

FINAL REPORT

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Project Leader: Ms S J Thompson
Levington Agriculture

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Manea, Cambs

Project Co-ordinator: Mr P Wallace

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PRACTICAL SECTION FOR GROWERS

Introduction

The most serious aphid pests of lettuce are the Currant-Lettuce aphid (*Nasonovia ribisnigri*), the Potato aphid (*Macrosiphum euphorbiae*), the Peach-Potato aphid (*Myzus persicae*) and the Lettuce Root aphid (*Pemphigus bursarius*) (Parker & Blood-Smyth 1996). Damage is caused by direct feeding, honeydew excretion and by the spread of viral diseases. Control of aphids is essential for the production of uniform and high quality yield of crop.

Products currently in use (with either full or off-label recommendations) include a choice of the more persistent organophosphorous compounds, the relatively less persistent carbamates and short persistent pyrethroids. These are principally used as foliar sprays. For outdoor lettuce, routine chemical sprays of aphicides have proved generally effective, but problems exist in lack of persistence, in the development of aphid resistance and in concerns over chemical residues in the crop. This has resulted in a need for new products for the control of lettuce aphid.

New products under investigation include the imidazolimine compound imidacloprid (Gaucho) as a seed treatment and triazamate (Aztec), another new class of triazole-acetate insecticide with recommendations for use as a foliar spray, or soil drench treatment.

Imidacloprid insecticide, applied as a soil treatment, protected lettuce plants from developing infestations of *Myzus persicae* for 60-100 days after planting (Palumbo & Kerns 1994), and after successful trials on sugarbeet (Dewar, Haylock & Ecclestone 1996) and lettuce, an emergency Off-label Approval for the use of imidacloprid on lettuce was granted by the Pesticide Safety Directive in early 1996.

Triazamate is of particular interest as a fully systemic compound with good persistence and selectivity in favour of beneficial insects. Work by Parker & Blood-Symth (1996) found that 'the current commercial standards for foliar aphid control on lettuce (pirimicarb and demeton-S-methyl) had poor efficiency and persistence...in comparison to some newer insecticides' and noted that 'triazamate was particularly effective'. This makes it an ideal candidate for improved resistance strategy and integrated pest management programmes.

Benefits to the grower

Between 60-70% of the UK lettuce acreage is expected to be at risk from aphid attack in any one year, and control of aphids constitutes a relatively high proportion of the standard input costs of lettuce production (six treatment programme with standard pirimicarb). The use of triazamate (and/or imidacloprid) might enable cost savings to be made in reduced number of treatment applications and in improved quality of production.

With the peaks of foliar aphid activity tending to occur in mid-summer (June/July) (Ellis *et al* 1995), the trials were planted when peak aphid activity was expected in areas susceptible to aphid attack.

Objective of the project

To evaluate different rates and programmes of use of triazamate and imidacloprid for the control of foliar and root aphids in outdoor lettuce.

The trials compared differing rates/timings of triazamate with the standard weekly application of pirimicarb and an untreated control as shown on the table below. The trials were carried out on Gaucho treated seed and untreated seed.

Treatment		Application timings
Triazamate	high rate	3 treatments at 2 week intervals
Triazamate	high rate	2 treatments at 3 week intervals
Triazamate	low rate	3 treatments at 2 week intervals
Triazamate	low rate	6 treatments at 1 week intervals
Pirimicarb	standard	6 treatments at 1 week intervals

Results

There was very hot weather throughout the duration of the trial, and this, coupled with the increased use of treated seed in general by growers prevented the general aphid population building up.

Unfortunately the very low aphid populations meant that although it was clear that all treatments effectively controlled aphid numbers when compared to the untreated controls, it was not possible to discern differences between treatments. The trials on Gaucho treated seed showed that in general, aphid numbers were significantly lower than on the untreated seed.

Control of root aphid with the Gaucho treatment was good with no root aphid present on any of the treated seed plots at any of the trial sites. On the untreated-seed trials there were slightly more root aphid present on the pirimicarb treated plots than on the triazamate treated plots.

SCIENCE SECTION

Materials and methods

The trials were conducted on three sites, at Tattershall in Lincolnshire, Wissington in Suffolk and Manea in Cambridgeshire. At each site there were two trials running in parallel, one with triazamate alone, the other with triazamate following seed treatment with imidacloprid.

Table 1 Key dates

Site name	Planting date	Pre-treatment assessment	Hearting assessment	Harvest assessment
1st - Tattershall	03.07.97	10.07.97	31.07.97	14.08.97
2nd - Wissington	10.07.97	21.07.97	08.08.97	21.08.97
3rd - Manea	01.08.97	12.08.97	27.08.97	22.09.97

The rates and application timings are shown in Table 2 on the following page. The treatments were replicated four times in the trials and were of randomised block design.

Plot size was 1.83m x 10m.

The treatments were applied with pressurised plot sprayers at the relevant intervals and maintenance sprays of Unicrop Zineb and Novosol were applied as required.

