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Vining peas: Threshold for control of pea aphid

PROCESSORS & GROWERS RESEARCH ORGANISATION

Vining peas: Threshold for control of pea aphid

1991 - 1992

SUMMARY: The results of eight experiments carried out in vining peas over two years, showed that significant yield increases were obtained following sprays to control pea aphid *(Acyrthosiphon pisum)*. The largest yield increases were obtained from a single application of pirimicarb at either the visible bud stage (GS 202) or at first flower (GS 203). The mean percentage of infested shoots at these stages were 37.7 and 43.8 respectively. A spray at the late vegetative stage gave a similar yield increase, but one made at first pod did not produce a significant yield increase compared with no treatment at all.

OBJECT: To determine a threshold for pea aphid in vining peas and to study the effects on crop health, yield and quality.

MATERIALS & METHODS:

Sites: Experiments were carried out in commercial vining pea crops at four sites in both 1991 and 1992:-

1991	1992
1. Terrington St. Clement, Norfolk (PGRO)	1. Gorefield, Cambs (PGRO)
2. Gedney Dyke, Lincs (PGRO)	2. Moulton-Seas-End, Lincs (PGRO)
3. Crimplesham, Norfolk (ADAS)	3. Thorney, Cambs (ADAS)
4. Carrington, Lincs (ADAS)	4. Crimplesham, Norfolk (ADAS)

Details of husbandry are shown in Appendix 1.

Treatments: At all sites, single sprays of pirimicarb (Aphox) were applied by precision plot sprayers at a rate of 280 g product per hectare in 200 or 250 l water. The details and intended crop growth stages were as follows:-

1. late vegetative growth stage	(GS 107)
2. visible bud	(GS 202)
3. first flower	(GS 203)
4. first pod	(GS 204)

The actual spray timings are shown in Appendix 2.

Assessments: Assessments of aphid infestation were made at each of the growth stages immediately prior to spraying, by examining the growing shoots of 25 randomly selected plants on each plot and recording the number of plants infested with one or more aphids. A final aphid assessment was made 7 or 10 days after the last spray.

Harvest: At the appropriate crop stage, i.e. either freezing or canning stage, plots 5 m x 2 m were cut by hand and the total haulm weight recorded. The haulm was then vined using a plot viner and the weight of vined peas recorded. The results were expressed as tonnes/ha. Where possible, pea maturity of each plot was measured by tenderometer.

Analyses: Results from individual sites were analysed for variance using Genstat 5 and a multi-site analysis was also done.

RESULTS: The results of each experiment are shown in Appendix 3.

Aphid species present: Pea aphid *(Acyrthosiphon pisum)* were the main species present at all sites in 1991 and 1992. In 1991, however, black bean aphid *(Aphis fabae)* were recorded in addition to the pea aphid at Carrington and Crimplesham. Aphid populations built up rapidly during the latter part of the season at all sites.

In 1992, aphid infestation was relatively high quite early in the season and at most sites continued to rise. However, at Moulton-Seas-End, the population declined rapidly from the end of June and fell to zero by 23rd July. At some sites there was re-invasion of aphids following the early application of aphicide.

Weather conditions: In 1991, the weather conditions prevented spray applications at some of the intended growth stages at Terrington and Carrington. Aphid control at the visible bud stage at Terrington was poor due to the frequent rain and cool temperatures during late June. In 1992, a heavy storm at Crimplesham in the middle of July, reduced the aphid population to zero.

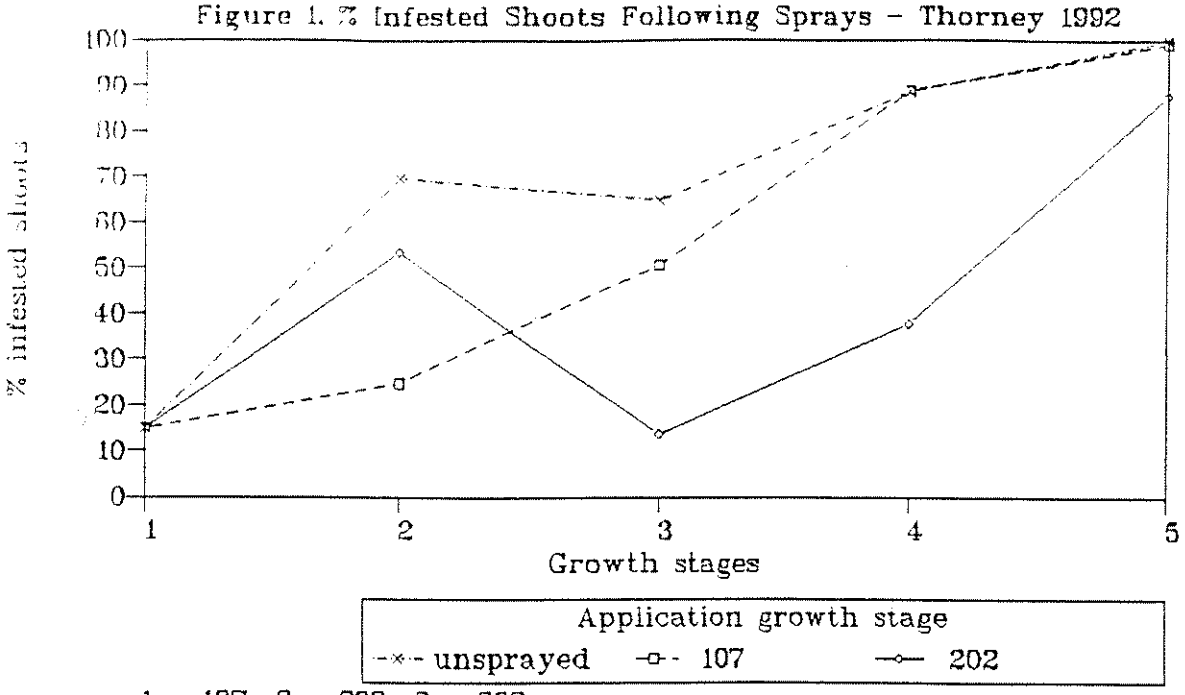
Aphid infestation - 1991-1992: On average 27% of the plants were infested with aphid at the late vegetative growth stage. The data of average shoot infestation per site at each growth stage following treatments is shown in Table 1.

