 8	75.00	-	17.250	-
	CITOWETT	EC	100.0	5					
					4	25.00	25.00	0.500	0.500
					5, 6	25.00	25.00	0.525	0.525
					7, 8	25.00	25.00	0.575	0.575
4.	KENDAL	EC	21.5	7	1-3	500.00	107.50	9.000	2.150
					5, 6	500.00	107.50	10.500	2.258
					7, 8	500.00	107.50	11.500	2.473
5.	KESTREPTO	WP	17.0	4	5, 6	60.00	10.20	1.260	0.214
					7, 8	60.00	10.20	1.380	0.235
	CITOWETT	EC	100.0	4	5, 6	25.00	25.00	0.525	0.525
					7, 8	25.00	25.00	0.575	0.575

TABLE II - DETAILS OF TREATMENTS (Continued)

No.	TREATMENT	FORM	% A.I.	No. APPLNs	APPLN No.	RATE PER 100 LITRES		RATE PER HECTARE	
						ACTUAL (g or ml)	ACTIVE (g)	ACTUAL (kg or L)	ACTIVE (kg)
6.	KOCIDE	DF	40.0	4	5, 6	75.00	30.00	1.575	0.630
					7, 8	75.00	30.00	1.725	0.690
7.	KOCIDE 2000	WP	35.0	4	5, 6	64.30	22.51	1.350	0.473
					7, 8	64.30	22.51	1.479	0.518
8.	MANKOCIDE	WP	45.0	4	5, 6	71.43	32.14	1.500	0.675
					7, 8	65.22	29.35	1.500	0.675
9.	SERENADE	WP	70.0	4	5, 6	523.81	366.67	11.000	7.700
					7, 8	478.26	334.78	11.000	7.700
10.	SURROUND	WP	100.0	4	5, 6	2619.05	2619.05	55.000	55.000
					7, 8	2391.30	2391.30	55.000	55.000
11.	YATES PROTECTOR	SC	25.0	4	5, 6	2.00	500.00	42.000	10.500
					7, 8	2.00	500.00	46.000	11.500

TABLE III - APPLICATION DETAILS SUMMARY

APPLICATION No.		1	2	3	4
DATE		3rd September '99	15th September '99	23rd September '99	28th September '99
INTERVAL (days)		-	12	8	5
GROWTH STAGE		Dormant	10% Bud Swell	Tight Cluster	Open Cluster
WATER / PLOT (L)		3.0	3.1	3.1	3.1
WATER / HECTARE (L)		1900	2000	2000	2000
COVERAGE		Complete	Complete	Complete	Complete
WIND SPEED (km/hr)		3-4	-	-	3
WIND DIRECTION		NE	-	-	SW
DRIFT		Nil	-	-	Nil
TEMPERATURE (^{O}C)		18.0	15.0	15.0	13.0
REL. HUMIDITY (%)		58.0	71.0	61.0	44.5
DRYING TIME (mins)		20	45	30	30
DRYING SPEED		Normal	Slow	Normal	Normal
RAINFALL (mm)	PREV. 24 hrs	0.2	7.6	0.0	0.2
	FOLL. 24 hrs	0.0	0.0	0.0	0.0
	FOLL. 48 hrs	0.0	9.8	0.0	0.0
	FOLL. 1 week	1.4	10.6	0.2	0.0
	FOLL. 2 weeks	32.2	10.8	0.2	9.6
CLOUD COVER		3 / 10	6 / 10	0 / 10	0 / 10
CROP / SOIL SURFACE		Dry	Dry	Dry	Dry
FROST		Nil	Nil	Nil	Nil

TABLE III - APPLICATION DETAILS SUMMARY (Continued)

APPLICATION No.		5	6	7	8
DATE		1st October '99	6th October '99	12th October '99	19th October '99
INTERVAL (days)		4	5	6	7
GROWTH STAGE		White Tip	70% Bloom	10% Petalfall	99% Petalfall
WATER / PLOT (L)		3.3	3.3	3.6	3.6
WATER / HECTARE (L)		2100	2100	2300	2300
COVERAGE		Complete	Complete	Complete	Complete
WIND SPEED (km/hr)		-	0-3	0-3	0-1
WIND DIRECTION		-	NE	NE	SW
DRIFT		-	Nil	Nil	Nil
TEMPERATURE (^{O}C)		17.0	20.5	20.0	15.0
REL. HUMIDITY (%)		55.0	58.0	60.0	66.0
DRYING TIME (mins)		30	30	35	30
DRYING SPEED		Normal	Normal	Normal	Normal
RAINFALL (mm)	PREV. 24 hrs	0.0	0.0	0.0	0.0
	FOLL. 24 hrs	0.0	0.0	0.0	0.0
	FOLL. 48 hrs	0.0	9.6	1.4	0.0
	FOLL. 1 week	9.6	11.0	5.0	4.4
	FOLL. 2 weeks	14.6	14.6	9.4	4.4
CLOUD COVER		0 / 10	8 / 10	9 / 10	0 / 10
CROP / SOIL SURFACE		Dry	Dry	Dry	Dry
FROST		Nil	Nil	Nil	Nil

TABLE IV - OVERALL TREATMENT PROGRAMME

No.	TREATMENT	APPLICATION NUMBER (* = *APPLICATION MADE*)							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1.	UNTREATED CONTROL	-	-	-	-	-	-	-	-
2.	CGA 245704, @ 14 g / 100 L	-	-	-	*	*	*	*	*
3.	CIT 30, @ 750 mls / 100 L + CITOWETT, @ 25 mls / 100 L	-	-	-	*	*	*	*	*
4.	ELICITOR, @ 500 mls / 100 L	*	*	*	-	*	*	*	*
5.	KEYSTREPTO, @ 60 g / 100 L + CITOWETT, @ 25 mls / 100 L	-	-	-	-	*	*	*	*
6.	KOCIDE DF, @ 75 g / 100 L	-	-	-	-	*	*	*	*
7.	KOCIDE 2000, @ 64.3 g / 100 L	-	-	-	-	*	*	*	*
8.	MANKOCIDE, @ 1.5 kg / ha	-	-	-	-	*	*	*	*
9.	SERENADE 70WP, @ 11.0 kg / ha	-	-	-	-	*	*	*	*
10.	SURROUND, @ 55.0 kg / ha	-	-	-	*	*	*	*	*
11.	YATES PROTECTOR, @ 2.0 L / 100 L	-	-	-	-	*	*	*	*

TABLE V - EFFECT ON FRESH FIREBLIGHT INFECTION

TREATMENT	NUMBER OF FRESH FIREBLIGHT STRIKES PER TREATMENT (6 Trees)				TOTAL TREES INFECTED (out of 6 trees)
	10 DAT * *29th October '99*	21 DAT *10th November*	30 DAT *17th November*	42 DAT *29th November*	42 DAT
UNTREATED CONTROL	1	5	10	11	3
CGA 245704, @ 14 g / 100 L	10	18	28	32	5
CIT 30, @ 750 mls / 100 L ++	0	0	2	3	3
ELICITOR, @ 500 mls / 100 L	0	5	15	26	6
KEYSTREPTO, @ 60 g / 100 L ++	0	1	2	5	3
KOCIDE DF, @ 75 g / 100 L	0	1	2	4	2
KOCIDE 2000, @ 64.3 g / 100 L	0	0	1	1	1
MANKOCIDE, @ 1.5 kg / ha	2	3	8	11	3
SERENADE 70WP, @ 11 kg / ha	2	3	8	22	4
SURROUND, @ 55 kg / ha	0	2	11	12	4
YATES PROTECTOR, @ 2.0 L / 100 L	0	1	4	23	4

* DAT = Days After Treatment (days after the last application was made).

++ CIT 30 and KeyStrepto were both tankmixed with Citowett, @ 25 mls / 100 L.