Assessments

A pre-treatment assessment of aphid numbers was taken from 1 plant per plot and aphids were recorded by species. Due to the low aphid numbers, the results section shows only the total number of aphid per plot rather than the number of each aphid species per plant.

At hearting twelve plants per plot were cut and the whole plant top was assessed for aphid numbers and recorded by species. Results are again shown only by total aphid numbers per plot.

At harvest 12 plants per plot were harvested and the outer leaves were removed as ready for marketing. Numbers of aphid were recorded as at hearting. The roots of the harvested plants were dug up and assessed for root aphid using a score of 0-5 where 0 was no root aphid present and 5 indicated severe contamination of the roots. All plants in the trial were subject to crop destruction.

Due to overspraying with insecticide by the grower, one of the untreated-seed trials was lost.

Table 2 Programme of treatment application

Weeks after planting		0	1	2	3	4	5	6	7
	g a.i./ha								
Untreated	-								
Triazamate	56g		T1		T2		T3		
Triazamate	56g		T1			T2			
Triazamate	28g		T1		T2		T3		
Triazamate	28g		T1	T2	T3	T4	T5	(T6)	
Pirimicarb			T1	T2	T3	T4	T5	(T6)	
Following seed treatment with imidacloprid									
Untreated seed	-								
Untreated	-								
Triazamate	56g			T1		T2			
Triazamate	56g				T1				
Triazamate	28g			T1		T2			
Triazamate	28g			T1	T2	T3	(T4)		
Pirimicarb				T1	T2	T3	(T4)		

Due to the high temperatures the lettuce were harvested early and so the final weekly treatments (shown in brackets) were not applied.

Results for trials on untreated seed

Pre-treatment

The pre-treatment assessment (immediately before the first treatment application) of aphid numbers found there to be low aphid infestation at two sites, and no aphid at the third site in Cambridgeshire. There was uniform aphid infestation across all plots at each site.

At Hearting

At hearting there was no significant difference in aphid numbers between the treatments at the second site, and no aphid found at the third site. There were no visible quality differences at any site.

At Harvest

At the second site, the total numbers of aphid per plot at harvest was slightly higher in the untreated plots, but not to a level of statistical significance ($P=0.05$). At the third site there were over 100 aphids on one of the untreated plots, but nil on the other untreated plots. This resulted in no statistical significant differences in the results, although the number of aphid on the untreated was higher than the other treatments. There were no visible quality differences at any sites.

Root Aphid

The root aphid scores for the triazamate treatments were slightly lower than the untreated and pirimicarb treatments, however this was significant only at a probability level of 10%.

All results can be found in more detail in Appendix 1.

Results for trials on Gaucho treated seed

Pre-treatment

There were significantly higher aphid numbers on the untreated seed control plots when compared with the Gaucho treated seed plots.

At Hearting

The first site had no significant differences between treatments in aphid numbers at hearting. The untreated seed plots on the second site had significantly more aphid when compared with the Gaucho only, and 28g rate of Triazamate applied at fortnightly intervals. The third site had no aphid present at hearting. There were no visible quality differences at any sites.

At Harvest

At harvest the first site had very low aphid numbers and there were no significant differences between treatments. The second site had no aphid present. The third site had significantly more aphid on the untreated-seed plots when compared with the other treatments, although aphid numbers were still very low. There were no visible quality differences at any of the sites.

Root Aphid

Although there were no root aphid at the first site, the second and third sites had significantly more root aphid present on the untreated-seed than on the Gaucho treatments.

All results can be found in more detail in Appendix 2.

Interactions

The paired trials were sited next to each other and assessed at the same time. The effects of seed treatment plus spray treatments could therefore be compared with untreated seed plus spray treatments. Due to the low numbers of aphids present only the results of the assessments of numbers of aphids present at hearting at Wisington, and the numbers of root aphids at Wisington and Manea combined could be analysed.

The aphid numbers on the lettuces at hearting were significantly reduced by Gaucho seed treatment compared with untreated seed lettuces in the adjacent trial. There were no significant spray treatment effects nor interactions with the Gaucho seed treatment at Wisington.

At Wisington and Manea seed treatment with Gaucho was effective against root aphids and subsequent sprays were unnecessary, whereas untreated seed required protection and Triazamate was indicated to be effective.

Conclusion

There was very hot weather throughout the duration of the trial, and this, coupled with the increased use of treated seed in general by growers prevented the general aphid population building up.

The trials on Gaucho treated seed showed that in general aphid numbers were significantly lower than on the untreated seed.

Control of root aphid with the Gaucho treatment was good with no root aphid present on any of the treated seed plots at any of the trial sites. On the untreated-seed trials there were slightly more root aphid present on the pirimicarb treated plots than on the triazamate treated plots.

