Final Report (January 2000)

Project title :	Leeks and salad onions: Control of thrips using seed treatments
Project number :	FV 185b
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Final report :	January 2000
Location of project :	Thames Valley W.C.Emmett and Son, Wilton Farm, Little Marlow, Bucks. SL7 3RR On land at Severalls Farm, Wallingford, Oxon. O.S. Ref. : SU 609902
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Date project commenced :	1 April 1998
Date completion due :	31 December 1999
Key words :	Leeks, salad onions, thrips, *Thrips tabaci*, fipronil, imidacloprid, Gaucho, seed treatment

The results and conclusions in this report are based on a series of experiments and surveys. The conditions under which the work was carried out and the results have been reported with detail and accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial product recommendations.

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PRACTICAL SECTION FOR GROWERS

Objectives and Background

Onion thrips (*Thrips tabaci*) is a widespread and serious pest of leeks, salad onions and other Alliacious crops that has become increasingly difficult to control in recent years, particularly on leeks. It is slightly easier to control on salad onions, but an intensive programme of sprays is still required to be effective. The damage is unsightly and it reduces the shelf life of crops. The pest is likely to become more difficult to control, because approval on both crops for the most effective insecticide, chlorpyrifos (e.g. Dursban 4) was revoked in 1999.

Because thrips is such a serious pest the HDC alone, or in 1997 jointly with Aventis (formerly Rhône-Poulenc Agriculture), sponsored various trials to evaluate new methods of chemical control and better ways of forecasting whether and when to apply sprays to control thrips.

On leeks none of the insecticides screened in 1996 was significantly better than Dursban 4, the most effective insecticide available then for use on leeks and salad onions, (although its approval for use on these crops has now been revoked). Nor, in a separate trial on leeks that year, did spray adjuvants improve the effectiveness of Dursban 4.

In 1997 jointly-funded, non-replicated trials were done on leeks and salad onions to evaluate programmes of sprays with a new insecticide (fipronil - EXP 60720A) from Aventis. Sprays of fipronil were effective, but unfortunately the company seems unlikely to develop this insecticide for use as a spray on edible crops in Europe.

Trials on leeks in Holland showed that fipronil and imidacloprid applied as seed treatments were highly effective against thrips on leeks. Fipronil also controlled onion fly, was generally more effective against thrips and unlike imidacloprid, did not affect germination.

Trials were done on leeks in 1998 and 1999 to assess the effectiveness, under UK conditions, of fipronil and imidacloprid seed treatments. Each was applied to pelleted seed in 1998 and to pelleted and naked seed in 1999, at similar rates to those tested in Holland or recommended by the manufacturers.

A preliminary trial was also done on salad onions in 1999. Seed treatments of fipronil or imidacloprid at five different rates were applied to assess how safe they were to the crop and whether they controlled thrips.

Summary of Results :

On leeks in 1998 seed treatments of fipronil (at 50 g a.i. per 250,000 seeds) or imidacloprid (at 42 g a.i. per 250,000 seeds) reduced the numbers of onion thrips present 105 and 138 days after drilling (DAD). Fipronil reduced the numbers by 90 and 80 per cent and imidacloprid by 68 and 61 per cent respectively on each occasion. The amount of damage was slight and differences between treatments were not detectable.

Neither insecticide, applied to both pelleted and naked seed, was as effective in 1999 as they were in 1998, although both products generally reduced the numbers of thrips present in July and August, 104 and 129 DAD respectively. Imidacloprid reduced the numbers of thrips present equally effectively on pelleted and naked seeds. Fipronil was less effective, particularly and unaccountably on pelleted seed. The trial in 1999 was drilled a month earlier than the one in 1998, but the intervals between drilling and assessing the numbers of thrips on the plants were comparable. Despite the poorer control in 1999, both treatments appeared to reduce damage by thrips slightly and to a similar extent.

Imidacloprid delayed germination considerably in 1998, although by the end of the experiment the numbers and weights of the plants were comparable with those of the untreated plants. Fipronil did not reduce germination; indeed the final numbers and weights of the plants were greater than those of the untreated plants when assessments for thrips were made in September.

Neither treatment affected the emergence of pelleted or naked seed in 1999, when conditions for germination were better. This happened despite using imidacloprid (at the manufacturers recommendation) at a slightly higher rate in 1999 (60 instead of 42 g a.i. per 250,000 seeds).

Because nothing was known about their effects on salad onions, seed treatments of fipronil and imidacloprid were evaluated in a preliminary trial 1999. The effects on germination and on the control of thrips of five rates of both insecticides were assessed. None of the treatments affected germination, but the highest rates tested did not control thrips either.

