PROCESSORS & GROWERS RESEARCH ORGANISATION

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Project Leader:	Dr. A. J. Biddle
Location of Project:	Processors and Growers Research Organisation Great North Road Thornhaugh Peterborough Cambs PE8 6HJ
Project Co-ordinator:	P. Shepherd
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CONTENTS

RELEVANCE TO GROWERS

The objective of the project was to determine the infestation threshold of pea aphid at each susceptible growth stage of vining peas and to study the effects on crop yield.

The results identified levels of aphid infestation, as determined by presence of aphid on plants or shoots, at which economic yield responses could be obtained following insecticide treatment at specific growth stages.

An action threshold has been suggested for vining peas where aphid infestation develops at any of the specific growth stages from the vegetative stages up to and including the development of the first pod.

SUMMARY

Economic yield increases were obtained in vining peas following sprays of pirimicarb for pea aphid control. At specific growth stages, aphid infestation was determined by assessing the percentage of plants on which pea aphid were present.

Where plant infestation was 15% or more during the vegetative growth stages, up to the enclosed bud stage, yields were significantly increased following a single spray.

When re-infestation of approximately 15% of plants had occurred after an earlier insecticide application, a further yield improvement was obtained.

The work indicated that an action threshold for aphid control should be based on a 15% plant infestation at any stage up to and including the time of first pod development.

ACTION POINTS FOR GROWERS

* Inspect crop for aphids regularly up to the enclosed bud stage - do not wait for flowers to open.

* Look carefully for aphids particularly on the undersides of the leaves.

* Spray when aphids are present on 15% of plants.

* Continue to examine crops regularly at the visible bud, first flower and first pod growth stages.

* Repeat the spray if aphid have re-infested 15% or more of plants.

INTRODUCTION

Pea aphid (*Acyrthosiphon pisum*) is one of the most common pests of peas and can infest crops at any time during the growing season. Damage resulting in yield loss can be incurred by direct feeding, the production of honeydew, which encourages the development of saprophytic moulds and virus transmission (Biddle, 1985). In combining peas, significant yield responses were obtained from single applications of pirimicarb applied at specific growth stages when aphid populations had exceeded 20% shoots infested (Lane & Walters, 1991).

In vining peas, the growing season is much shorter and growth stages at which spraying for aphid give an economic yield response have been identified (Biddle, Blood Smyth and Talbot, 1994). However, the level of infestation, expressed as the number of infested shoots at which such yield responses are achieved, is not known.

In order to elucidate the infestation threshold for vining peas, a series of trials was undertaken in commercial crops of vining peas during 1993 and 1994.

MATERIALS AND METHODS

Sites: Experiments were carried out in commercial crops of vining peas at four sites in both 1993 and 1994. Details of the sites and cultivars are shown in Table 1.

Table 1 Details of sites

Site	Year	Location	Cultivar
1.	1993	Metheringham, Lincs	Puget
2.	1993	Holbeach St Matthews, Lincs	Vera
3.	1993	Gedney Hill, Lincs	Orcado
4.	1993	Thorney, Cambs	Sancho
5.	1994	Blankney, Lincs	Polo
6.	1994	Fleet, Lincs	Sancho
7.	1994	Gedney Hill, Lincs	Scout
8.	1994	Moulton-Seas-End, Lincs	Sancho

At all sites, sprays of pirimicarb (Aphox) were applied to 5m x 2m plots at 280g product/ha in 220 l of water using a Van de Weij plot sprayer with HC/0.59/3 nozzles at 2.5 bar.

Sprays were applied at specific crop growth stages as defined by Knott, (1987). and each treatment was replicated four times. The treatment schedules are shown in Tables 2 and 3 and the spray dates are shown in Appendix I.

Table 2 Spray Timings - 1993 trials

		Growth Stage
1.	Untreated	-
2.	1 spray	late vegetative (107)
3.	2 sprays	107 and enclosed bud (201)
4.	1 spray	201
5.	1 spray	open flower(203)

Table 3 Spray Timings - 1994 trials

		Growth Stage
1.	Untreated	-
2.	1 spray	107
3.	2 sprays	107+201
4.	1 spray	201
5.	2 sprays	201 + first pod (204)
6.	1 sprays	203
7.	2 sprays	203 + 204

Pea aphid infestation was assessed prior to spraying by examining 15 shoots per plot and recording presence or absence of aphid. At the appropriate time, the plots were cut and vined using the PGRO plot viner. The yield of the vined peas was recorded and maturity measured by tenderometer.

RESULTS

The results of each trial are shown in Appendix II

Aphid infestation

On average, 40% of the shoots were infested by pea aphid at the late vegetative growth stage in the 1993 trials and 13.5% of shoots were infested in 1994. Table 4 shows the aphid infestation levels on untreated plots throughout both seasons.

Aphid populations fluctuated at some sites, and at Gedney Hill in 1993, the number of infested shoots declined suddenly from an initial high level. In 1994, the infestation at Gedney Hill was slow to build up earlier in the season. Re-infestation occurred at several sites in both years, following sprays made at the earlier growth stages (Appendix II).