Table 3a. Pre-treatment assessment of aphid numbers
Triazamate on lettuce

Trial Id. 978141 978142 Mean Duncan
MRT 5%

Treatments Rate ai/ha Timing

1	Untreated		5.75 a	0.00 a	2.88	a
2	Triazamate 56g	2 wks	4.75 a	0.00 a	2.38	a
3	Triazamate 56g	3 wks	4.25 a	0.00 a	2.13	a
4	Triazamate 28g	2 wks	4.75 a	0.00 a	2.38	a
5	Triazamate 28g	1 wk	4.50 a	0.00 a	2.25	a
6	Pirimicarb280g	1 wk	6.75 a	0.00 a	3.38	a
	Mean		5.13	0.00	2.56	

Treatment by Site interactions

Trial	F test	NS
LSD(0.05)		**
LSD(0.01)		1.37
Treatments	F test	1.85
LSD(0.05)		NS
LSD(0.01)		2.38
		3.20

Significance

LSD(0.05)	0.00
LSD(0.01)	0.00

CV%

SE/Plot	64.3	0.0
	3.29	0.00

Trial ID.:

978141	SJT/978141.97814.1997.TOTAL NUMBER OF APHIDS	21/7/97
978142	SJT/978142.97814.1997.TOTAL NUMBER OF APHIDS	12/8/97

Table 3b. Assessment of aphid numbers at hearting
Triazamate on lettuce

Treatments	Rate ai/ha	Timing	Trial Id.	978141	978142	Mean	Duncan MRT 5%
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Treatments Rate ai/ha Rate Timing

1	Untreated			4.50 a	0.00 a	2.25	a
2	Triazamate 56g	2 wks		4.75 a	0.00 a	2.38	a
3	Triazamate 56g	3 wks		3.75 a	0.00 a	1.88	a
4	Triazamate 28g	2 wks		4.50 a	0.00 a	2.25	a
5	Triazamate 28g	1 wk		3.75 a	0.00 a	1.88	a
6	Pirimicarb280g	1 wk		4.50 a	0.00 a	2.25	a
	Mean			4.29	0.00	2.15	

Treatment by Site interactions

Trial	F test		NS
	LSD(0.05)		**
	LSD(0.01)		1.05
Treatments	F test		1.42
	LSD(0.05)		NS
	LSD(0.01)		1.82
Significance			2.46

LSD(0.05)		NS
LSD(0.01)		3.81
CV%		5.27
SE/Plot		58.9
		2.53
		0.0
		0.00

Trial ID.:	
978141 SJT/978141,97814,1997,TOTAL NUMBER OF APHIDS	15/8/97
978142 SJT/978142,97814,1997,TOTAL NUMBER OF APHIDS	27/8/97

Table 3c. Assessment of aphid numbers at harvest
Triazamate on lettuce

Trial Id.	978141	978142	Mean	Duncan MRT 5%
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Treatments Rate ai/ha Rate Timing

1 Untreated	2.50 a	27.25 a	14.88	a
2 Triazamate 56g	1.50 a	0.00 a	0.75	a
3 Triazamate 56g	1.00 a	0.00 a	0.50	a
4 Triazamate 28g	1.25 a	0.00 a	0.63	a
5 Triazamate 28g	0.50 a	0.00 a	0.25	a
6 Pirimicarb280g	1.25 a	0.00 a	0.63	a
Mean	1.33	4.54	2.94	

Treatment by Site interactions

Trials	F test	NS
	LSD(0.05)	NS
	LSD(0.01)	9.31
Treatments	F test	12.53
	LSD(0.05)	NS
	LSD(0.01)	16.12
		21.71

Significance

LSD(0.05)	NS	NS
LSD(0.01)	2.77	33.53
	3.84	46.36

CV%

SE/Plot	138.1	489.9
	1.84	22.25

Trial ID.:

978141	SJT/978141.97814.1997.TOTAL NUMBER OF ADULT APHIDS	28/8/97
978142	SJT/978142.97814.1997.TOTAL APHID NUMBERS	29/9/97

Table 3d. Root aphids on trials with triazamate
Score 0-5 where 0=none, 5=severe infestation

Treatments	Rate ai/ha	Timing	Trial Id.	978141	978142	Mean	Duncan MRT 5%
1 Untreated				0.60 a	0.09 a	0.34	a
2 Triazamate 56g		2 wks		0.06 a	0.00 a	0.03	a
3 Triazamate 56g		3 wks		0.12 a	0.00 a	0.06	a
4 Triazamate 28g		2 wks		0.35 a	0.00 a	0.18	a
5 Triazamate 28g		1 wk		0.08 a	0.00 a	0.04	a
6 Pirimicarb280g		1 wk		0.64 a	0.04 a	0.34	a
Mean				0.31	0.02	0.17	

Treatment by Site interactions

Trial	F test		NS
	LSD(0.05)		**
	LSD(0.01)	0.17	
Treatments	F test	0.23	
	LSD(0.05)	+	
	LSD(0.01)	0.30	
Significance		0.40	