Hawke's Bay fire blight warnings over bloom in 1999

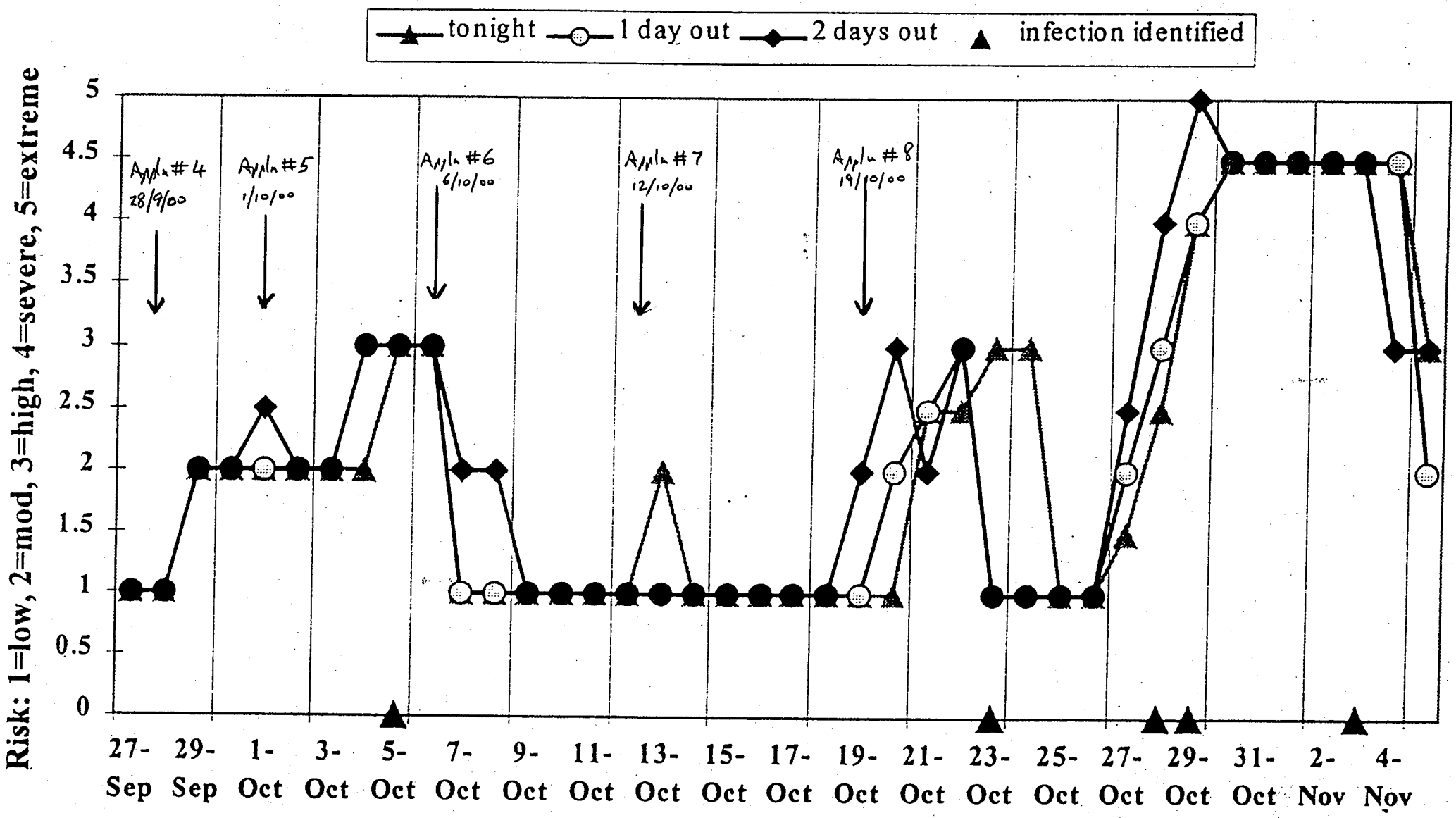


TABLE VI - EFFECT ON FRESH FIREBLIGHT STRIKES *

TREATMENT	MEAN NUMBER OF FRESH FIREBLIGHT STRIKES PER TREE			
	10 DAT *29 October*	**21 DAT** *10 November*	**30 DAT** *18 November*	**42 DAT** *29 November*
UNTREATED CONTROL	0.17 abA	0.83 abAB	1.67 abA	1.83 abcA
CGA 245704, @ 14 g / 100 L	1.67 aA	3.00 aA	4.67 aA	5.33 aA
CIT 30, @ 750 mls / 100 L	0.00 bA	0.00 bB	0.33 bA	0.50 bcA
ELICITOR, @ 500 mls / 100 L	0.00 bA	0.83 abAB	2.50 abA	4.33 abA
KEYSTREPTO, @ 60 g / 100 L	0.00 bA	0.17 bAB	0.33 bA	0.83 bcA
KOCIDE DF, @ 75 g / 100 L	0.00 bA	0.17 bAB	0.33 bA	0.67 bcA
KOCIDE 2000, @ 64.3 g / 100 L	0.00 bA	0.00 bB	0.17 bA	0.17 cA
MANKOCIDE, @ 1.5 kg / ha	0.33 abA	0.50 bAB	1.33 abA	1.83 abcA
SERENADE 70WP, @ 11 kg / ha	0.33 abA	0.50 bAB	1.33 abA	3.67 abcA
SURROUND, @ 55 kg / ha	0.00 bA	0.33 bAB	1.83 abA	2.00 abcA
YATES PROTECTOR, @ 2.0 L / 100 L	0.00 bA	0.17 bAB	0.67 bA	3.83 abcA
LSD 0.05	1.50	2.20	3.49	3.95
LSD 0.01	2.00	2.94	4.65	5.27
CV %	29.96	35.71	43.95	42.73

* Based on new Fireblight strikes from infections that have occurred over the flowering period.

TABLE VII - EFFECT ON FIREBLIGHT STRIKES FROM OLD INFECTED WOOD *

TREATMENT	MEAN NUMBER OF OLD FIREBLIGHT STRIKES PER TREE			
	10 DAT *29 October*	**21 DAT** *10 November*	**30 DAT** *18 November*	**42 DAT** *29 November*
UNTREATED CONTROL	0.33 bAB	0.67 abA	0.83 NS	1.33 NS
CGA 245704, @ 14 g / 100 L	0.33 bAB	0.50 abA	0.83 NS	1.33 NS
CIT 30, @ 750 mls / 100 L	0.00 bB	0.17 bA	0.33 NS	0.67 NS
ELICITOR, @ 500 mls / 100 L	0.00 bB	1.00 abA	1.00 NS	1.00 NS
KEYSTREPTO, @ 60 g / 100 L	0.00 bB	0.17 bA	0.33 NS	0.33 NS
KOCIDE DF, @ 75 g / 100 L	0.00 bB	1.50 aA	1.50 NS	1.50 NS
KOCIDE 2000, @ 64.3 g / 100 L	0.17 bB	0.50 abA	0.67 NS	0.67 NS
MANKOCIDE, @ 1.5 kg / ha	0.17 bB	0.33 abA	0.67 NS	0.67 NS
SERENADE 70WP, @ 11 kg / ha	0.00 bB	0.50 abA	0.50 NS	0.67 NS
SURROUND, @ 55 kg / ha	0.17 bB	0.50 abA	0.50 NS	0.50 NS
YATES PROTECTOR, @ 2.0 L / 100 L	1.00 aA	1.17 bA	1.67 NS	1.67 NS
LSD 0.05	0.58	1.17	1.34	1.40
LSD 0.01	0.77	1.56	1.79	1.86
CV %	17.02	27.92	29.68	29.89

* Based on shoots infected on wood that was infected in the 1998 season and not removed at pruning.

TABLE VIII - EFFECT ON FRUITFINISH AND FOLIAGE PHYTOTOXICITY AT THINNING

TREATMENT	FRUITFINISH			FOLIAGE PHYTOTOXICIY SCORE (0-10)
	CLEAN FRUIT (%)	MILD RUSSET (%)	SEVERE RUSSET (%)	
UNTREATED CONTROL	100.00 aA	0.00 bB	0.00 bB	0.00 bB
CGA 245704, @ 14 g / 100 L	100.00 aA	0.00 bB	0.00 bB	0.00 bB
CIT 30, @ 750 mls / 100 L	83.40 cA	9.17 aA	6.17 aA	6.50 aA
ELICITOR, @ 500 mls / 100 L	96.17 abA	2.00 bB	1.83 bB	0.00 bB
KEYSTREPTO, @ 60 g / 100 L	100.00 aA	0.00 bB	0.00 bB	0.00 bB
KOCIDE DF, @ 75 g / 100 L	94.17 bcA	2.50 bB	3.33 bB	0.00 bB
KOCIDE 2000, @ 64.3 g / 100 L	96.33 abA	3.67 bB	0.00 bB	0.00 bB
MANKOCIDE, @ 1.5 kg / ha	98.00 abA	2.00 bB	0.00 bB	0.00 bB
SERENADE 70WP, @ 11 kg / ha	98.00 abA	1.83 bB	0.17 bB	0.00 bB
SURROUND, @ 55 kg / ha	100.00 aA	0.00 bB	0.00 bB	0.00 bB
YATES PROTECTOR, @ 2.0 L / 100 L	100.00 aA	0.00 bB	0.00 bB	0.00 bB
LSD 0.05	5.70	3.93	3.81	0.29
LSD 0.01	7.60	5.24	5.07	0.39
CV %	2.68	46.08	49.89	4.11