Table 1 - Aphid Infestation: Results of 7 sites in 1991 and 1992

Growth stage	Vegetative	% aphid infested shoots Visible bud	1st flower	1st pod	1st pod +7-10 days
Late vegetative	-	14.7	28.2	22.8	17.9
Visible bud	-	37.7	10.4	9.2	14.5
First flower	-	-	43.8	8.6	14.2
First pod	-	-	-	34.8	11.8
Untreated	27.3	49.2	56.1	38.2	17.7
SED		2.84	4.25	2.83	1.37

Re-invasion of aphids tended to occur at most sites following the spray applied at the late vegetative stage. The most significant re-invasion occurred in 1992 at Thorney and the results in Figure 1 show the % infested shoots at each growth stage following treatment at the late vegetative (107) and visible bud (202) growth stages.

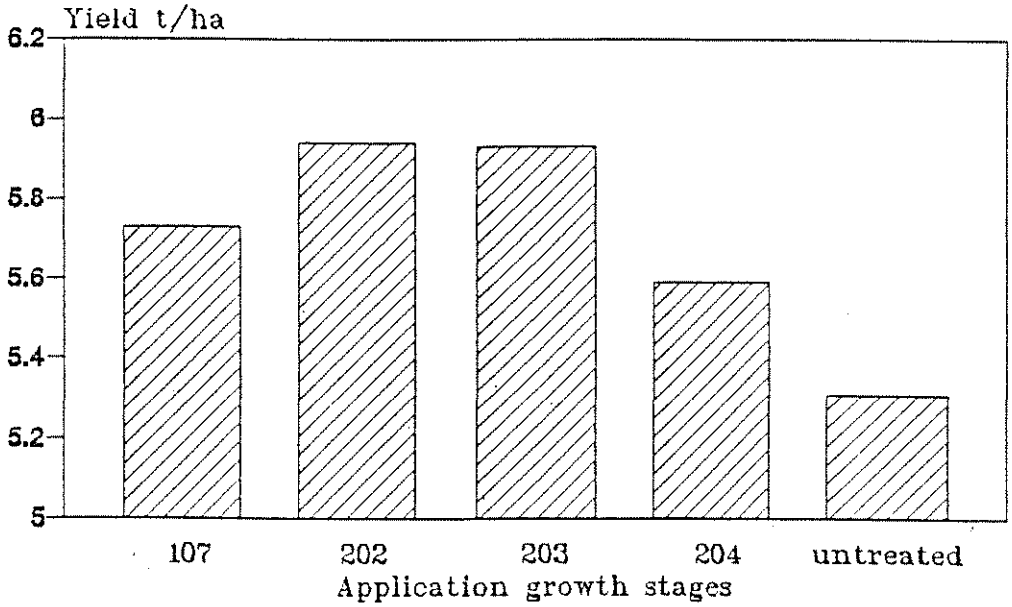
Figure 1. % Infested Shoots Following Sprays - Thorney 1992



1 = 107 2 = 202 3 = 203
4 = 204 5 = 204+7-10 days

Yield responses to treatments - 1991-1992: Significant yield responses following treatment were obtained at Crimplesham in 1991 and at three sites, Thorney, Crimplesham and Gorefield in 1992. Because the 1991 Terrington site was sprayed at different crop growth stages, the data were not included in an analysis of results of all sites. The yield responses to treatments at each growth stage are shown in Figure 2.

Figure 2. Yield Responses to Aphicide 1991-1992 (7 Experiments)



DISCUSSION: All sites had aphids present at an early growth stage. Sprays reduced aphid infestation in most cases, but gave varying levels of control at some sites and probably because inclement and cool weather conditions did not favour aphicidal activity.