CV%	129.9	334.7	
SE/Plot	0.40	0.07	

Trial ID.:			
978141	SJT/978141, 1997, AVERAGE LETTUCE ROOT APHID SCORE	05	20/8/97
978142	SJT/978142, 1997, AVERAGE LETTUCE ROOT APHID SCORE	05	29/9/97

Table 4a. Pre-treatment assessment of aphid numbers
Imidacloprid and triazamate on lettuce

Treatments	Rate ai/ha	Timing	Trial Id.	978150	978151	978152	Mean	Duncan MRT 5%
1 Untreated				16.75 c	5.75 b	0.00 a	7.50	b
2 Imidacloprid				10.50 b	0.75 a	0.00 a	3.75	ab
3 Imidacloprid+Triazamate	2 wks	Seed		8.50 ab	0.50 a	0.00 a	3.00	a
4 Imidacloprid+Triazamate	3 wks			8.00 ab	0.00 a	0.00 a	2.67	a
5 Imidacloprid+Triazamate	2 wks			4.00 a	0.25 a	0.00 a	1.42	a
6 Imidacloprid+Triazamate	1 wk			10.75 b	0.75 a	0.00 a	3.83	ab
7 Imidacloprid+Pirimicarb280g	1 wk			9.25 ab	0.00 a	0.00 a	3.08	a
Mean				9.68	1.14	0.00	3.61	

Treatment by Site interactions

Trials	F test		**
	LSD(0.05)		**
	LSD(0.01)	2.36	
Treatments	F test	3.30	
	LSD(0.05)	+	
	LSD(0.01)	3.60	
Significance		5.05	

CV%			
SE/Plot			
Trial ID.:			

978150 AS/978150,97815,1997,TOTAL NUMBER OF APHIDS 17/7/97
 978151 SJT/978151,97815,1997,TOTAL NUMBER OF APHIDS 21/7/97
 978152 SJT/978152,97815,1997,TOTAL NUMBER OF APHIDS 12/8/97

Table 4b. Assessment of aphid numbers at hearting
Imidacloprid and triazamate on lettuce

Treatment	Trial Id.	978150	978151	978152	Mean	Duncan MRT 5%
Treatments	Rate ai/ha	Timing				
1 Untreated		2.00 a	2.75 b	0.00 a	1.58	b
2 Imidacloprid		1.25 a	0.50 a	0.00 a	0.58	a
3 Imidacloprid+Triazamate	2 wks	0.75 a	0.75 ab	0.00 a	0.50	a
4 Imidacloprid+Triazamate	3 wks	1.00 a	1.50 ab	0.00 a	0.83	ab
5 Imidacloprid+Triazamate	2 wks	1.75 a	0.50 a	0.00 a	0.75	ab
6 Imidacloprid+Triazamate	1 wk	1.75 a	1.75 ab	0.00 a	1.17	ab
7 Imidacloprid+Pirimicarb	1 wk	1.00 a	1.25 ab	0.00 a	0.75	ab
Mean		1.36	1.29	0.00	0.88	

Treatment by Site interactions

Trials	F test				NS
	LSD(0.05)				**
	LSD(0.01)				0.63
Treatments	F test				0.84
	LSD(0.05)				NS
	LSD(0.01)				0.96
Significance					1.28
LSD(0.05)					
LSD(0.01)					

CV%					
SE/Plot					
Trial ID.:					

978150 AS/978150,97815,1997,TOTAL NUMBER OF APHIDS 31/7/97
 978151 SJT/978151,97815,1997,TOTAL NUMBER OF APHIDS 10/8/97
 978152 SJT/978152,97815,1997,TOTAL NUMBER OF APHIDS 27/8/97

Table 4c. Assessment of aphid numbers at harvest
Imidacloprid and triazamate on lettuce

Treatments	Rate ai/ha	Timing	978150	978151	978152	Mean	Duncan MRT 5%
1 Untreated			0.75 a	0.00 a	1.00 b	0.58	b
2 Imidacloprid	Seed		0.25 a	0.00 a	0.00 a	0.08	a
3 Imidacloprid+Triazamate	56g	2 wks	0.25 a	0.00 a	0.00 a	0.08	a
4 Imidacloprid+Triazamate	56g	3 wks	0.25 a	0.00 a	0.00 a	0.08	a
5 Imidacloprid+Triazamate	28g	2 wks	0.00 a	0.00 a	0.00 a	0.00	a
6 Imidacloprid+Triazamate	28g	1 wk	0.00 a	0.00 a	0.00 a	0.00	a
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00 a	0.00 a	0.00 a	0.00	a
Mean			0.21	0.00	0.14	0.12	
Treatment by Site interactions							
Trials							NS
F test							NS
LSD(0.05)							0.21
LSD(0.01)							0.28
Treatments							**
F test							**
LSD(0.05)							0.32
LSD(0.01)							0.43
Significance			NS		**		
LSD(0.05)			0.90	0.00	0.46		
LSD(0.01)			1.23	0.00	0.63		
CV%			282.0	0.0	216.0		
SE/Plot			0.60	0.00	0.31		
Trial ID.:							
978150 AS/978150,97815,1997,TOTAL NUMBER OF APHIDS 14/8/97							
978151 SJT/978151,97815,1997,TOTAL NUMBER OF APHIDS 21/8/97							
978152 SJT/978152,97815,1997,TOTAL NUMBER OF APHIDS 29/9/97							