At the seed rate used (3,100,000 seeds per hectare, approx. ≡ 1¼ million seeds per acre), the second highest rates tested equated to the legal maxima of each insecticide permitted per hectare. It seems therefore that the amounts of fipronil or imidacloprid that might realistically be permitted per seed are insufficient to control thrips on salad onions.

Action points for growers

- If, as expected, fipronil is approved in Belgium in January 2000 as a seed treatment for leeks, UK growers could legally import and sow fipronil-treated seed.

- It would seem prudent for growers to drill a limited area of such seed initially and to compare it with untreated (no fipronil) seed. Observations that should be made include :-

i) Whether germination is reduced or delayed.

ii) Whether the numbers of plants that establish and their vigour is affected.

iii) Whether the numbers of thrips present on treated and untreated plants differ at intervals throughout the season.

Practical and financial anticipated benefits

- Results from these trials (and from other trials or observations in Holland and the UK) suggest that fipronil and imidacloprid seed treatments control thrips effectively for 10 -20 weeks after drilling.

- If they used seed treatments, growers should be able to reduce the number of insecticide sprays that they currently have to apply to leeks.

- Seed treatments do not involve growers in any extra work, yet save them the time they would otherwise spend spraying crops.

- Insecticidal seed treatments seem likely to complement, rather than replace sprays, by becoming an important component of an integrated crop management (ICM) programme for leeks. If used they should reduce the amount of insecticide used and decrease the risk of thrips becoming resistant to the declining number of insecticides still approved for their control.

SCIENCE SECTION

INTRODUCTION

Onion thrips (*Thrips tabaci*) is a widespread and serious pest of leeks (*Allium porrum* and *A.fistulosum*), salad onions (*A. cepa*) and other Alliacious crops. The pest has become increasingly difficult to control in recent years, particularly on leeks. It is slightly easier to control on salad onions, but an intensive programme of sprays is required to be effective. Because of this the HDC alone, or in 1997 jointly with Aventis (formerly Rhône-Poulenc Agriculture), sponsored various trials to evaluate new methods of chemical control and better ways of forecasting whether and when to apply sprays to control thrips.

On leeks none of the insecticides screened in 1996 (FV 185) was significantly better than Dursban 4 (chlorpyrifos), the most effective insecticide then available for use on either crop (although for cutworm control). Nor, in a separate trial on leeks that year (also
FV 185), did spray adjuvants improve the effectiveness of Dursban 4.

In 1997 jointly-funded, non-replicated trials (FV 185a) were done on leeks and salad onions to evaluate programmes of sprays with a new insecticide (fipronil - EXP 60720A) from Aventis . Sprays of fipronil were effective, but unfortunately the company seems unlikely to develop this insecticide for use as a spray on edible crops in Europe. They intend, however, to develop it as a seed treatment on various crops and approval for its use on leeks is expected in Belgium in January 2000.

Results from field trials on leeks in Holland (Ester, de Vogel and Bouma, 1997) showed that fipronil seed treatments were highly effective against thrips (and onion fly), yet they did not affect germination or establishment in the field. Aventis have also done trials of their own that showed that fipronil seed treatments were highly effective against both pests. Imidacloprid was slightly less effective and somewhat phytotoxic in the Dutch trials and other done in the UK (Julian Davies, *pers com.*).

The trials on leeks were designed to assess the effectiveness, under UK conditions, of both fipronil and imidacloprid seed treatments. Fipronil was used at the rate tested in most of the Dutch trials and the one likely to be approved in Belgium (50 g a.i. per 'unit' of seed - 250,000 seeds). Aventis have data from various crops treated at this rate that show that it controls many pests effectively. In 1998 imidacloprid was used at the highest rate used in Dutch trials that was not significantly phytotoxic (42 g a.i. per 'Unit' of seed), but it was used at a higher rate (60 g a.i.) in 1999, in line with new recommendations from the manufacturers, Bayer plc.

Little, if any, information was available about the effect of fipronil or imidacloprid seed treatments on salad onions. A screening trial was therefore done in which both insecticides were applied at five rates, to establish how safe they were to the crop and whether they controlled thrips.

Materials and Methods

Leek Trials : Site and Crop Details

The trials on leeks were done in commercial crops of leeks on a vegetable farm near Wallingford, Oxon. The trials were not sprayed with insecticides, but otherwise they were treated in the same way as the rest of the crop. Full details of the site and the crop details are given in Table 1.