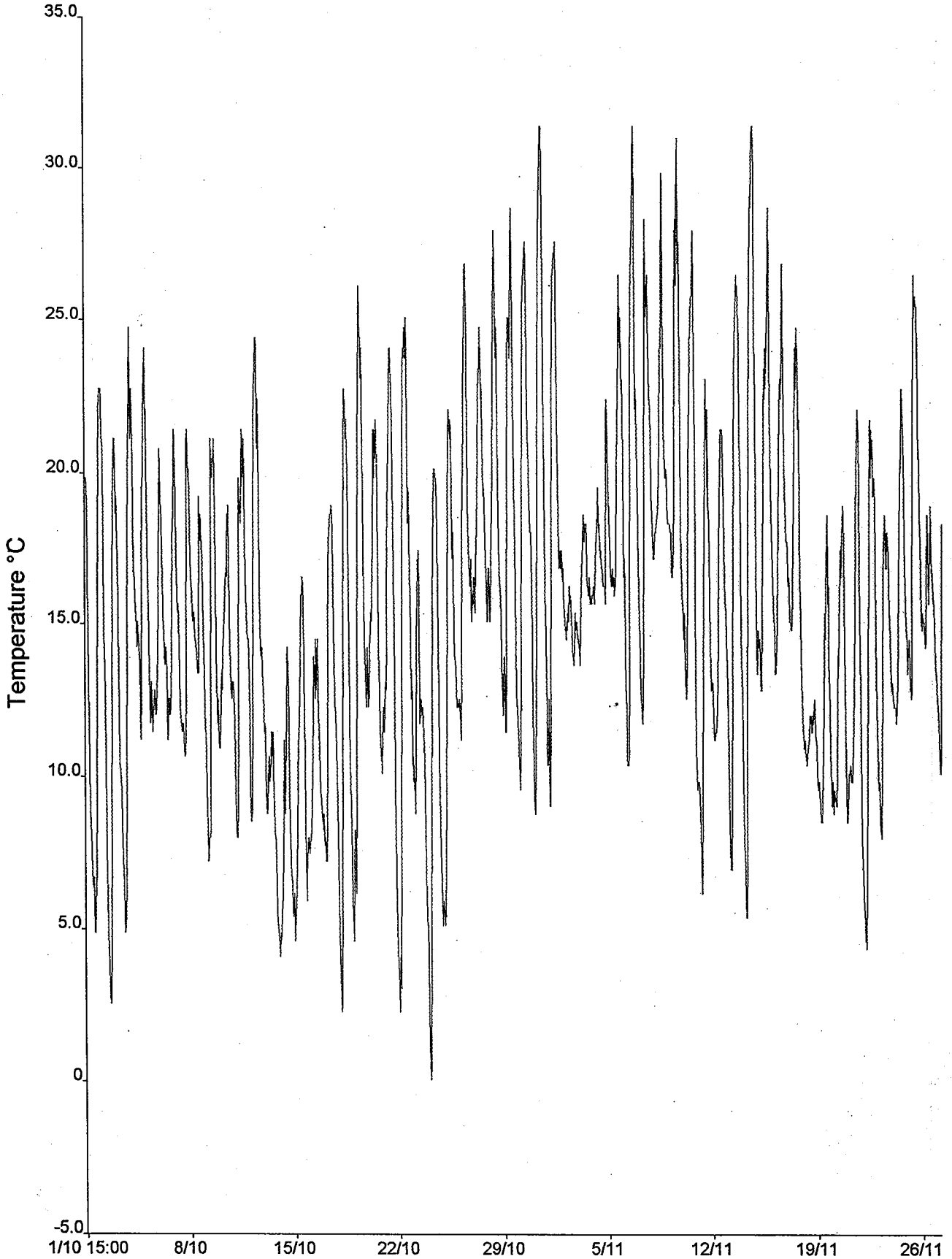
TABLE IX - EFFECT ON FRUITFINISH AT HARVEST

TREATMENT	MEAN FRUIT WEIGHT	CLEAN FRUIT	PERCENT FRUIT RUSSET WITHIN RESPECTIVE CATEGORIES			EXPORT GRADE
	(g)	(%)	< 20%	20-50%	>50%	(%)
UNTREATED CONTROL	229.82 abcA	54.04 aABC	44.64 bcBC	1.38 bB	0.30 bB	98.68 aA
CGA 245704, @ 14 g / 100 L	223.64 abcA	38.63 bBCD	59.41 aAB	1.18 bB	0.65 bB	98.05 aA
CIT 30, @ 750 mls / 100 L	244.20 aA	8.87 cE	63.57 aA	10.20 aA	17.36 aA	72.44 bB
ELICITOR, @ 500 mls / 100 L	232.49 abcA	55.19 aAB	43.45 bcBC	0.23 bB	1.13 bB	98.57 aA
KEYSTREPTO, @ 60 g / 100 L	206.56 cA	54.34 aAB	43.71 bcBC	0.91 bB	1.03 bB	98.31 aA
KOCIDE DF, @ 75 g / 100 L	214.06 bcA	30.37 bD	64.72 aA	8.79 aA	0.81 bB	95.10 aA
KOCIDE 2000, @ 64.3 g / 100 L	219.62 abcA	41.26 bBCD	57.04 aAB	1.35 bB	0.34 bB	98.30 aA
MANKOCIDE, @ 1.5 kg / ha	227.94 abcA	33.30 bD	62.76 aA	2.35 bB	1.59 bB	96.06 aA
SERENADE 70WP, @ 11 kg / ha	214.47 abcA	39.48 bBCD	56.62 abAB	2.42 bB	1.48 bB	96.10 aA
SURROUND, @ 55 kg / ha	237.37 abA	60.03 aA	37.16 cC	1.42 bB	0.39 bB	98.19 aA
YATES PROTECTOR, @ 2.0 L / 100 L	238.39 abA	38.43 bCD	56.29 abAB	2.11 bB	2.11 bB	94.73 aA
LSD 0.05	30.08	12.47	12.26	4.71	4.22	4.51
LSD 0.01	40.11	16.63	16.35	6.28	5.62	6.01
CV %	5.81	13.31	10.02	38.27	35.81	2.29

APPENDIX II

Weather Recording Data – On Site Tinytag Data Logger

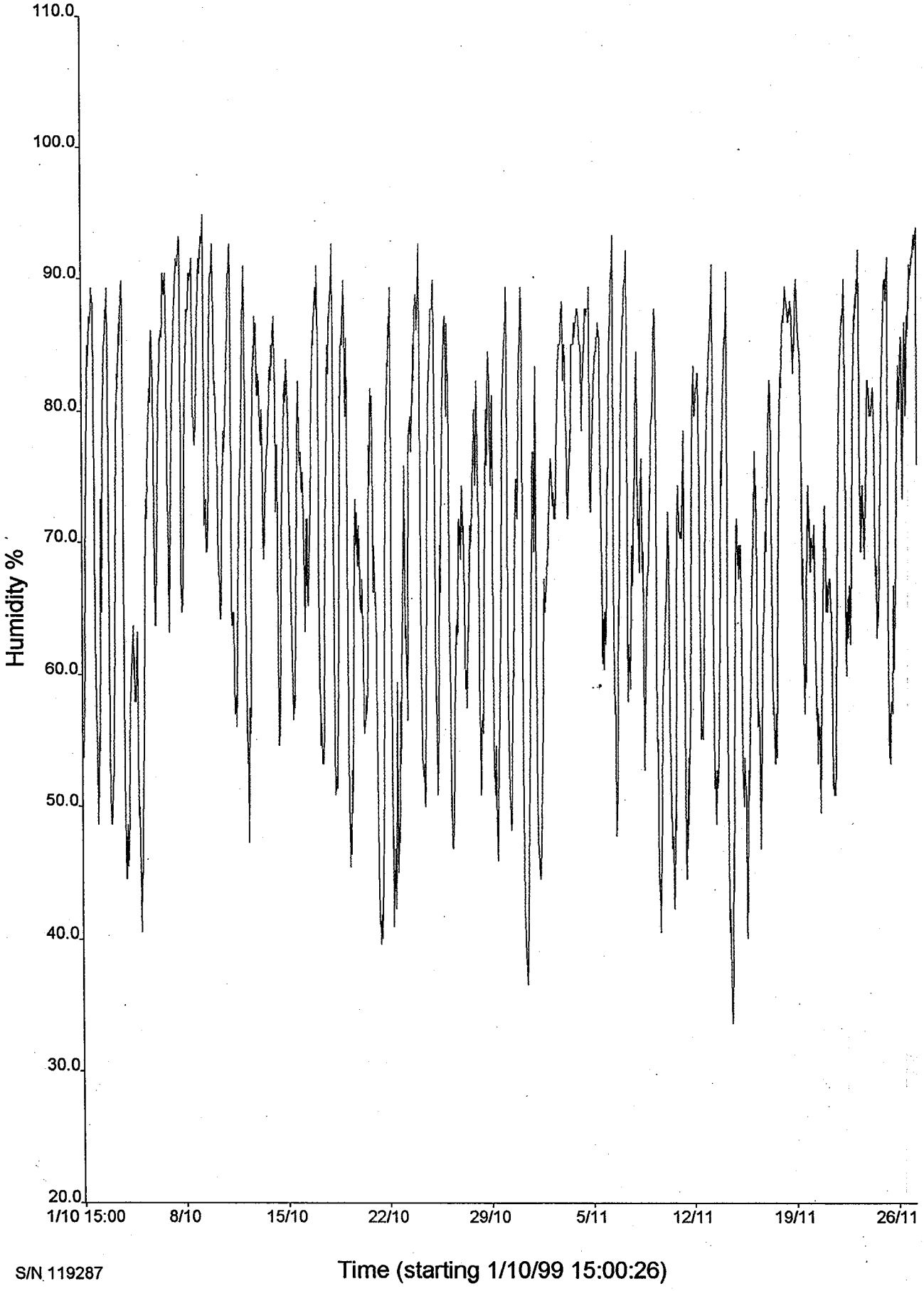
Fireblight - Packhams



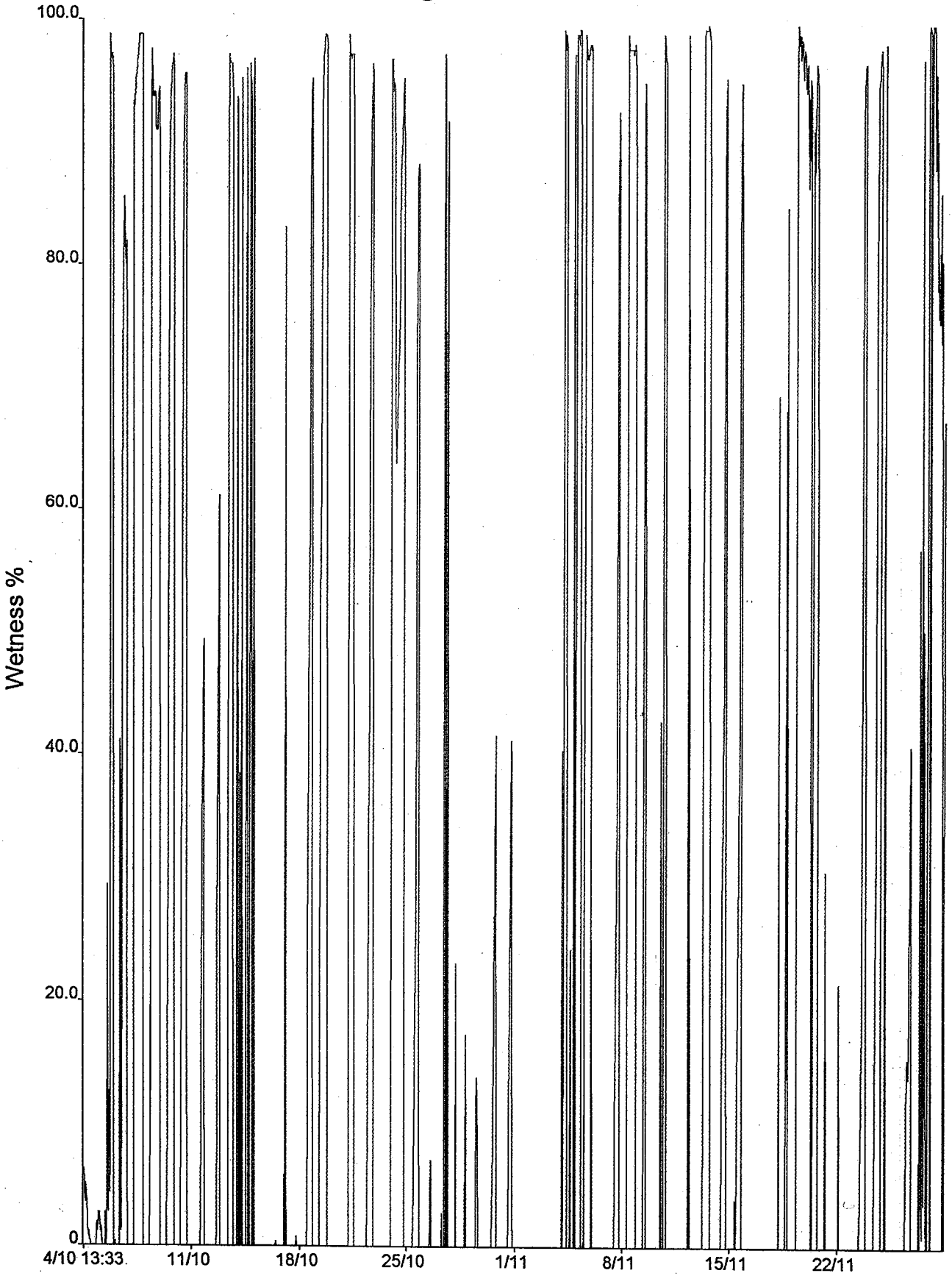
S/N 119287

Time (starting 1/10/99 15:00:26)