Table 4d. Root aphid on trials with imidacloprid and triazamate
Score 0-5 where 0=none, 5=severe

Treatments	Rate ai/ha	Timing	978150	978151	978152	Mean	Duncan MRT 5%
1 Untreated			0.00 a	0.43 b	0.23 b	0.22	b
2 Imidacloprid	Seed		0.00 a	0.00 a	0.00 a	0.00	a
3 Imidacloprid+Triazamate	56g	2 wks	0.00 a	0.00 a	0.00 a	0.00	a
4 Imidacloprid+Triazamate	56g	3 wks	0.00 a	0.00 a	0.00 a	0.00	a
5 Imidacloprid+Triazamate	28g	2 wks	0.00 a	0.00 a	0.00 a	0.00	a
6 Imidacloprid+Triazamate	28g	1 wk	0.00 a	0.00 a	0.00 a	0.00	a
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00 a	0.00 a	0.00 a	0.00	a
Mean			0.00	0.06	0.03	0.03	

Treatment by Site interactions

Trials	F test						NS
	LSD(0.05)						NS
	LSD(0.01)						0.08
Treatments	F test						0.10
	LSD(0.05)						**
	LSD(0.01)						0.12
Significance							0.16

CV%				*	NS		
SE/Plot			0.0	314.1	467.2		
			0.00	0.19	0.15		

Trial ID.:							
978150	AS/978150,97815,1997,AVERAGE LETTUCE ROOT APHID SCORE	05	13/8/97				
978151	SJT/978151,97815,1997,AVERAGE LETTUCE ROOT APHID SCORE	05	21/8/97				
978152	SJT/978152,97815,1997,AVERAGE LETTUCE ROOT APHID SCORE	0-5	29/9/97				

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Appendix 1

Results from trials on untreated seed

Lettuce: Aphid control with triazamate
 LA Trial ID : 978141 Wisington
 Client name & number : HDC FV 162b
 Assessment : Pre-treatment
 Assessment Date : 21/7/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			6.00	8.00	8.00	1.00	5.75	a
2 Triazamate 56g		2 wks	2.00	7.00	7.00	3.00	4.75	a
3 Triazamate 56g		3 wks	0.00	5.00	4.00	8.00	4.25	a
4 Triazamate 28g		2 wks	4.00	3.00	4.00	8.00	4.75	a
5 Triazamate 28g		1 wk	8.00	3.00	2.00	5.00	4.50	a
6 Pirimicarb 280g		1 wk	3.00	7.00	13.00	4.00	6.75	a
Mean			3.83	5.50	6.33	4.83	5.13	
					LSD(0.05)		4.96	
					LSD(0.01)		6.86	
					Significance		NS	
					CV%		64.25	
					S.E./PLOT		3.29	

Lettuce: Aphid control with triazamate
 LA Trial ID : 978141 Wisingington
 Client name & number : HDC FV 162b
 Assessment : Aphid count on 12 plants/plot
 Assessment Date : 15/8/97
 Variable : Total number of aphid

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			9.00	7.00	0.00	2.00	4.50	a
2 Triazamate 56g		2 wks	2.00	15.00	0.00	2.00	4.75	a
3 Triazamate 56g		3 wks	2.00	8.00	2.00	3.00	3.75	a
4 Triazamate 28g		2 wks	5.00	11.00	2.00	0.00	4.50	a
5 Triazamate 28g		1 wk	1.00	11.00	2.00	1.00	3.75	a
6 Pirimicarb 280g		1 wk	3.00	10.00	4.00	1.00	4.50	a
Mean			3.67	10.33	1.67	1.50	4.29	
					LSD(0.05)		3.81	
					LSD(0.01)		5.27	
					Significance		NS	
					CV%		58.88	
					S.E./PLOT		2.53	

Lettuce: Aphid control with triazamate
 LA Trial ID : 978141 Wisington
 Client name & number : HDC FV 162b
 Assessment Date : 28/8/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			1.00	1.00	1.00	7.00	2.50	a
2 Triazamate 56g		2 wks	0.00	2.00	4.00	0.00	1.50	a
3 Triazamate 56g		3 wks	0.00	3.00	0.00	1.00	1.00	a
4 Triazamate 28g		2 wks	1.00	0.00	2.00	2.00	1.25	a
5 Triazamate 28g		1 wk	0.00	0.00	2.00	0.00	0.50	a
6 Pirimicarb 280g		1 wk	1.00	0.00	4.00	0.00	1.25	a
Mean			0.50	1.00	2.17	1.67	1.33	
					LSD(0.05)		2.77	
					LSD(0.01)		3.84	
					Significance		NS	
					CV%		138.07	
					S.E./PLOT		1.84	