Table 1. Leek Trials : Site Details and Trial Diary

	Trial in 1998	Trial in 1999
Location :	Near Wallingford, Oxon	
Soil type :	Sandy loam	
Drill :	5 - Row Stanhay (S 781) drill	Kverneland Accord Miniair S Pelleted seed : 80 : 10 Disc Naked seed : 80 : 15 Disc
Cultivar :	Glorina	Glorina
Plot size :	7 m x 1 bed (5 rows)	7 m x 1 bed (4 rows)
Trial Diary :		
Drilled :	6 May	8 April
Seedling / plant emergence counts :	22 May 19 August	7 May 12 June
Numbers of thrips on plants :	19 August 21 September	21 July 15 August
	Additional assessments of the numbers of thrips on random samples from untreated plots were made both years on :- 5 & 13 July, on 5 & 12 August and 12 September.	9 July 12 August
Numbers and weights of plants :	21 September (Nos and weights per m row)	21 July 15 August (Weight of 20-plant sample examined for thrips)

Treatments

Fipronil and imidacloprid were applied to the seed using a polymer film coating system with a side-vented, drum film coater ('Polycota' 20 DX). Seedcote Systems Ltd., Thetford, Norfolk applied the treatments in 1998 and Germains Ltd., Kings Lynn, did so in 1999, although the same equipment was used in both years. The rates used, generally those that had been tested most extensively in Holland, are shown in Table 2. A higher rate of imidacloprid was used in 1999 at the manufacturers recommendation. Pelleted and naked seed was used in the trial in 1999, but pelleted seed only was used in 1998.

Table 2 : Rates of Insecticidal Seed Treatments Evaluated Against Thrips on Leeks

Treatment (Active ingredient and formulation)	Rates of insecticidal seed treatments used (g a.i. per 'Unit' of seed - 250,000 seeds)	
	Trial in 1998	**Trial in 1999**
Fipronil - EXP 80145 (50 % FS)	50	50
Imidacloprid - 70 % WS	42	60
Untreated (no insecticide) control	Nil	Nil

Assessments

The numbers of seedlings per m of row were assessed twice in both seasons. In 1998 it did not rain for almost a month after the crop was drilled and the seed germinated in two flushes. Two sizes of plant were evident for most of the season, so the numbers and weights of 'large' and 'small' plants were recorded separately each time these were assessed. This was not necessary in 1999 because the seeds germinated evenly.

The numbers of adult and larval thrips present on samples of 20 plants per plot were recorded 105 and 138 days after drilling (DAD) in 1998, and 104 and 129 DAD after drilling in 1999. The first assessments in both years were scheduled for 10 weeks after drilling, but sampling was delayed because so few thrips were present. The numbers of thrips on 10 'large' and 10 'small' plants were also recorded separately in 1998. Twenty similar-sized plants were sampled on both occasions in 1999.

Attempts were made to assess the plots for visual signs of thrips damage on four occasions in 1998 and two occasions in 1999. No differences due to thrips could be detected in 1998, but small differences between treatments were detected in 1999.

In 1998, 138 DAD, the plants in 5 x 1m lengths of row per plot were dug up and the plants trimmed. The numbers and weights of the plants, again designated as 'large' or 'small', were recorded separately. In 1999 the weights of the plants to be assessed for thrips were weighed before they were examined for insects.

Design of the Trials

A randomised block design of 3 treatments x 10 replicates was used in 1998.

A 2 x 3 factorial design, with five replicates (2 types of seed x 3 treatments) was used in 1999.

Salad Onion Trial

Site and Crop Details

The trial on salad onions was done in a commercial crops of salad onions on a vegetable farm near Wallingford, Oxon. The trial was not sprayed with insecticides, but otherwise it was treated in the same way as the rest of the crop. Full details of the site and the crop details are given in Table 3.

Treatments

The salad onion seed (naked seed) was treated with insecticide in a similar way to the leek seed, using a polymer film coating system with a side-vented, drum film coater ('Polycota' 20 DX), by Germains Ltd., Kings Lynn. The treatments used are shown in Table 4.

Assessments

The numbers of seedlings that emerged and the numbers of plants that established were assessed twice by counting the numbers of plants in 10 x 0.3m lengths of row per plot.

The numbers of adult and larval thrips were assessed twice on 20 July and 12 August, 56 and 79 DAD, respectively. On both occasions samples of 30 plants per plot, selected at random, were dug up and the roots were removed. The plants were submerged, one at a time, in 50 per cent alcohol in a shallow tray. Any thrips were removed by brushing the plants carefully with a small (15mm) paint brush, after which the alcohol was strained through a fine sieve (300 mesh). The thrips caught on the sieve were washed into small tubes and counted later under a microscope. The weights of the plants were recorded on the second occasion, before washing-off the thrips.

The plots were also assessed, on a 1 - 5 scale each time, once for vigour and twice for damage caused by thrips. Damage on old and new leaves was recorded separately on the second occasion.