Fireblight - Packhams



Fireblight - Packhams



S/N 132859

APPENDIX III

Weather Recording Data – Regional Data Loggers

Hawke's Bay Fire Blight (blossom blight) Risk

at 5 pm, Friday, 1 October 1999

Sponsored by ENZA & Heinz-Wattie's **Prepared by HortResearch & CHS**

AVERAGE DAILY TEMPERATURES

Logger Site	Logged data				Forecast data	
	27	28	29	1-Oct-99	1 Oct	2
Longlands Rd	8.6	8.7	10.1	12.3	13	13
Trotter Rd	11.6	10	9.7	13	13	13
Allen Rd	10.8	9.1	10.5	12.9	13	13
Swamp Rd area*	12	10	13	12.9	13	13

Notes:
- Average daily temperatures (mean of 24 records from 0100-2400 hrs) above 15° C indicate rapid multiplication of bacteria is occurring on flowers - a warning sign.
- Compare average daily temperatures (mean of max + min) from *warmer sites* within your orchard blocks with above data to estimate your risk from our predictions.
*Oamarunui Settlement Rd - temp means are being estimated from raw data.

FIRE BLIGHT (blossom) INFECTION RISK

Date	Risk	Comments
1-Oct-99	**mod**	a change from low risk yesterday. Rain not expected but heavy dews
1	**mod**	could occur. Warmer temperatures expected, but still cool early
2 Oct	**mod**	mornings.

Note: Although average daily temps are still below 15 C due to cool nights (frosts in some localities), hourly heat accumulation above 18.3 C was significant today, and high maximum temperatures over the next two days will add significantly to this. This indicates that district risk has changed to **moderate**.
An appropriate response is: apply fire blight spray **only if**: 1) pipfruit block is in flower, 2) variety is highly susceptible, 3) active cankers are present in or near block, 4) average temperatures at warmer sites in block are higher than indicated above (around 15 C), 5) a heavy due occurs overnight. A low rate copper spray (carries a potential russet risk), is the preferred option at this early stage as higher-risk situations definitely requiring streptomycin may occur in the near future. To avoid resistance problems don't exceed two streptomycins.

Disclaimer: This service is designed to help growers make informed fire blight spraying decisions. However fire blight risk prediction is not an exact science. Infection risks are strongly influenced by inoculum load, crop status and weather conditions on individual blocks. While all due care is taken in preparing this forecast, neither HortResearch nor Crop Health Services give a warranty on the contents or accept responsibility for its use.

Hawke's Bay Fire Blight (blossom blight) Risk

at 7 pm, Friday, 8 October 1999

Sponsored by ENZA & Heinz-Wattie's **Prepared by HortResearch & CHS**

AVERAGE DAILY TEMPERATURES

Logger Site	Logged data				Forecast	
	4	5	6	8-Oct-99	8	9
Longlands Rd	14.5	**15.7**	14.5	15.3	13.5	15
Trotter Rd	14.5	**16.5**	13.9	15	13.5	15
Allen Rd	14.7	**16.7**	14.3	15.2	13.5	15
Te Aute Rd	14	**15.7**	14.6	15.8	14.5	15

Notes:
- Average daily temperatures (mean of 24 records from 0100-2400 hrs) above 15° C indicate rapid multiplication of bacteria is occurring on flowers - a warning sign.
- **Compare average daily temperatures (mean of max + min) from *warmer sites* within your orchard blocks with above data to estimate your risk from our predictions.**
- note that today's mean temperature is based on only 18 hours data and is adjusted the next day once the full 24 hours of data is obtained. Forecast mean temperatures are based on MetService data and only approximate.

FIRE BLIGHT (blossom) INFECTION RISK

Date	Risk	Comments
8-Oct-99	**low**	Assume CDH reduced to zero on 6 Oct by spraying
8	**low**	rain expected Friday and overnight
9	**mod**	rain expected Sunday

Bb symptoms should occur 57 DD ≥ 12.7 C from infection date (assumed to be 6 Oct).

Note: You should have sprayed at-risk blocks by now. On correctly sprayed blocks CDHs > 18.3 C should have reset to zero and will have to build up to the threshold of around 110 again before infection can recur. Risk should therefore be low. Unsprayed blocks could develop FB.

Disclaimer: This service is designed to help growers make informed fire blight spraying decisions. However fire blight risk prediction is not an exact science. Infection risks are strongly influenced by inoculum load, crop status and weather conditions on individual blocks. While all due care is taken in preparing this forecast, neither HortResearch nor Crop Health Services give a warranty on the contents or accept responsibility for its use.

Hawke's Bay Fire Blight (blossom blight) Risk

at 7 pm, 20 Oct 1999

Sponsored by ENZA & Heinz-Wattie's **Prepared by HortResearch & CHS**

AVERAGE DAILY TEMPERATURES

Logger Site	Logged data				Forecast	
	17	18	19	20 Oct	21	22
Longlands Rd	10.5	12.1	12.1	14.4	**15.5**	**15**
Trotter Rd	10.7	12.1	11.9	**16.2**	**16**	**15**
Allen Rd	10.6	12.1	12	**17.3**	**16**	**15**
Te Aute Rd	10.2	12.1	12	13.9	**15.5**	**15**
Lawn Rd	10.3	12.1	12.1	14.7	**15**	**15**
Swamp Rd area	11	12.7	13	13.0	**16.5**	**15**

Notes:

- If average daily temperatures (mean of 24 records from 0100-2400 hrs) rise above 15° C this indicates rapid multiplication of bacteria is occurring on flowers - a warning sign. Today's average is adjusted downwards tomorrow night when the full 24 hrs data is in.

- Compare average daily temperatures (mean of max + min) from *warmer sites* within your orchard blocks with above data to estimate your risk from our predictions.

FIRE BLIGHT (blossom) INFECTION RISK

Date	Risk	Comments
20 Oct	**low**	av temps exceeding 15 C some sites.
21	**mod**	High av temps and rapid heat accumulation expected
22	**high**	early shower possible Friday am

Low - no action necessary **Mod (Alert)** - be prepared to act (your site may be warmer than reference site- might require action) **High** - urgent action recommended nd = no data

Bb symptoms should occur 57 DD ≥ 12.7 C from 6 Oct (so far 33.3 at Te Aute; 25.8 at Lawn Rd).

Note: Fireblight strikes have been reported at one or two sites. These are being investigated. Sites warmer than the reference sites above may be at high risk by tomorrow night.

Disclaimer: This service is designed to help growers make informed fire blight spraying decisions. However fire blight risk prediction is not an exact science. Infection risks are strongly influenced by inoculum load, crop status and weather conditions on individual blocks. While all due care is taken in preparing this forecast, neither HortResearch nor Crop Health Services give a warranty on the contents or accept responsibility for its use.

Hawke's Bay Fire Blight (blossom blight) Risk

at 7 pm, 24 Oct 1999

Sponsored by ENZA & Heinz-Wattie's **Prepared by HortResearch & CHS**

AVERAGE DAILY TEMPERATURES

Logger Site	Logged data				Forecast	
	21	22	23	24 Oct	25	26
Longlands Rd	15.3	15.9	14.3	11.1	12	12
Trotter Rd	16.4	15.6	14.5	12.5	12	12
Allen Rd	16.7	15.9	15.6	13.2	12	12
Te Aute Rd	14.4	14.6	14.3	10.4	12	12
Lawn Rd	16.6	15.9	13.7	12	12	12
Swamp Rd area	16.5	16.4	17.7	12 est	12	12

Notes:

- If average daily temperatures (mean of 24 records from 0100-2400 hrs) rise above 15° C this indicates rapid multiplication of bacteria is occurring on flowers - a warning sign. Today's average is adjusted downwards tomorrow night when the full 24 hrs data is in.
- **Compare average daily temperatures (mean of max + min) from *warmer sites* within your orchard blocks with above data to estimate your risk from our predictions.**

FIRE BLIGHT (blossom) INFECTION RISK

Date	Risk	Comments
24 Oct	**high**	cool day but rain will have triggered blossom infection at many sites
25	**low**	if spray applied to at-risk blocks. High if not as strikes may be progressing.
26	**low**	ditto

Low - no action necessary **Mod (Alert)** - be prepared to act (your site may be warmer than reference site- might require action) **High** - urgent action recommended nd = no data

Bb symptoms should occur 57 DD ≥ 12.7 C from 6 Oct (so far 44 at Te Aute; 36.6 at Lawn Rd).

Note: General high risk situation tonight for at-risk blocks due to high heat accumulation by last night and rainfall today. Some sites had not crossed infection threshold last night but most were at a high risk level. Will reset heat accumulation to zero as from today on assumption that at-risk blocks have been sprayed. This may be the last blossom blight high risk event for this season. However shoot blight can occur with 1) temperatures above 15 C, 2) presence of blossom blight or weeping cankers and 3) presence of sucking insects eg aphids, ALCM.