Lettuce: Aphid control with triazamate
 LA Trial ID : 978141 Wisington
 Client name & number : HDC FV 162b
 Assessment Date : 20/8/97
 Variable : Average lettuce root aphid score 0-5 (5 = severe)

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			1.25	1.08	0.00	0.08	0.60	a
2 Triazamate 56g		2 wks	0.08	0.08	0.08	0.00	0.06	a
3 Triazamate 56g		3 wks	0.08	0.16	0.25	0.00	0.12	a
4 Triazamate 28g		2 wks	0.41	0.41	0.58	0.00	0.35	a
5 Triazamate 28g		1 wk	0.25	0.00	0.08	0.00	0.08	a
6 Pirimicarb 280g		1 wk	0.08	0.83	1.58	0.08	0.64	a
Mean			0.36	0.43	0.43	0.03	0.31	
					LSD(0.05)		0.61	
					LSD(0.01)		0.84	
					Significance		NS	
					CV%		129.90	
					S.E./PLOT		0.40	

Lettuce: Aphid control with triazamate
 LA Trial ID : 978142 Manea
 Client name & number : HDC FV 162b
 Assessment : Pre-treatment
 Assessment Date : 12/8/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1	Untreated		0.00	0.00	0.00	0.00	0.00
2	Triazamate 56g	2 wks	0.00	0.00	0.00	0.00	0.00
3	Triazamate 56g	3 wks	0.00	0.00	0.00	0.00	0.00
4	Triazamate 28g	2 wks	0.00	0.00	0.00	0.00	0.00
5	Triazamate 28g	1 wk	0.00	0.00	0.00	0.00	0.00
6	Pirimicarb 280g	1 wk	0.00	0.00	0.00	0.00	0.00
	Mean		0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate
 LA Trial ID : 978142 Manea
 Client name & number : HDC FV 162b
 Assessment : At hearting
 Assessment Date : 27/8/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1	Untreated		0.00	0.00	0.00	0.00	0.00
2	Triazamate 56g	2 wks	0.00	0.00	0.00	0.00	0.00
3	Triazamate 56g	3 wks	0.00	0.00	0.00	0.00	0.00
4	Triazamate 28g	2 wks	0.00	0.00	0.00	0.00	0.00
5	Triazamate 28g	1 wk	0.00	0.00	0.00	0.00	0.00
6	Pirimicarb 280g	1 wk	0.00	0.00	0.00	0.00	0.00
	Mean		0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate
 LA Trial ID : 978142 Manea
 Client name & number : HDC FV 162b
 Assessment Date : 29/9/97
 Variable : Total aphid numbers

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			109.00	0.00	0.00	0.00	27.25	a
2 Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00	a
3 Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00	a
4 Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00	a
5 Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00	a
6 Pirimicarb 280g		1 wk	0.00	0.00	0.00	0.00	0.00	a
Mean			18.17	0.00	0.00	0.00	4.54	
					LSD(0.05)		33.53	
					LSD(0.01)		46.36	
					Significance		NS	
					CV%		489.90	
					S.E./PLOT		22.25	

Lettuce: Aphid control with triazamate
 LA Trial ID : 978142 Manea
 Client name & number : HDC FV 162b
 Assessment Date : 29/9/97
 Variable : Aphid on roots score 0-5 (0 = none 5 = severe)

Treatments	Rate ai/ha	Timing	Rep				Mean	Duncan's MRT 5%
			1	2	3	4		
1	Untreated		0.00	0.00	0.00	0.34	0.08	a
2	Triazamate	56g 2 wks	0.00	0.00	0.00	0.00	0.00	a
3	Triazamate	56g 3 wks	0.00	0.00	0.00	0.00	0.00	a
4	Triazamate	28g 2 wks	0.00	0.00	0.00	0.00	0.00	a
5	Triazamate	28g 1 wk	0.00	0.00	0.00	0.00	0.00	a
6	Pirimicarb	280g 1 wk	0.00	0.00	0.00	0.17	0.04	a
Mean			0.00	0.00	0.00	0.08	0.02	
			LSD(0.05)				0.11	
			LSD(0.01)				0.15	
			Significance				NS	
			CV%				334.66	
			S.E./PLOT				0.07	

Appendix 2

Results from trials on Gaucho treated seed

Lettuce: Aphid control with triazamate & imidicloprid
 LA Trial ID : 978150 Tattershall
 Client name & number : HDC FV 162b
 Assessment : 1 wk prespray
 Assessment Date : 17/7/97
 Crop GS : 8 leaves
 Plant Part : Current lettuce
 Variable : Total number of aphid