Table 3 : Salad Onion Trial : Site Details and Trial Diary

	Trial in 1999
Location :	Near Wallingford, Oxon
Soil type :	Sandy loam
Drill :	7 - Row Stanhay (S 781) drill
Cultivar :	White Lisbon
Plot size :	7 m x 1 bed (7 rows)
Trial Diary :	
Drilled :	25 May
Seedling emergence counts :	12 June 12 July
Numbers of thrips on plants :	20 July 11 - 12 August
Plants scored for damage by thrips :	20 July 12 August
Weight of 30 plants per plot recorded :	12 August

Table 4 : Rates of Insecticidal Seed Treatments Evaluated Against Thrips on Salad Onions

Treatment (Active ingredient and formulation)	Rates of insecticidal seed treatments used (g a.i. per 'Unit' of seed - 250,000 seeds and rate as proportion of the normal - 'N' rate) *	
Fipronil - EXP 80145 (50 % FS)	16	(2 'N')
	8	**('N'),**
	4	(0.5 'N'),
	2	(0.25 'N'),
	1	(0. 125 'N'),
Imidacloprid - 70 % WS	20	(2 'N')
	10	**('N'),**
	5	(0.5 'N'),
	2.5	(0.25 'N'),
	1.2	(0. 125 'N'),
Untreated (no insecticide) control	Nil	(2 plots per replicate)

* At the seed rates used (3.1 million seeds per hectare) the 'normal' ('N') rates of each insecticide tested applied slightly less than the legal maximum amounts of active ingredient of each insecticide allowed or likely to be allowed per hectare. The maximum amounts (g of active ingredient) of each insecticide permitted per hectare and the amounts applied at the 'N' rates were :-

	Maximum permitted (g a.i. per hectare)	Applied at the 'N' rate (g a.i. per hectare)
Fipronil :	100 g	98.8
Imidacloprid	125	124

Results

Trials on Leeks

Numbers and weights of plants

1998 Trial : The seeds germinated slowly in 1998 because the weather was so dry and 16 days after drilling there was an average of 5.6 seedlings per m row in the untreated plots, compared with 132 per m in September (Table 5).

Imidacloprid seed treatment delayed germination considerably and 16 and 105 days after drilling there were significantly fewer seedlings in these plots compared with the untreated ones (Table 5). However, by the end of the experiment in September, 138 days after drilling, the numbers were comparable.

Fipronil did not affect germination adversely and there were either similar numbers or more seedlings or plants in the plots treated with this insecticide than there were in the untreated ones (Table 5).

Both insecticides increased the weights of the plants in September, when the final assessments were made, fipronil more so than imidacloprid (Table 5).

1999 Trial : Neither treatment affected the emergence of pelleted or naked seed in 1999, when conditions for germination were better (Table 6). This happened despite using imidacloprid (at the manufacturers recommendation) at a slightly higher rate in 1999 (60 instead of 42 g a.i. per 250,000 seeds). Differences in growth or vigour were not detectable at any time and the plants examined for thrips in August were similar in weight, although average-sized plants were sampled deliberately (Table 7).

Table 5 : Effect of Seed Treatments on Germination, Plant Establishment and the Weights of Plants in 1998

Treatment	Total seedlings / m row 22 May (16 DAD) *	Total seedlings / m row 19 August (105 DAD) *	Final yields - 5 x 1m row Nos of plants 21 September (138 DAD) *	Final yields - 5 x 1m row Wt. of plants (kg) 21 September (138 DAD) *
		'Large' plants	'Large' plants	'Large' plants
Fipronil	-	51.5	40.6	1.989
Imidacloprid	-	40.4	36.7	1.877
Untreated	-	42.4	37.3	1.610
SED +/-		2.85	-	0.13
Significance		0.01	NS	0.05
		'Small' plants	'Small' plants	'Small' plants
Fipronil	-	89.1	22.4	0.299
Imidacloprid	-	83.9	19.1	0.289
Untreated	-	90.5	19.3	0.253
SED +/-		-	-	-
Significance		NA	NS	NS
	Total	Total	Total	Total
Fipronil	5.6	140.6	63.0	2.288
Imidacloprid	2.9	124.3	55.8	2.166
Untreated	5.6	132.9	56.6	1.863
SED +/-	0.61	3.48	2.79	0.13
Significance	0.001	0.001	0.05	0.05

* DAD = Days after drilling NS = Differences not significant
NA = Not analysed

Table 6 : Effect of Seed Treatments on Germination and Plant Establishment in 1999

Insecticide	Nos of Seedlings per m of Row - 7 May (29 DAD) Type of Seed Pelleted	Naked	Mean	
	NS #			
Fipronil - 50g	10.6	12.9	11.8	NS ##
Imidacloprid - 60g	11.7	11.8	11.7	
Untreated control	12.1	12.2	12.2	
Mean	11.5	12.3	11.9	
		NS ###		