Table 4 Aphid infestation on untreated plots -1993 and 1994.

growth stage	% shoots infested 105-108	201	203	204
1993				
1. Metheringham	10.0	37.5	30.0	-
2. Holbeach St Matthews	35.0	65.0	25.0	-
3. Gedney Hill	45.0	12.5	0	-
4. Thorney	70.0	52.5	35.0	-
1994				
5. Blakney	12.0	30.6	5.7	11.7
6. Fleet	10.0	16.7	63.3	58.3
7. Gedney Hill	12.0	5.0	16.7	16.7
8. Moulton-Seas-End	20.0	23.3	17.7	35.0

Yield responses to treatment

The results showing the yield responses following aphicide application at the individual sites are shown in Appendix II.

Significant yield responses to treatment occurred at two sites, numbers 1 and 4 in 1993 and at site 6 in 1994. Analysis of the combined data for all sites in both years are shown in Tables 5 and 6 together with the level of aphid infestation at each growth stage. In 1993 there was an overall significant yield improvement following sprays made at visible bud (202) and up to first flower (203). In 1994, additional yield increases were obtained from a second spray made at first pod (204) at sites 6 and 8 where aphids re-infested following the earlier spray applications.

Table 5 Aphid infestation and yield responses to aphicide application - 1993

	% infested shoots				
growth stage:	107/8	201	203		
treatment timing:				Yield(t/ha)	Yield as % of untreated
1. untreated	40.0	41.9	22.5	3.66	100
2. 107/8	40.0	-	-	3.98	107
3. 107/8+201	40.0	6.3	-	3.89	106
4. 201	40.0	48.8	-	3.97	110
5. 203	40.0	58.1	32.5	3.47	94
SED @ p=0.001				0.24	6.4
cv%				8.8	8.7

Table 6 Aphid infestation and yield responses to aphicide application - 1994

	% infested shoots					
growth stage;	105/9	201	203	204	yield t/ha	yield as % of untreated
treatment timing;						
1. untreated	13.5	15.4	32.7	35.4	4.76	100
2. 105/9	13.5	-	-	-	5.04	106
3. 105/9+201	13.5	8.3	-	-	5.16	108
4. 201	13.5	20.0	-	-	5.04	107
5. 201+204	13.5	15.0	-	20.8	5.36	113
6. 203	13.5	-	26.3	-	5.35	112
7. 203+204	13.5	-	34.2	13.3	5.53	116
SED @ p=0.001					0.15	2.8
cv%					4.0	3.6

Yield response in relation to aphid infestation

In 1993, aphid infestation was generally higher at the beginning of the season where 40% of the shoots were infested by the late vegetative growth stage. Yields were significantly increased by sprays made at that stage and at the enclosed bud stage, but no increase was obtained by a spray made at first flower by which time 58% of shoots were infested.

In 1994, aphid infestation was not so high and significant yield increases occurred from sprays applied at the enclosed bud stage, by which time the aphid infestation had reached 15-20% shoots. Further yield improvements were obtained from a second spray made at first pod when between 13-21% of shoots had become re-infested following the earlier spray.

CONCLUSIONS

Earlier work has identified the susceptible growth stages of vining peas at which economic responses to aphicide application have been obtained, although in that work, the aphid infestation was high (Biddle, Blood Smyth & Talbot, 1994).

The subsequent work reported here has indicated that further yield improvements can be obtained if aphids re-infest the crop after an earlier spray has been applied.

Although infestation at the different sites was variable, there was a generally lower level at all sites in the 1994 trials, and yield responses to treatment were also variable, but tended to correlate with the level of aphid attack. By examining the combined data from the 1994 sites, it appeared that significant yield improvements were obtained where aphid attack had reached a level of 15-20% at the enclosed bud stage and where re-infestation developed, a further yield increase was obtained following a spray at first pod, when aphids were present on 13-20% of shoots.

Therefore, a suitable action threshold for aphid control is 15% shoot infestation at each of the susceptible growth stages up to the first pod stage (204).

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APPENDIX I

Spray timings and growth stages - 1993 trials

site:	Metheringham	Holbeach St Matthew	Gedney Hill	Thorney
Sprays applied:				
growth stage	108	107	107	108
date	16 June	21 June	26 June	21 June
growth stage	210	201	202	201
date	24 June	2 July	2 July	1 July
growth stage	203	203	203	203
date	22 July	3 August	2 August	4 August

Spray timings and growth stages - 1994 trials

site:	Blankney	Fleet	Gedney Hill	Moulton-Seas end
Sprays applied:				
growth stage	108	106	105	106
date	23 June	16 June	6 June	18 June
growth stage	201	201	201	201
date	30 June	28 June	22 June	28 June
growth stage	203	203	203	203
date	5 July	5 July	30 June	5 July
growth stage	204	204	204	204
date	11 July	13 July	4 July	13 July