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated		Seed	15.00	12.00	15.00	25.00	16.75	c
2 Imidicloprid		2 wks	14.00	7.00	9.00	12.00	10.50	b
3 Imidicloprid+Triazamate 56g		3 wks	7.00	6.00	9.00	12.00	8.50	ab
4 Imidicloprid+Triazamate 56g		2 wks	4.00	8.00	9.00	11.00	8.00	ab
5 Imidicloprid+Triazamate 28g		1 wk	1.00	7.00	4.00	4.00	4.00	a
6 Imidicloprid+Triazamate 28g		1 wk	8.00	17.00	11.00	7.00	10.75	b
7 Imidicloprid+Pirimicarb280g		1 wk	10.00	12.00	6.00	9.00	9.25	ab

Mean

8.43 9.86 9.00 11.43 9.68
 LSD(0.05) 5.36
 LSD(0.01) 7.35
 Significance **
 CV% 37.29
 S.E./PLOT 3.61

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978150 Tattershall
 Client name & number : HDC FV 162b
 Assessment Date : 31/7/97
 Crop GS : 20 leaves
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			5.00	0.00	2.00	1.00	2.00	a
2 Imidacloprid		Seed	1.00	3.00	0.00	1.00	1.25	a
3 Imidacloprid+Triazamate	56g	2 wks	0.00	2.00	0.00	1.00	0.75	a
4 Imidacloprid+Triazamate	56g	3 wks	0.00	0.00	4.00	0.00	1.00	a
5 Imidacloprid+Triazamate	28g	2 wks	2.00	3.00	0.00	2.00	1.75	a
6 Imidacloprid+Triazamate	28g	1 wk	2.00	1.00	1.00	3.00	1.75	a
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00	3.00	0.00	1.00	1.00	a
Mean			1.43	1.71	1.00	1.29	1.36	
					LSD(0.05)		2.35	
					LSD(0.01)		3.22	
					Significance		NS	
					CV%		116.69	
					S.E./PLOT		1.58	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978150 Tattershall
 Client name & number : HDC FV 162b
 Assessment Date : 14/8/97
 Crop GS : Heart formed ready to harvest
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			0.00	3.00	0.00	0.00	0.75	a
2 Imidacloprid		Seed	0.00	0.00	1.00	0.00	0.25	a
3 Imidacloprid+Triazamate	56g	2 wks	0.00	1.00	0.00	0.00	0.25	a
4 Imidacloprid+Triazamate	56g	3 wks	0.00	1.00	0.00	0.00	0.25	a
5 Imidacloprid+Triazamate	28g	2 wks	0.00	0.00	0.00	0.00	0.00	a
6 Imidacloprid+Triazamate	28g	1 wk	0.00	0.00	0.00	0.00	0.00	a
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00	0.00	0.00	0.00	0.00	a
Mean			0.00	0.71	0.14	0.00	0.21	
					LSD(0.05)		0.90	
					LSD(0.01)		1.23	
					Significance		NS	
					CV%		281.97	
					S.E./PLOT		0.60	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978150 Tattershall
 Client name & number : HDC FV 162b
 Assessment Date : 13/8/97
 Variable : Number root aphid

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1 Untreated		Seed	0.00	0.00	0.00	0.00	0.00
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00
5 Imidacloprid+Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00
6 Imidacloprid+Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00
Mean			0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978151 Wissington
 Client name & number : HDC FV 162b
 Assessment Date : 21/7/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			3.00	2.00	10.00	8.00	5.75	b
2 Imidacloprid		Seed	1.00	1.00	1.00	0.00	0.75	a
3 Imidacloprid+Triazamate 56g		2 wks	0.00	1.00	0.00	1.00	0.50	a
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00	a
5 Imidacloprid+Triazamate 28g		2 wks	0.00	1.00	0.00	0.00	0.25	a
6 Imidacloprid+Triazamate 28g		1 wk	1.00	0.00	2.00	0.00	0.75	a
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00	a
Mean			0.71	0.71	1.86	1.29	1.14	
					LSD(0.05)		2.32	
					LSD(0.01)		3.17	
					Significance		**	
					CV%		136.36	
					S.E./PLOT		1.56	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978151 Wisington
 Client name & number : HDC FV 162b
 Assessment : Aphid count on 12 plants/plot
 Assessment Date : 10/8/97
 Variable : Total number of aphid

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			2.00	1.00	4.00	4.00	2.75	b
2 Imidacloprid		Seed	1.00	0.00	0.00	1.00	0.50	a
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	1.00	2.00	0.75	ab
4 Imidacloprid+Triazamate 56g		3 wks	2.00	0.00	3.00	1.00	1.50	ab
5 Imidacloprid+Triazamate 28g		2 wks	2.00	0.00	0.00	0.00	0.50	a
6 Imidacloprid+Triazamate 28g		1 wk	1.00	2.00	4.00	0.00	1.75	ab
7 Imidacloprid+Pirimicarb280g		1 wk	4.00	0.00	1.00	0.00	1.25	ab
Mean			1.71	0.43	1.86	1.14	1.29	
					LSD(0.05)		1.89	
					LSD(0.01)		2.59	
					Significance		NS	
					CV%		98.97	
					S.E./PLOT		1.27	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978151 Wisington
 Client name & number : HDC FV 162b
 Assessment Date : 21/8/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1 Untreated			0.00	0.00	0.00	0.00	0.00
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00
5 Imidacloprid+Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00
6 Imidacloprid+Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00
Mean			0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978151 Wissington
 Client name & number : HDC FV 162b
 Assessment Date : 21/8/97
 Variable : Average lettuce root aphid score 0-5 (5 = severe)