Insecticide	Nos of Seedlings per m of Row - 12 June (65 DAD) Type of Seed Pelleted	Naked	Mean	
	NS #			
Fipronil - 50g	10.5	13.1	11.8	NS ##
Imidacloprid - 60g	10.8	11.1	11.0	
Untreated control	11.4	11.1	11.2	
Mean	10.9	11.8	11.3	
		NS ###		

Significance levels (* = 5%; ** = 1 %; *** = 0.1% or NS - not significant) and if significant, least significant differences (LSDs) for comparisons between :-

Individual treatments ## Insecticides ### Pelleted v naked seed

Table 7 : Effect of Seed Treatments on the Weight of Plants in 1999 ◆

Insecticide	Weight (g) of 20 plants on 21 July (104 DAD) Type of Seed Pelleted	Naked	Mean	
		NS #		
Fipronil - 50g	388	390	389	NS ##
Imidacloprid - 60g	368	380	374	
Untreated control	380	386	383	
Mean	378.7	385.3	382.0	
		NS ###		

Insecticide	Weight (kg) of 20 plants on 15 August (129 DAD) Type of Seed Pelleted	Naked	Mean	
		NS #		
Fipronil - 50g	1.55	1.59	1.57	NS ##
Imidacloprid - 60g	1.46	1.55	1.51	
Untreated control	1.53	1.64	1.59	
Mean	1.51	1.59	1.56	
		NS ###		

Significance levels (* = 5%; ** = 1 %; *** = 0.1% or NS - not significant) and if significant, least significant differences (LSDs) for comparisons between :-
Individual treatments ## Insecticides ### Pelleted v naked seed

◆ N.B. Average-sized plants sampled deliberately on both occasions

Control of thrips

1998 Trial : Both seed treatments reduced the numbers of thrips on leeks 105 and 138 days after drilling. Fipronil reduced the numbers by 90 and 80 percent and imidacloprid by 68 and 61 percent respectively on each occasion (Table 8).

Compared with the numbers on untreated plants, there were always relatively fewer thrips larvae on the 'small' plants than there were on the 'large' ones (Table 9).

The amount of damage was slight and differences between treatments were not detectable.

1999 Trial : Neither insecticide, applied to both pelleted and naked seed, was as effective in 1999 as they were in 1998, although both products generally reduced the numbers of thrips present in July and August, 104 and 129 DAD respectively, (Tables 10 & 11). Imidacloprid reduced the numbers of thrips present equally effectively on pelleted and naked seeds. Fipronil was less effective, particularly and unaccountably on pelleted seed . The trial in 1999 was drilled a month earlier than the one in 1998, but the interval between drilling and assessing the numbers of thrips on the plants were comparable with the intervals in 1998.

The amounts of insecticide applied to the seed, compared with the intended 'target' doses are chown in Table 11a. Achieved loadings ranged from 87 per cent to 96 per cent of the intended rates. The achieved dose closest to the intended figure occurred on the pelleted seed treated with fipronil, where control was unaccountably low.

Despite the poorer control in 1999, both treatments appeared to reduce damage by thrips slightly and to a similar extent (Table 12).

Table 8 : Numbers of thrips on leeks in 1998

Treatment	Nos of thrips / 10 plants 1st Assessment 19 August (105 DAD)			2nd Assessment 21 September (138 DAD)		
	Adults Large plants	Larvae Large plants	Total thrips Large plants	Adults Large plants	Larvae Large plants	Total thrips Large plants
Fipronil	0.6	2.7	3.3	3.2	9.9	13.1
Imidacloprid	2.0	8.1	10.1	8.2	19.0	27.2
Untreated	5.4	22.9	28.3	10.7	46.7	57.4
SED +/-	1.20	3.60	4.23	2.12	10.28	10.77
Significance	0.01	0.001	0.001	0.01	0.01	0.01
	Adults Small plants	Larvae Small plants	Total thrips Small plants	Adults Small plants	Larvae Small plants	Total thrips Small plants
Fipronil	0.1	0.7	0.8	1.1	5.9	7.0
Imidacloprid	1.2	2.4	3.6	2.9	10.0	12.9
Untreated	2.2	12.2	14.4	7.3	36.7	44.0
SED +/-	0.50	2.43	2.71	1.53	8.08	9.26
Significance	0.01	0.001	0.001	0.01	0.01	0.01
	Total thrips per 20 plants					
Fipronil	0.7	3.4	4.1	4.3	15.8	20.1
Imidacloprid	3.2	10.5	13.7	11.1	29.0	40.1
Untreated	7.6	35.1	42.7	18.0	83.4	101.4
SED +/-	1.41	4.94	5.72	2.72	16.9	18.9
Significance	0.001	0.001	0.001	0.001	0.01	0.01