Disclaimer: This service is designed to help growers make informed fire blight spraying decisions. However fire blight risk prediction is not an exact science. Infection risks are strongly influenced by inoculum load, crop status and weather conditions on individual blocks. While all due care is taken in preparing this forecast, neither HortResearch nor Crop Health Services give a warranty on the contents or accept responsibility for its use.

Hawke's Bay Fire Blight (blossom blight) Risk

at 7 pm, 27 Oct 1999

Sponsored by ENZA & Heinz-Wattie's **Prepared by HortResearch & CHS**

AVERAGE DAILY TEMPERATURES

Logger Site	Logged data				Forecast	
	24	25	26	27 Oct	28	29
Longlands Rd	10.6	9.7	12.7	**17.4**	**16**	**15.5**
Trotter Rd	11.5	9.3	12.7	**17.4**	**16**	**15.5**
Allen Rd	12.3	10.7	13.8	**17.7**	**16**	**15.5**
Te Aute Rd	10.0	9.7	12.3	**17.4**	**16**	**15.5**
Lawn Rd	11.4	9.9	12.7	**17.2**	**16**	**15.5**
Swamp Rd area	12	10.9	13.3	**17.5**	**16**	**15.5**

Notes:

- If average daily temperatures (mean of 24 records from 0100-2400 hrs) rise above 15° C this indicates rapid multiplication of bacteria is occurring on flowers - a warning sign.

- Compare average daily temperatures (mean of max + min) from *warmer sites* within your orchard blocks with above data to estimate your risk from our predictions.

FIRE BLIGHT (blossom) INFECTION RISK

Date	Risk	Comments
27 Oct	low-mod	high average today and rapid heat unit accumulation
28	mod	
29	mod-high	warm weekend expected

Low - no action necessary **Mod (Alert)** - be prepared to act (your site may be warmer than reference site- might require action) **High** - urgent action recommended nd = no data

Note: Shoot blight can occur with 1) temperatures above 15 C, 2) presence of blossom blight or weeping cankers and 3) presence of sucking insects eg aphids, ALCM. Several outbreaks on Braeburn have been reported. Check Braeburn blocks carefully and inform either D Manktelow 877 2767 or Greg Tate 879 8875 if strikes are present for HortResearch follow-up to investigate causal factors.

Disclaimer: This service is designed to help growers make informed fire blight spraying decisions. However fire blight risk prediction is not an exact science. Infection risks are strongly influenced by inoculum load, crop status and weather conditions on individual blocks. While all due care is taken in preparing this forecast, neither HortResearch nor Crop Health Services give a warranty on the contents or accept responsibility for its use.

APPENDIX IV

Weather Station Details
(Whakatu - 2km from trial site)

PAGE : 51
DATE : 04-OCT-99

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
DAILY CLIMATOLOGICAL RECORD AT 0900 LOCAL (F301)

.... = ACCUMULATED VALUE
---- = MISSING RAINFALL
* = ESTIMATED VALUE

STATION D96696 15876 WHAKATU EWS MONTH 9 YEAR 1999

DAY	C	V	SFCWIND DIR	SFCWIND SPD	OCCURRENCES G	S	H	L	T	F	RAIN 0.1MM	TEMPERATURES 0.1 DEG C DRY	WET	RH%	MAX	MIN	GMIN	EARTH TEMPERATURE 0.1 DEG C 10CM	20CM	30CM	100CM	PRESS 0.1MB	SUN 0.1HR	RAD	WIND RUN	MAX GUST DIR	SPD	EVAP 0.1MM	***	T	DAY
1			28	6	-	-	-	-	-	-		80	56	67	123	37	4	75	84		111			146	176	05	11				1
2			10	1	-	-	-	-	-	-		118	83	59	197	3	-34	78	79		112			151	190	29	15				2
3			23	3	-	-	-	-	-	-	2	98	88	87	173	49	12	85	91		112			110	144	08	12				3
4			24	3	-	-	-	-	-	-		102	90	85	160	36	2	95	94		112			164	170	05	17				4
5			17	1	-	-	-	-	-	-		113	112	98	191	16	0	97	97		112			169	220	05	16				5
6			31	5	-	-	-	-	-	-		145	107	59	188	46	8	106	101		112			166	331	01	20				6
7			02	8	-	-	-	-	-	-		163	133	69	190	123	73	122	117		113			46	232	02	17				7
8			20	7	-	-	-	-	-	-	14	111	93	78	119	109	101	115	120		114			46	303	16	17				8
9			24	10	-	-	-	-	-	-		85	64	72	125	48	21	81	96		115			119	492	21	27				9
10			24	10	-	-	-	-	-	-		81	59	69	133	43	14	84	90		116			164	190	25	18				10
11			24	4	-	-	-	-	-	-		73	61	82	159	-1	-36	77	85		116			169	161	05	11				11
12			24	3	-	-	-	-	-	-		105	89	80	163	18	-10	96	95		116			148	243	05	14				12
13			04	9	-	-	-	-	-	-	134	138	121	81	168	99	52	122	116		116			105	354	06	22				13
14			04	3	-	-	-	-	-	-	76	141	139	98	197	131	125	133	130		116			100	209	24	16				14
15			26	2	-	-	-	-	-	-		155	132	76	212	80	49	126	120		117			164	211	26	21				15
16			21	1	-	-	-	-	-	-	98	136	115	76	187	56	26	116	117		118			121	317	16	19				16
17			23	9	-	-	-	-	-	-		114	104	87	150	101	96	118	124		119			73	198	23	16				17
18			21	3	-	-	-	-	-	-		103	97	92	165	31	3	103	107		120			179	191	04	11				18
19			33	10	-	-	-	-	-	-		152	125	71	205	82	59	115	120		121			82	414	35	20				19
20			28	19	-	-	-	-	-	-		154	106	51	194	91	39	119	119		122			193	457	28	35				20
21			28	10	-	-	-	-	-	-	8	127	88	56	128	61	13	118	112		123			121	615	22	36				21
22			23	14	-	-	-	-	-	-		115	84	63	156	41	-10	95	91		123			157	307	20	26				22
23			26	4	-	-	-	-	-	-		98	81	78	162	14	-24	105	94		123			205	177	05	12				23
24			23	3	-	-	-	-	-	-		111	92	77	146	18	-18	114	100		123					05	17				24
25			23	1	-	-	-	-	-	-		115	94	74	179	9	-15	121	108		123			173	116	31	17				25
26			25	0	-	-	-	-	-	-		118	100	78	184	32	1	113	109		123			133	187	19	21				26
27			23	5	-	-	-	-	-	-	2	136	96	56		54	13	112	114		123										27
28			26	5	-	-	-	-	-	-		79	50	60	153	2	-19	100	90		124				145	17	16				28
29			25	7	-	-	-	-	-	-		117	88	65	156	-11	-35	116	100		124			221	152	16	20				29
30			24	9	-	-	-	-	-	-		142	99	54	236	0	-19	124	109		124			225	206	22	20				30
TOTAL											33.4																				TOTAL
MEAN															16.9	4.7	1.6	10.6	10.4		11.8		14.3								MEAN

Appln #1
Appln #2
Appln #3
Appln #4

SUMMARY.

HIGHEST DAILY RAINFALL	13.4 ON 13	VAPOUR PRESSURE	10.2
TOTAL RAIN DAYS 0.1 MM OR MORE	7	MEAN TEMPERATURE	10.8
TOTAL WET DAYS 1.0 MM OR MORE	4	RANGE	12.2
TOTAL DAYS SCREEN FROST	2	HIGHEST MAXIMUM	ON
TOTAL DAYS GROUND FROST	10	LOWEST MINIMUM	-1.1 ON 29
		LOWEST MAXIMUM	ON
		HIGHEST MINIMUM	13.1 ON 14
		LOWEST GRASS MIN	-3.6 ON 11
		HIGHEST GUST	KTS FROM DEG T ON

UNITS:
C = EIGHTS
V = KILOMETERS
DIR = TENS DEGREE TRUE
SPD = KNOTS
RAD = 0.1 MJ/SQ M
WIND RUN = KILOMETERS
*** :
EVAPORIMETER TYPE :

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
DAILY CLIMATOLOGICAL RECORD AT 0900 LOCAL (F301)