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			0.00	0.41	0.16	1.16	0.43	b
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00	a
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00	a
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00	a
5 Imidacloprid+Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00	a
6 Imidacloprid+Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00	a
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00	a
Mean			0.00	0.06	0.02	0.17	0.06	
					LSD(0.05)		0.29	
					LSD(0.01)		0.40	
					Significance		*	
					CV%		314.13	
					S.E./PLOT		0.19	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978152 Manea
 Client name & number : HDC FV 162b
 Assessment : pre-treatment
 Assessment Date : 12/8/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1 Untreated			0.00	0.00	0.00	0.00	0.00
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00
3 Imidacloprid+Triazamate	56g	2 wks	0.00	0.00	0.00	0.00	0.00
4 Imidacloprid+Triazamate	56g	3 wks	0.00	0.00	0.00	0.00	0.00
5 Imidacloprid+Triazamate	28g	2 wks	0.00	0.00	0.00	0.00	0.00
6 Imidacloprid+Triazamate	28g	1 wk	0.00	0.00	0.00	0.00	0.00
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00	0.00	0.00	0.00	0.00
Mean			0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978152 Manea
 Client name & number : HDC FV 162b
 Assessment Date : 27/8/97
 Crop GS : At hearting
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean
1 Untreated			0.00	0.00	0.00	0.00	0.00
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00
3 Imidacloprid+Triazamate	56g	2 wks	0.00	0.00	0.00	0.00	0.00
4 Imidacloprid+Triazamate	56g	3 wks	0.00	0.00	0.00	0.00	0.00
5 Imidacloprid+Triazamate	28g	2 wks	0.00	0.00	0.00	0.00	0.00
6 Imidacloprid+Triazamate	28g	1 wk	0.00	0.00	0.00	0.00	0.00
7 Imidacloprid+Pirimicarb	280g	1 wk	0.00	0.00	0.00	0.00	0.00
Mean			0.00	0.00	0.00	0.00	0.00

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978152 Manea
 Client name & number : HDC FV 162b
 Assessment Date : 29/9/97
 Variable : Total number of aphids

Treatments	Rate ai/ha	Timing	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Duncan's MRT 5%
1 Untreated			2.00	0.00	1.00	1.00	1.00	b
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00	a
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00	a
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00	a
5 Imidacloprid+Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00	a
6 Imidacloprid+Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00	a
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00	a
Mean			0.29	0.00	0.14	0.14	0.14	
					LSD(0.05)		0.46	
					LSD(0.01)		0.63	
					Significance		**	
					CV%		216.02	
					S.E./PLOT		0.31	

Lettuce: Aphid control with triazamate & imidacloprid
 LA Trial ID : 978152 Manea
 Client name & number : HDC FV 162b
 Assessment Date : 29/9/97
 Variable : Number of aphid on roots score 0-5 (0 = none 5 = severe)

Treatments	Rate ai/ha	Timing	Rep					Duncan's	
			1	2	3	4	5	Mean	MRT 5%
1 Untreated			0.83	0.00	0.00	0.08	0.23	b	
2 Imidacloprid		Seed	0.00	0.00	0.00	0.00	0.00	a	
3 Imidacloprid+Triazamate 56g		2 wks	0.00	0.00	0.00	0.00	0.00	a	
4 Imidacloprid+Triazamate 56g		3 wks	0.00	0.00	0.00	0.00	0.00	a	
5 Imidacloprid+Triazamate 28g		2 wks	0.00	0.00	0.00	0.00	0.00	a	
6 Imidacloprid+Triazamate 28g		1 wk	0.00	0.00	0.00	0.00	0.00	a	
7 Imidacloprid+Pirimicarb280g		1 wk	0.00	0.00	0.00	0.00	0.00	a	
Mean			0.12	0.00	0.00	0.01	0.03		
					LSD(0.05)		0.23		
					LSD(0.01)		0.31		
					Significance		NS		
					CV%		467.22		
					S.E./PLOT		0.15		

Appendix 3

Chemicals used in the trial

Product name	Active ingredient	Concentration	Company of origin	Approval status
Aztec	Triazamate	13.72%w/w	Cyanamid	Experimental
Gaucho	Imidacloprid	70%w/w	Bayer	Off-label Approval
Novosol FC	<i>Bacillus thuringiensis</i>	84000 IU/mg	Ashlade	Full
Pirimor	Pirimicarb	50%w/w	Zeneca	Full
Unicrop Zineb	Zineb	70%w/w	Unicrop	Full