* DAD = Days after drilling

Table 9 : **Numbers of thrips on insecticide-treated leeks, as a percentage of the numbers on untreated plants in 1998**

Treatment	Nos of thrips larvae / 10 plants, as percentage of the numbers on untreated plants	
	1st Assessment 19 August (105 DAD)	2nd Assessment 21 September (138 DAD)
	Large plants	Large plants
Fipronil	12	21
Imidacloprid	35	41
	Small plants	Small plants
Fipronil	6	16
Imidacloprid	19	27

* DAD = Days after drilling

Table 10 : Numbers of Thrips per 20 Plants on 21 July (104 DAD) in 1999

Numbers of Adult Thrips per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
		NS #		
Fipronil - 50g	6.8	5.8	6.3	NS ##
Imidacloprid - 60g	4.0	6.4	5.2	
Untreated control	8.2	5.4	6.8	
Mean	6.3	5.9	6.1	
		NS ###		

Numbers of Thrips Larvae per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
		NS #		*
Fipronil - 50g	14.2	9.0	11.6	LSD
Imidacloprid - 60g	6.6	3.2	4.9	± 6.9 ##
Untreated control	17.2	15.0	16.1	
Mean	12.7	9.1	10.9	
		NS ###		

Total Thrips per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
		NS #		*
Fipronil - 50g	21.0	14.8	17.9	LSD
Imidacloprid - 60g	10.6	9.6	10.1	± 9.4 ##
Untreated control	25.4	20.4	22.9	
Mean	19.0	14.9	17.0	
		NS ###		

Significance levels (* = 5%; ** = 1 %; *** = 0.1% or NS - not significant) between insecticide-treated seed and untreated control and if significant least significant differences (LSDs) for comparisons between :-

Individual treatments ## Insecticides ### Pelleted v naked seed

Table 11 : Numbers of Thrips per 20 Plants on 15 August (129 DAD) in 1999

Numbers of Adult Thrips per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
	NS #			
Fipronil - 50g	31.6	22.8	27.2	NS ##
Imidacloprid - 60g	29.2	19.6	24.4	
Untreated control	24.4	32.8	28.6	
Mean	28.4	25.1	26.7	
	NS ###			

Numbers of Thrips Larvae per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
	**	LSD ± 65.5#		
				**
Fipronil - 50g	271.2	164.8	218.0	LSD
Imidacloprid - 60g	137.2	137.8	137.5	± 46.2 ##
Untreated control	176.8	243.8	210.3	
Mean	195.1	182.1	188.6	
	NS ###			

Total Thrips per 20 Plants

Insecticide	Type of Seed		Mean	
	Pelleted	Naked		
	**	LSD ± 72.98 #		
				**
Fipronil - 50g	302.8	187.6	245.2	LSD
Imidacloprid - 60g	166.4	157.4	161.9	± 51.5 ##
Untreated control	201.2	276.6	238.9	
Mean	223.5	207.2	215.3	
	NS ###			

Significance levels (* = 5%; ** = 1 %; *** = 0.1% or NS - non-significant) and if significant least significant differences (LSDs) for comparisons between :-
Individual treatments ## Insecticides ### Pelleted v naked seed

Table 11a : **Target Doses Actual Amounts of Fiprnoil and Imidacloprid on Leek Seed**

	G a.i. per 250,000 seeds		
	Target dose	Actual amounts Pelleted seed	(Per cent of target) Naked seed
Fipronil	50	48.2 (96)	44.0 (88)
Imidacloprid	60	54.7 (91)	52.4 (87)

Table 12 : Amounts of Damage on Leeks Caused by Thrips in 1999

Insecticide	Plant damage Score - 21 July (104 DAD) (5 = No damage 1 = Severe damage) Type of Seed Pelleted	Naked	Mean	
		NS #		*
Fipronil - 50g	3.8	4.2	4.0	LSD
Imidacloprid - 60g	4.8	4.0	4.4	± 0.5 ##
Untreated control	3.8	3.4	3.6	
Mean	4.1	3.9	4.0	
		NS ###		

Insecticide	Plant damage Score - 15 Aug. (129 DAD) (1 = No damage 5 = Severe damage) Type of Seed Pelleted	Naked	Mean	
		NS #		*
Fipronil - 50g	3.6	4.0	3.8	LSD
Imidacloprid - 60g	3.6	4.0	3.8	± 0.6 ##
Untreated control	3.2	3.0	3.1	
Mean	3.5	3.7	3.6	
		NS ###		

Significance levels (* = 5%; ** = 1 %; *** = 0.1% or NS - not significant) and if significant least significant differences (LSDs) for comparisons between :-
Individual treatments ## Insecticides ### Pelleted v naked seed

Salad Onion Trial

Both fipronil and imidacloprid increased the numbers of seedlings present 18 and 38 DAD, fipronil more so than imidacloprid, but the rate at which either product was used did not appear to have an effect (Table 13). Fipronil and imidacloprid-treated plots also appeared to be marginally more vigorous than the untreated ones, fipronil more so than imidacloprid when the trial finished, 79 DAD. There was again no evidence of a dose response with either product (Table 13). Differences in the weights of 30 plants per plot, at the end of the experiment (79 DAD) were insignificant (Table 13).