APPENDIX II

1993 Trials

Site 1. Metheringham

Treatment	% infested shoots			yield (t/ha)	tenderometer (TR)
growth stage	16/6 (108)	24/6 (201)	6/7 (203)	22/7	
1. Untreated	10.0	37.5	30.0	3.61	75
2. 108	10.0	-	-	3.95	74
3. 108/201	10.0	0	-	4.27	75
4. 201	10.0	17.5	-	3.84	75
5. 203	10.0	20.0	37.5	3.58	75
SED @ p=0.05				0.21	1.2
				sig	nsd
cv%				7.9	2.3

Site 2. Holbeach St Matthews

Treatment	% infested shoots			yield (t/ha)	tenderometer (TR)
growth stage	21/6 (107)	2/7 (201)	7/7 (203)	3/8	
1. untreated	35.0	65.0	25.0	4.23	95
2. 107	35.0	-	-	3.92	95
3. 107/201	35.0	10.0	-	4.15	96
4. 201	35.0	70.0	-	4.25	95
5. 203	35.0	30.0	20.0	4.17	96
SED @ p=0.05				0.39	1.6
				nsd	nsd
cv%				13.4	2.3

Site 3 - Gedney Hill

Treatment	% infested shoots			yield (t/ha)	tenderometer (TR)
growth stage	26/6 (107)	2/7 (202)	7/7 (203)	2/8	
1. untreated	45.0	12.5	0	4.95	80
2. 107	45.0	-	-	6.18	85
3. 107/202	45.0	10.0	-	5.25	83
4. 202	45.0	37.5	-	5.51	83
5. 203	45.0	12.5	2.5	4.58	79
SED @ p=0.05				0.72	2.8
				nsd	nsd
cv%				19.4	4.9

Site 4 - Thorney

Treatment	% infested shoots			yield (t/ha)	tenderometer (TR)
growth stage	21/6 (108)	1/7 (201)	7/7 (203)	4/8	
1. untreated	70.0	52.5	35.0	1.85	111
2. 108	70.0	-	-	1.86	112
3. 108/201	70.0	5.0	-	1.88	114
4. 201	70.0	70.0	-	2.27	109
5. 203	70.0	57.5	70.0	1.54	105
SED @ p=0.05				0.18	5.6
				sig	nsd
cv%				13.5	7.2

1994 Trial

Site 5 - Blankney

Treatment	% infested shoots				yield t/ha	tenderometer (TR)
growth stage	23/6 (108)	30/6 (201)	5/7 (203)	11/7 (204)	22/7	
1. untreated	12.0	16.7	30.0	31.7	2.78	93
2. 108	12.0	-	-	-	3.05	95
3.108+201	12.0	5.0	-	-	3.01	94
4. 201	12.0	16.7	-	-	3.22	93
5. 201+204	12.0	5.0	-	3.3	3.14	93
6. 203	12.0	-	31.7	-	3.07	92
7. 203+204	12.0	-	51.7	3.3	3.23	90
SED @ p=0.05					0.24	2.8
					nsd	nsd
cv%					10.8	4.3

Site 6 - Fleet

Treatment	% infested shoots				yield t/ha	tenderometer (TR)
growth stage	16/6 (106)	28/6 (201)	5/7 (203)	13/7 (204)	25/7	
1. untreated	10.0	16.7	63.3	58.3	6.32	94
2. 106	10.0	-	-	-	6.91	92
3. 106-201	10.0	20.0	-	-	7.22	94
4. 201	10.0	31.7	-	-	6.94	95
5. 201+204	10.0	36.7	-	41.7	7.13	90
6. 203	10.0	-	41.7	-	7.39	90
7. 203+204	10.0	-	60.0	31.7	7.68	91
SED @ p=0.05					0.42	2.3
					sig	nsd
cv%					8.3	3.5

Site 7 - Gedney Hill

Treatment	% infested shoots				yield t/ha	tenderometer TR
growth stage	6/6 (105)	22/6 (201)	30/6 (203)	4/7 (204)	18/7	
1. untreated	12.0	5.0	16.7	16.7	5.40	117
2. 105	12.0	-	-	-	5.21	116
3. 105+201	12.0	0	-	-	5.38	118
4. 201	12.0	3.3	-	-	5.02	114
5. 201+204	12.0	0	-	13.3	5.68	117
6. 203	12.0	-	10.0	-	5.74	120
7. 203+204	12.0	-	5.0	5.0	5.67	116
SED @ p=0.05					0.39	5.1
					nsd	nsd
cv%					10.1	6.2

Site 8 - Moulton-Seas-End

Treatment	% infested shoots				yield t/ha	tenderometer TR
growth stage	18/6 (106)	28/6 (201)	5/7 (203)	13/7 (204)	26/7	
1. untreated	20.0	23.3	20.8	35.0	4.53	111
2. 106	20.0	-	-	-	4.99	105
3. 106+201	20.0	8.3	-	-	5.01	106
4. 201	20.0	28.3	-	-	4.98	107
5. 201+204	20.0	18.3	-	25.0	5.49	103
6. 203	20.0	-	21.7	-	5.21	104
7. 204	20.0	-	20.0	13.3	5.54	104
SED @ p=0.05					0.37	3.2
					nsd	nsd
cv%					10.1	4.3