.... = ACCUMULATED VALUE
---- = MISSING RAINFALL
* = ESTIMATED VALUE

STATION D96696 15876 WHAKATU EWS MONTH 10 YEAR 1999

DAY	C	V	SFCWIND DIR	SFCWIND SPD	OCCURRENCES G	S	H	L	T	F	RAIN 0.1MM	TEMPERATURES 0.1 DEG C DRY	WET	RH%	MAX	MIN	GMIN	EARTH TEMPERATURE 0.1 DEG C 10CM	20CM	30CM	100CM	PRESS 0.1MB	SUN 0.1HR	RAD	WIND RUN	MAX GUST DIR	SPD	EVAP 0.1MM	***	T	DAY	
1			26	3	-	-	-	-	-	-		125	99	70	158	27	-2	143	121		124			220	149	24	15				1	Appln #5
2			24	3	-	-	-	-	-	-		132	106	70	183	42	20	150	130		125			218	100	13	13				2	
3			22	0	-	-	-	-	-	-		94	79	80	184	13	-8	126	131		126			215	135	08	14				3	
4			16	1	-	-	-	-	-	-		115	88	67	206	41	24	137	137		127			213	424	25	25				4	
5			32	7	-	-	-	-	-	-		161	105	45	215	102	92	160	152		128			178	194	31	22				5	
6			24	3	-	-	-	-	-	-		112	107	94	166	104	104	150	157		130			149	116	11	16				6	Appln #6
7			27	2	-	-	-	-	-	-		134	123	87	180	102	89	162	161		131			139	127	17	25				7	
8			04	4	-	-	-	-	-	-	96	147	128	79	171	91	94	161	157		133			157	279	06	19				8	
9			22	5	-	-	-	-	-	-		130	127	96	173	119	136	157	162		135			102	156	08	16				9	
10			23	3	-	-	-	-	-	-		106	105	98	158	64	57	141	145		136			228	178	21	36				10	
11			21	8	-	-	-	-	-	-		131	108	74	171	99	81	145	153		137			135	232	19	22				11	
12			34	7	-	-	-	-	-	-		170	121	53	196	68	67	156	148		139			113	291	33	22				12	Appln #7
13			21	1	-	-	-	-	-	-	14	154	119	64	215	72	58	160	147		140			227	327	25	17				13	
14			22	14	-	-	-	-	-	-	26	76	64	83	90	73	89	129	152		140			73	389	21	33				14	
15			23	9	-	-	-	-	-	-	10	53	43	84	114	31	28	90	112		141			156	428	23	28				15	
16			23	13	-	-	-	-	-	-		84	61	68	138	38	35	98	107		141			182	305	24	24				16	
17			24	8	-	-	-	-	-	-		86	62	68	115	44	21	110	118		140			121	143	13	16				17	
18			25	1	-	-	-	-	-	-		104	82	72	141	64	66	134	128		139			253	200	24	23				18	
19			23	3	-	-	-	-	-	-		109	88	74	179	23	2	139	136		139			263	205	07*	17*				19	Appln #8
20			31	9	-	-	-	-	-	-		146	103	55	202	38	18	148	144		139			245	316	09	16				20	
21			00	8	-	-	-	-	-	-	14	151	111	58	192	130	106	154	161		139			107	399	33	28				21	
22			31	14	-	-	-	-	-	-		147	103	54	207	95	65	147	144		140			269	330	28	29				22	
23			23	2	-	-	-	-	-	-		136	96	56	191	17	-5	151	141		141			263	248	28	22				23	
24			33	3	-	-	-	-	-	-	30	150	108	56	151	67	43	152	155		142			107	214	22	19				24	
25			22	4	-	-	-	-	-	-		84	69	79	139	-3	-16	120	123		143			266	163	24	24				25	
26			25	4	-	-	-	-	-	-		118	98	76	161	45	29	149	143		143			242	198	07	16				26	
27			02	8	-	-	-	-	-	-	2	152	117	63	220	114	103	177	165		144			239	424	33	26				27	
28			01	8	-	-	-	-	-	-		171	141	70	208	137	138	175	174		144			130	273	35	24				28	
29			31	8	-	-	-	-	-	-	----	182	149	68		137	122	180	174		146										29	
30					-	-	-	-	-	-	----																				30	
31					-	-	-	-	-	-	----																				31	
TOTAL																														TOTAL	
MEAN														17.2	6.9	5.7	14.5	14.4		13.7			18.6							MEAN	

SUMMARY

HIGHEST DAILY RAINFALL	ON	VAPOUR PRESSURE	10.4
TOTAL RAIN DAYS 0.1 MM OR MORE		MEAN TEMPERATURE	12.1
TOTAL WET DAYS 1.0 MM OR MORE		RANGE	10.3
TOTAL DAYS SCREEN FROST		HIGHEST MAXIMUM	ON
TOTAL DAYS GROUND FROST		LOWEST MINIMUM	ON
		LOWEST MAXIMUM	ON
		HIGHEST MINIMUM	ON
		LOWEST GRASS MIN	ON
		HIGHEST GUST	KTS FROM DEG T ON

UNITS:
C = EIGHTS
V = KILOMETERS
DIR = TENS DEGREE TRUE
SPD = KNOTS
RAD = 0.1 MJ/SQ M
WIND RUN = KILOMETERS
*** :
EVAPORIMETER TYPE :

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
DAILY CLIMATOLOGICAL RECORD AT 0900 LOCAL (F301)

.... = ACCUMULATED VALUE
---- = MISSING RAINFALL
* = ESTIMATED VALUE

STATION D96696 15876 WHAKATU EWS MONTH 11 YEAR 1999

DAY	C	V	SFCWIND DIR	SFCWIND SPD	OCCURRENCES G	S	H	L	T	F	RAIN 0.1MM	TEMPERATURES 0.1 DEG C DRY	WET	RH%	MAX	MIN	GMIN	EARTH TEMPERATURE 0.1 DEG C 10CM	20CM	30CM	100CM	PRESS 0.1MB	SUN 0.1HR	RAD	WIND RUN	MAX GUST DIR	SPD	EVAP 0.1MM	***	T	DAY
1			33	3	-	-	-	-	-	-		189	139	54	268	90	63	184	187		150			271	335	31	25				1
2			32	5	-	-	-	-	-	-		193	140	52	234	90	59	195	186		152			260	254	13	17				2
3			19	5	-	-	-	-	-	-		147	130	81	163	145	147	188	199		153			43	254	15	18				3
4			07	8	-	-	-	-	-	-		162	142	79	174	137	129	176	177		155			99	473	06	24				4
5			06	12	-	-	-	-	-	-	74	170	157	87	187	157	148	182	178		156			107	441	05	25				5
6			06	8	-	-	-	-	-	-	8	162	156	94	198	154	152	170	172		157			192	398	05	24				6
7			03	8	-	-	-	-	-	-		176	158	82	216	159	153	180	177		157			212	242	06	18				7
8			03	3	-	-	-	-	-	-		193	164	73	244	109	88	200	180		157			270	201	05	17				8
9			26	3	-	-	-	-	-	-	2	183	167	84	239	120	102	194	191		158			171	266	00	16				9
10			05	4	-	-	-	-	-	-		189	169	81	255	176	162	197	196		159			126	389	01	24				10
11			04	3	-	-	-	-	-	-		183	156	74	268	167	163	184	193		161			229	418	33	28				11
12			35	10	-	-	-	-	-	-		188	133	50	241	144	117	207	195		162			242	483	22	31				12
13			25	5	-	-	-	-	-	-	10	129	91	57	194	53	12	178	175		163			246	200	21	24				13
14			26	4	-	-	-	-	-	-		135	113	75	181	113	103	172	181		164			261	230	28	20				14
15			30	9	-	-	-	-	-	-		179	129	53	209	63	42	194	183		165			306	216	31	20				15
16			29	3	-	-	-	-	-	-		193	138	51	264	56	19	206	189		166			305	343	32	22				16
17			02	7	-	-	-	-	-	-		178	138	62	236	150	106	205	202		166			273	383	07	22				17
18			03	10	-	-	-	-	-	-		177	146	70	226	147	128	205	203		168			198	305	04	23				18
19			17	1	-	-	-	-	-	-	166	176	146	71	201	146	133	206	202		169			231	202	10	16				19
20			27	5	-	-	-	-	-	-	124	108	103	94	122	101	104	154	180		170			52	345	18	22				20
21			23	10	-	-	-	-	-	-		110	87	71	168	87	80	129	148		171			200	406	22	22				21
22			24	17	-	-	-	-	-	-		124	88	59	170	86	65	132	142		171			269	451	23	33				22
23			24	10	-	-	-	-	-	-		112	82	64	180	81	59	134	150		169			255	202	26	20				23
24			24	2	-	-	-	-	-	-		131	113	79	189	48	25	162	160		168			190	156	20	21				24
25			21	5	-	-	-	-	-	-		180	153	74	187	82	60	177	169		167			148	337	24	22				25
26			25	5	-	-	-	-	-	-		147	121	72	186	119	120	171	170		167			238	185	05	16				26
27			03	6	-	-	-	-	-	-		183	154	72	217	127	113	203	190		167			294	306	08	23				27
28			08	6	-	-	-	-	-	-	676	170	152	82	175	151	142	204	203		167			91	344	10	28				28
29			01	3	-	-	-	-	-	-	148	140	121	79	175	99	103	161	161		170			184	449	21	34				29
30			22	16	-	-	-	-	-	-		117	83	60	169	78	57	130	145		170			300	262	24	30				30
TOTAL											120.8																				TOTAL
MEAN															20.5	11.5	9.8	17.9	17.9		16.3			20.9	316						MEAN

SUMMARY

HIGHEST DAILY RAINFALL	67.6 ON 28
TOTAL RAIN DAYS 0.1 MM OR MORE	8
TOTAL WET DAYS 1.0 MM OR MORE	6
TOTAL DAYS SCREEN FROST	0
TOTAL DAYS GROUND FROST	0

VAPOUR PRESSURE	13.1
MEAN TEMPERATURE	16.0
RANGE	9.0
HIGHEST MAXIMUM	26.8 ON 1
LOWEST MINIMUM	4.8 ON 24
LOWEST MAXIMUM	12.2 ON 20
HIGHEST MINIMUM	17.6 ON 10
LOWEST GRASS MIN	1.2 ON 13
HIGHEST GUST	34 KTS FROM 218 DEG T ON 29

UNITS:
C = EIGHTS
V = KILOMETERS
DIR = TENS DEGREE TRUE
SPD = KNOTS
RAD = 0.1 MJ/SQ M
WIND RUN = KILOMETERS
*** :
EVAPORIMETER TYPE :

APPENDIX V

Photographs

Photo I – General view of trial at dormant
(Application # 1 - 03 September 1999)