The numbers of thrips on the plants were low when the first assessments were made, 56 DAD and they varied considerably within treatments (Table 14). There were significantly fewer adult thrips on fipronil-treated plants than there were on the other treatments, although the dose rate had no effect. Fewer larvae were present too, but the differences were not significant statistically.

At the end of the trial, 79 DAD, there were marginally fewer thrips on the fipronil-treated plants than on the untreated ones, which harboured slightly fewer than those treated with imidacloprid (Table 14). Again there was no evidence of a dose-response effect with either insecticide; indeed the plants treated with fipronil at the highest rate harboured more thrips than those treated with lower rates (Table 14).

There was marginally less damage on fipronil treated plants than on the other treatments, 56 and 79 DAD, but differences were small and again did not relate to the dose rate (Table 14).

As with the leeks, the actual amounts of insecticides applied to the seed were very close to the intended 'target' doses (Table 14a).

Slight differences in growth occurred across the trial due to uneven irrigation and appreciable numbers of thrips invaded the crop from one quarter (the south west). Both factors may have affected the results, but there was no suggestion of a dose response effect with either product that might have been expected had the treatments had a real effect.

Table 13 : Germination, Establishment, Vigour and Final Weights of Salad Onions

Treatment ◆	Nos of Seedlings per 0.3m Row		Vigour (1 = Poorest 5 = Best)	Weight of 30 Plants per Plot (g) at Harvest
	12 June (18 DAD) #	12 July (48 DAD) #	12 Aug. (79 DAD)	12 Aug. (79 DAD)
1. Fipronil - 2 'N'	16.2	17.5	4.25	638
2. Fipronil - N'	14.2	16.0	4.5	804
3. Fipronil - 0.5 'N'	13.6	15.8	4.25	645
4. Fipronil - 0.25'N'	15.5	16.1	4.0	712
5. Fipronil -0.125 'N'	15.1	13.9	3.25	635
Mean	14.89	15.84	4.05	687
6. Imidacloprid - 2 'N'	13.8	12.5	4.0	833
7. Imidacloprid - 'N'	12.6	15.1	3.5	811
8. Imidacloprid - 0.5 'N'	11.0	13.6	3.25	711
9. Imidacloprid - 0.25 'N'	12.4	13.2	3.5	725
10. Imidacloprid -0.125 'N'	15.9	15.2	3.75	756
Mean	13.11	13.90	3.60	767
11. Untreated Control (1)	13.1	12.1	3.75	838
12. Untreated Control (2)	9.6	9.5	2.5	854
Mean of Trts.11 & 12	11.3	10.8	3.12	846
Level of Significance and Least Sig. Differences :-	**	***	*	NS
Between insecticides	1.4	1.13	0.48	-
Between insecticides and controls	1.87	1.47	0.64	-

◆ 'N' rates apply the equivalent of the maximum amount of active ingredient of each product permitted per hectare

Differences between treatments statistically different at 5 % (*), 1 % (**), 0.1 % (***) or NS (not significant)

Table 14 : Numbers of Thrips on Salad Onions

Treatment ◆	Numbers of Thrips per 30 Plants					
	20 July (56 DAD)			12 August (79 DAD)		
	Adults	Larvae	Total	Adults	Larvae	Total
1. Fipronil - 2 'N'	4.75	0.25	5.0	8.5	29.0	37.5
2. Fipronil – 'N'	3.5	3.0	6.5	6.75	19.25	26.0
3. Fipronil – 0.5 'N'	5.25	1.75	7.0	6.5	17.25	23.75
4. Fipronil - 0.25'N'	3.75	4.25	8.0	3.5	32.25	35.75
5. Fipronil -0.125 'N'	2.75	1.25	4.0	9.5	23.0	32.5
Mean	4.0	2.1	6.1	6.95	24.15	30.9
6. Imidacloprid - 2 'N'	11.25	3.0	14.25	18.0	21.0	39.0
7. Imidacloprid - 'N'	7.25	0.25	7.5	14.5	26.75	41.25
8. Imidacloprid - 0.5 'N'	4.25	0.0	4.25	13.33	35.33	46.70
9. Imidacloprid - 0.25 'N'	7.0	1.25	8.25	7.75	35.75	43.5
10. Imidacloprid -0.125 'N'	7.5	9.5	17.0	5.75	34.25	40.0
Mean	7.45	2.8	10.25	11.49	30.62	42.1
11. Untreated Control (1)	7.5	6.75	14.25	6.25	20.5	26.75
12. Untreated Control (2)	8.75	4.75	13.5	8.0	38.0	46.0
Mean of Trts.11 & 12	8.12	5.75	13.88	7.13	29.25	36.38
Level of Significance and Least Sig. Differences :-	*	NS	NS	*	**	**
Between insecticides	2.70	-	-	3.6	6.6	7.94
Between insecticides and controls	3.57	-	-	4.0	8.67	10.4