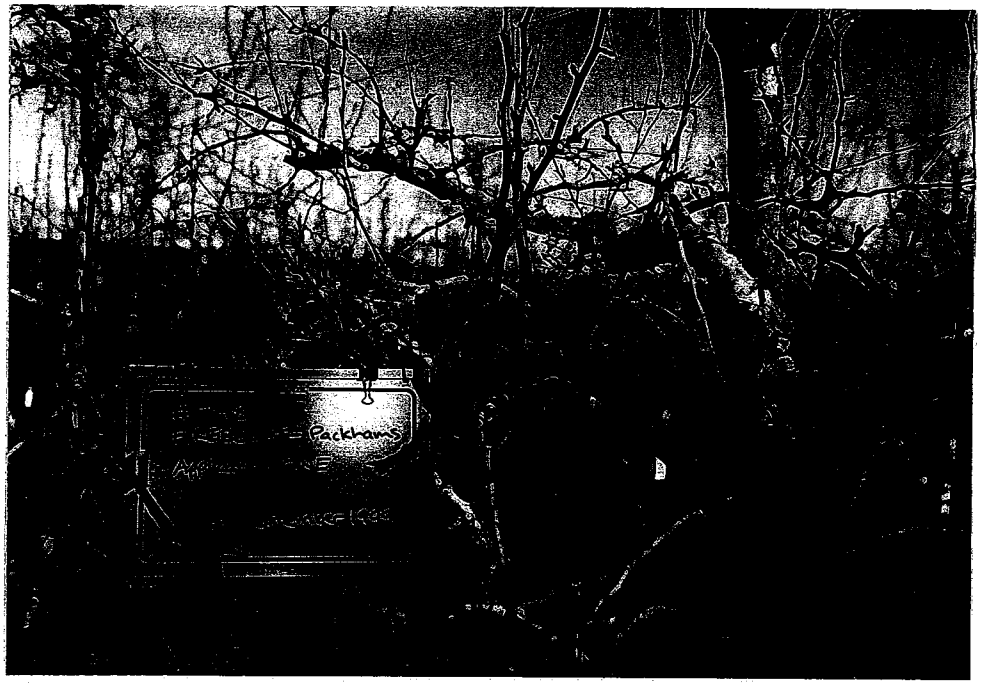


Photo II – Close-up of growth stage at Application # 1
(3 September 1999)

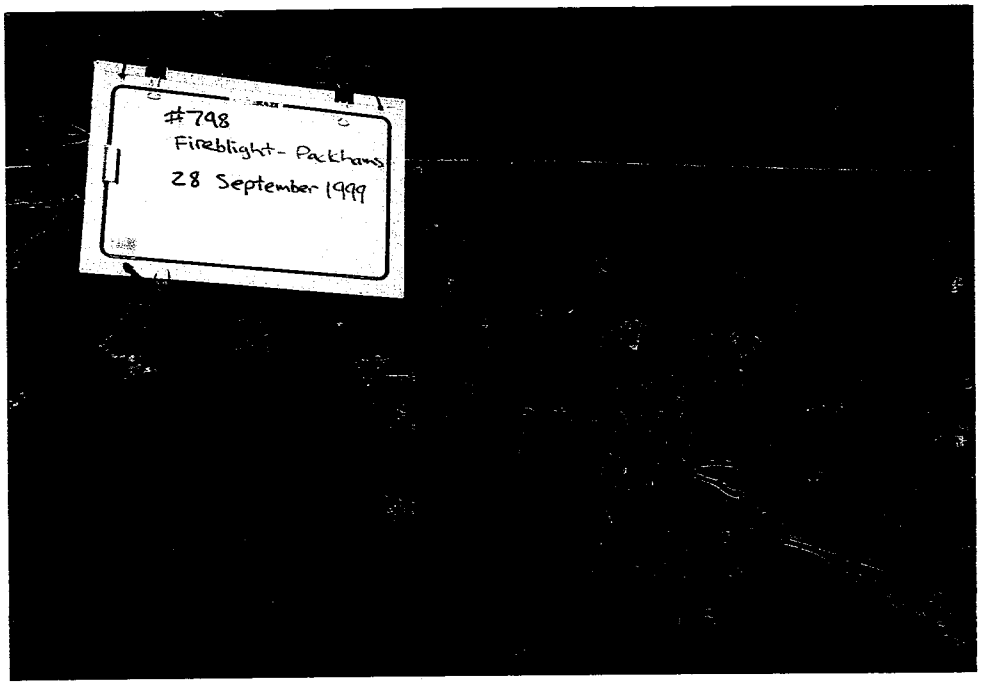


Photo III – Close-up of growth stage at Application # 4
(Open cluster - 28 September 1999)

Photo IV – General view of growth stage at first main application (# 5)
(White tip - 1 October 1999)

Photo V – Close-up of growth stage at first main application (# 5)
(White tip - 1 October 1999)

Photo VI – Close-up of growth stage at Application # 6
(6 October 1999)

Photo VII – General view of trial at 10% petalfall
(Application # 7 - 12 October 1999)

Photo VIII – Close-up of growth stage at Application # 7
(12 October 1999)

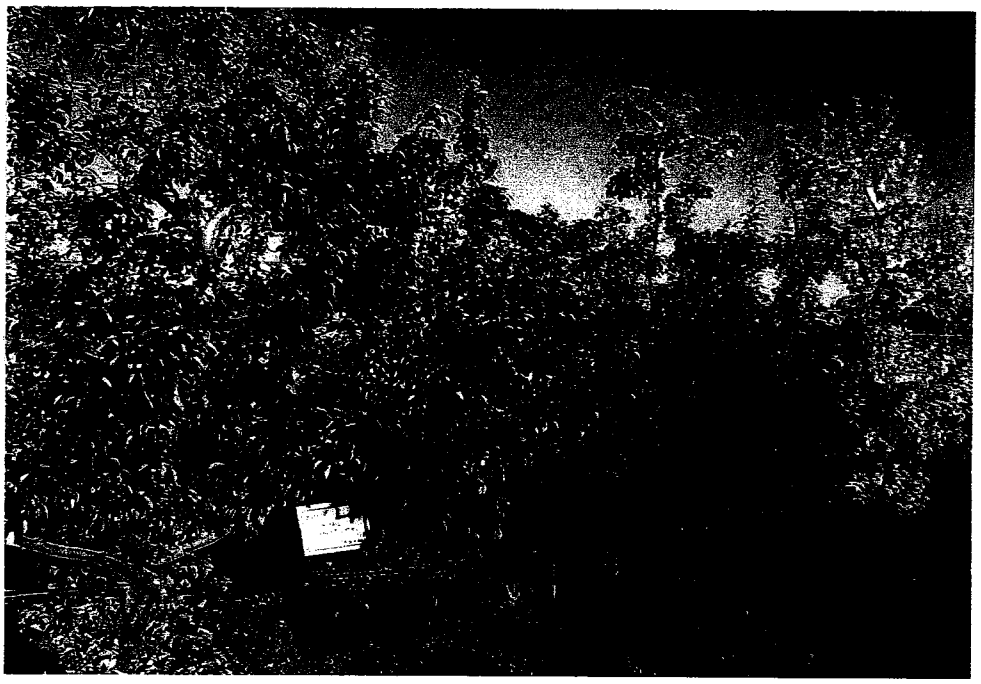


Photo IX – General view of trial at 99% petalfall
(Application # 8 - 19 October 1999)
Note white tree (Surround sprayed) in background

Photo X – Close-up of growth stage at final application (# 8)
(19 October 1999)

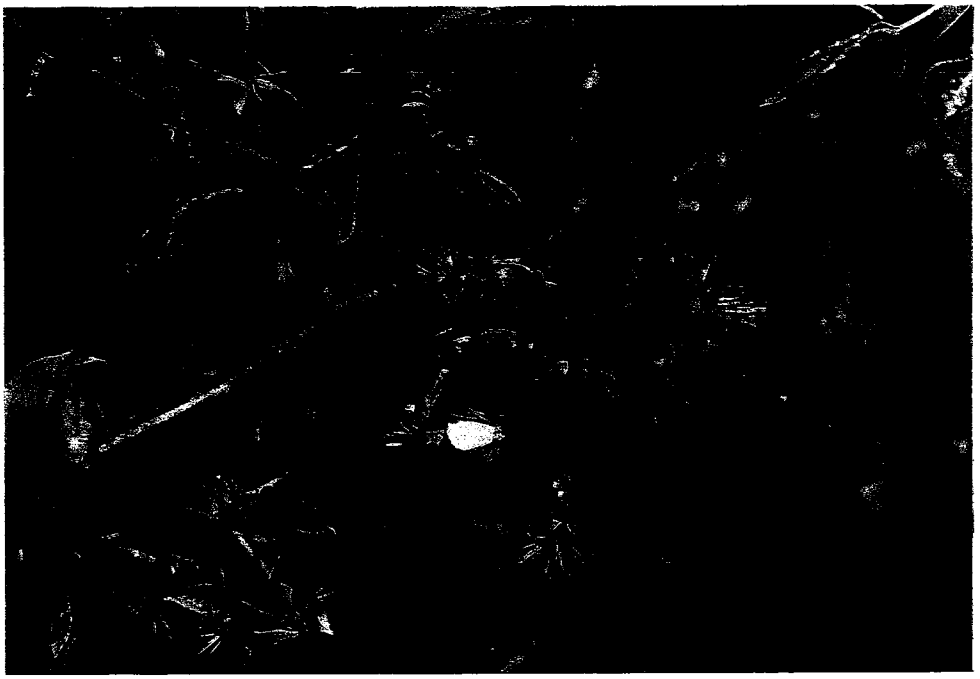


Photo XI – Foliage damage caused by CIT 30
(12 October 1999)

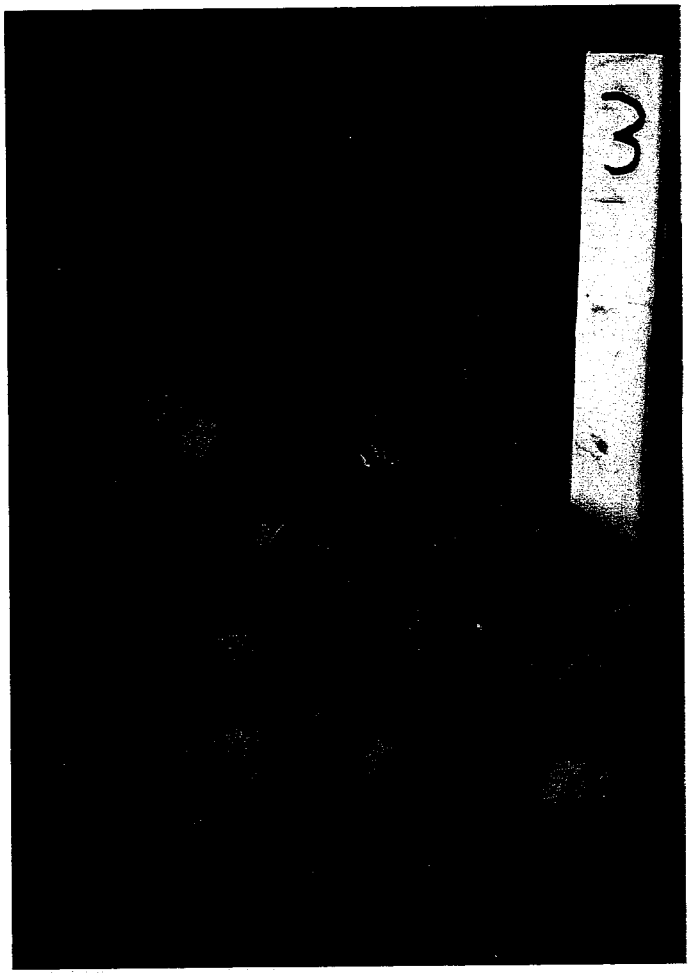


Photo XII – Close-up of fruit russet at harvest caused by CIT 30

Photo XIII – Tree sprayed with CIT 30 shown at harvest (four months after last spray) with smaller leaves and less dense tree