◆ 'N' rates apply the equivalent of the maximum amount of active ingredient of each product permitted per hectare

Differences between treatments statistically different at 5 % (*), 1 % (**), 0.1 % (***) or NS (not significant)

Table 14a : Target Doses and Actual Amounts of Fipronil and Imidacloprid on Salad Onion Seed

	G a.i. per 250,000 seeds	
	Target dose	Actual amounts (per cent of target)
Fipronil	16	16.2 (101)
	8	7.45 (93)
	4	3.73 (93)
	2	1.94 (97)
	1	0.91 (91)
Imidacloprid	20	18.5 (93)
	10	9.4 (94)
	5	4.7 (94)
	2.5	2.3 (92)
	1.25	1.2 (96)

Table 15 : Assessments of Damage to Salad Onions by Thrips

Treatment	Amount of Damage (1 = Most Damage 5 = Least Damage) 20 July (56 DAD)	12 August (79 DAD)	
		On Old Leaves	On New Leaves
1. Fipronil - 2 'N'	4.0	4.5	4.25
2. Fipronil – 'N'	4.0	3.75	4.25
3. Fipronil - 0.5 'N'	3.5	3.75	4.0
4. Fipronil - 0.25'N'	4.5	4.0	4.0
5. Fipronil -0.125 'N'	4.0	3.25	4.0
Mean	4.0	3.85	4.1
6. Imidacloprid - 2 'N'	3.75	3.5	3.75
7. Imidacloprid - 'N'	3.25	4.25	4.5
8. Imidacloprid - 0.5 'N'	2.5	4.0	4.5
9. Imidacloprid - 0.25 'N'	2.75	4.0	3.75
10. Imidacloprid -0.125 'N'	4.25	3.5	3.5
Mean	3.3	4.65	4.0
11. Untreated Control (1)	3.5	3.5	4.0
12. Untreated Control (2)	2.5	4.0	4.25
Mean of Trts.11 & 12	3.0	3.75	4.13
Level of Significance and Least Sig. Differences :-	**	NS	NS
Between insecticides	0.5	-	-
Between insecticides and controls	0.64	-	-

◆ 'N' rates apply the equivalent of the maximum amount of active ingredient of each product permitted per hectare

Differences between treatments statistically different at 5 % (*), 1 % (**), 0.1 % (***) or NS (not significant)

Conclusions and Discussion

Results from these trials and ones done in Holland show that seed treatments of fipronil and imidacloprid generally control thrips on leeks effectively for a time after drilling, after which they need to be supplemented by sprays. The length of protection varies between seasons for reasons that are not fully understood.

Neither seed treatment controlled thrips effectively on salad onions. Lower rates per seed had to be used on this crop to stay within the maximum amounts of insecticide permitted per hectare. These rates appeared to be too low to control thrips, although they increased slightly the numbers of plants that established, possibly because they controlled other pests, such as bean seed fly.

Fipronil, generally the more effective and less phytotoxic insecticide in many trials, seems likely to be approved for use on leeks in Belgium in time for the 2000 season. If approval is granted it will be legal for growers to import and to sow treated seed in the UK. The HDC may also apply for a SOLA for imidacloprid on leeks.

More information is needed about the persistence of seed treatments on leeks if growers are to time the application of supplementary insecticidal sprays accurately and cost effectively. Such information is best obtained from trials. It would be prudent, however, to monitor commercial crops of leeks grown from treated seed as well, to obtain information about the effectiveness of such treatments under different conditions in different seasons.

ACKNOWLEDGEMENTS

I thank Nick Bolton, formerly of Seedcote Systems Ltd. for supplying and treating the leek seed used in the trial in 1998 and Mark Butler of Germain's (UK) Ltd., who treated the leek and salad onion seed used in the trials in 1999. I also thank Philip Emmett of W.C.Emmett and Sons, on whose land all the trials were done, for his co-operation and the Horticultural Development Council for funding this project.

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