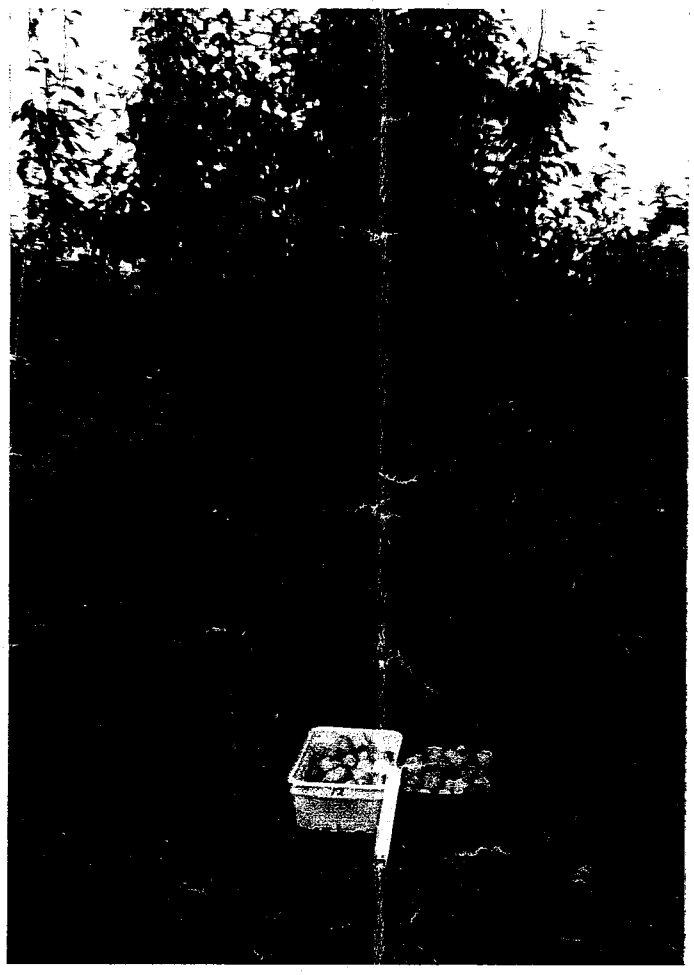


Photo XIV – Untreated Control tree shown at harvest

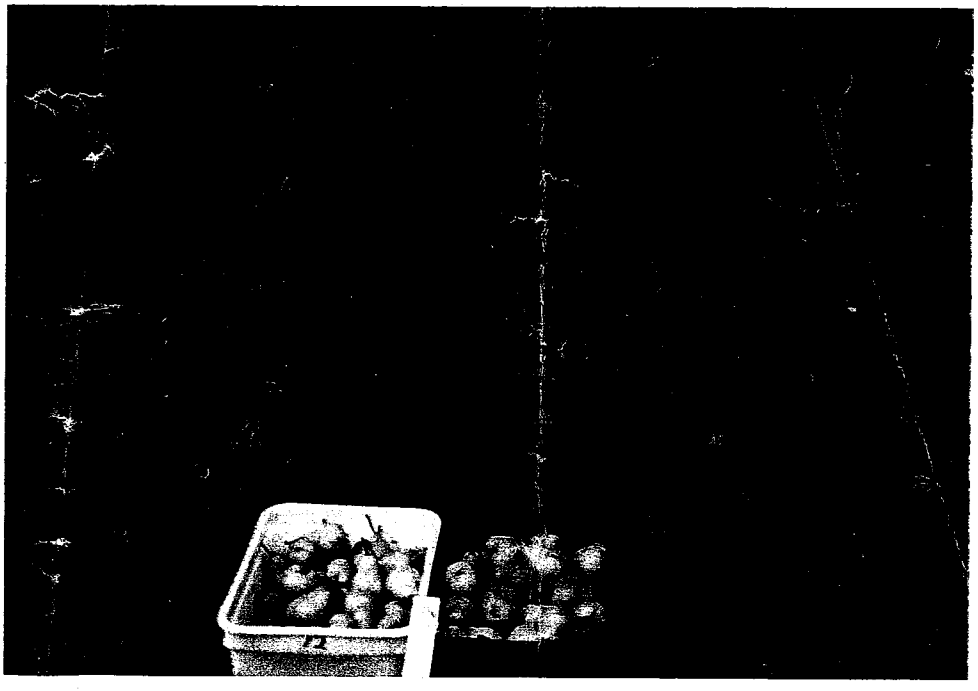


Photo XV – General view of untreated fruit at harvest

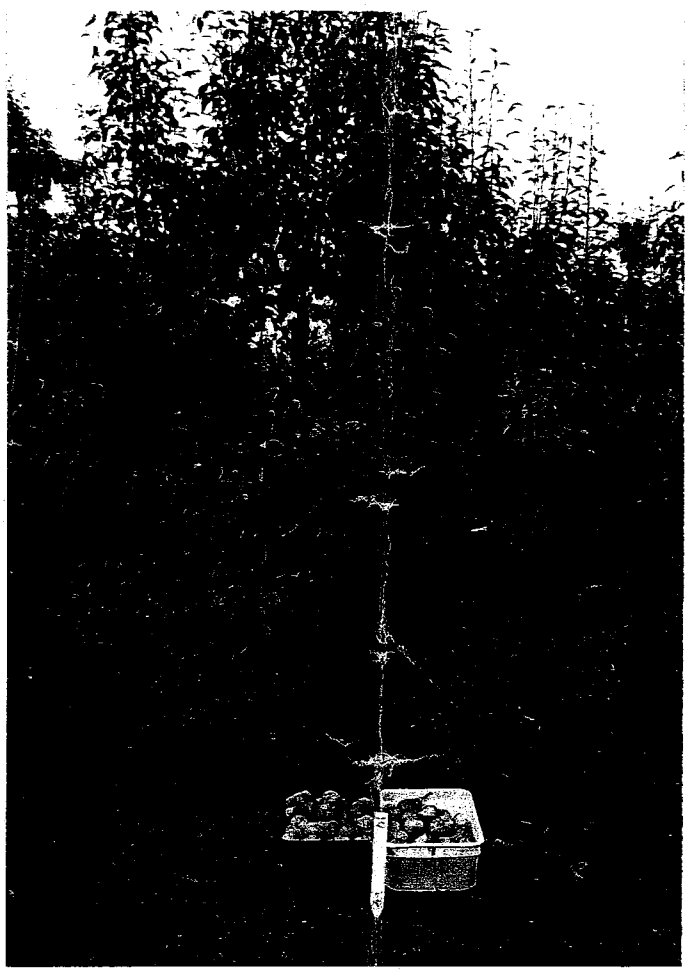


Photo XVI – Tree sprayed with Surround shown at harvest
(four months after last spray)

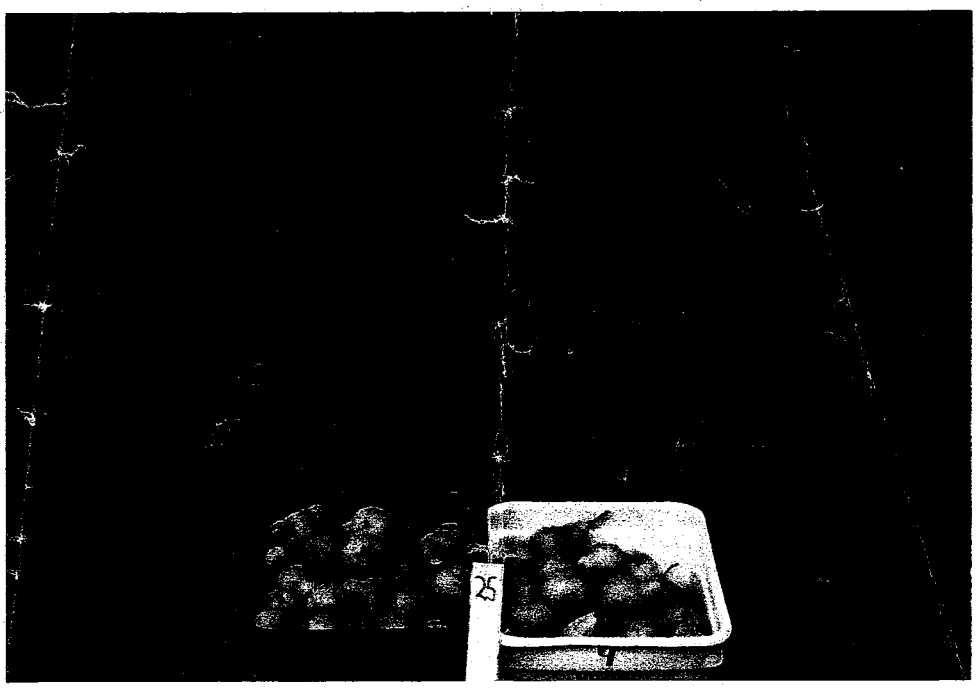


Photo XVII – General view of fruit at harvest from Surround sprayed tree