At most sites, aphid populations built-up steadily throughout the season, but there was clear evidence of a sharp population decline at one site in 1992. No single reason could be given for this and such a decline has been noted in work carried out by ADAS in a MAFF funded project on pea aphid in combining peas.

In some cases there was significant aphid re-infestation which occurred after spraying at the earlier growth stages. This may have contributed to the lower yield increases obtained from these treatments. Such re-infestation may have occurred from adjacent plots - a problem which is inherent in small plot experiments. However, re-infestation on a field scale may not be significant unless there is a continuous migration of aphids from overwintering sites or other crops.

Sprays applied at visible bud or first flower growth stages gave statistically significant yield increases compared with the untreated control. Yield increases averaged 12% with a maximum increase of 45% where plant infestation was between 37% and 44%. Early sprays were not so effective in providing yield increases and sprays made at first pod were too late to give a yield increase.

CONCLUSIONS: The growth stages at which spraying for pea aphid gives an economic yield response have been identified. However, the level of infestation, either as number of infested shoots or numbers of aphid per shoot, at which such yield responses are achieved, is not known. Further work is required to evaluate the insect threshold level at each susceptible growth stage in order to provide firm recommendations for aphid control in vining peas.

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APPENDIX 1

SITE DETAILS:

1991 Sites

1. Terrington St. Clements: G.A. Wilson (Terrington) Ltd., Orange Farm, Terrington St. Clement, Kings Lynn, Norfolk
   Variety - Waverex
   Plot size - 2 m x 5 m. Replicates - 6

2. Gedney: M. Sly, Gedney Hill, Holbeach, Lincs
   Variety - Darfon
   Plot size - 2 m x 5 m. Replicates - 6

3. Carrington: J. Ward Farms, Grange Farm, Carrington, Boston, Lincs
   Variety - Small Sieve Freezer
   Plot size - 2 m x 10 m. Replicates - 5

4. Crimplesham: Messrs Robinson, Manor Farm, Crimplesham, Downham Market, Norfolk
   Variety - Puget
   Plot size - 2 m x 5 m. Replicates - 5

1992 Sites

1. Gorefield: Mr. Newling, Gorefield, Wisbech, Cambs.
   Variety - Waverex
   Plot size - 2 m x 5 m. Replicates - 5

2. Moulton-Seas-End: Jack Buck Farms Ltd., Moulton Losegate, Moulton, Spalding, Lincs
   Variety - Markana
   Plot size - 2 m x 5 m. Replicates - 5

3. Thorney: Trumpington Farming Co., East Wryde Farm, Thorney, Peterborough, Cambs
   Variety - Nomad
   Plot size - 2 m x 10 m. Replicates - 5

4. Crimplesham: Messrs Robinson, Manor Farm, Crimplesham, Downham Market, Norfolk
   Variety - Puget
   Plot size - 2 m x 5 m. Replicates - 5

APPENDIX 2

Spray timings and growth stages - 1991 trials

Site:	Terrington	Geaney Hill	Crimplesham	Carrington
Sprays applied:				
GS	vis bud(202)	late veg(107)	late veg(105)	encl bud(201)
Date	26.6.91	29.6.91	5.7.91	10.7.91
GS	1st pod(204)	vis bud(202)	encl bud(201)	1st flower(203)
Date	8.7.91	8.7.91	10.7.91	15.7.91
GS	pod fill(206)	1st flower(203)	1st flower(203)	1st pod(204)
Date	15.7.91	11.7.91	16.7.91	17.7.91
GS	-	1st pod(204)	1st pod(204)	flat pod(205)
Date	-	15.7.91	25.7.91	19.7.91
Harvest date:	26.7.91	5.8.91		

Spray timings and growth stages - 1992 trials

Site:	Gorefield	Moulton	Thorney	Crimplesham
Sprays applied:				
GS	late veg(107)	107	107	107
Date	2.6.92	18.6.92	10.6.92	22.6.92
GS	vis bud(202)	202	202	202
Date	7.6.92	26.6.92	22.6.92	26.6.92
GS	1st flower(203)	203	203	203
Date	9.6.92	2.7.92	26.6.92	6.7.92
GS	1st pod(204)	204	204	204
Date	15.6.92	14.7.92	6.7.92	14.7.92
Harvest date:	3.7.92	3.8.92	21.7.92	31.7.92

APPENDIX 3

RESULTS:

1991 EXPERIMENTS

Site 1 - Terrington

% aphid infested shoots

Treatment	26/6	8/7	15/7	23/7
1 Visible bud	-	11.7	55.0	38.3
2 First pod	-	28.3	20.0	21.7
3 Pod fill	-	-	83.3	6.6
4 Untreated	10.0	32.0	65.0	30.0

Yield and maturity (26/7)

Treatment	Total haulm wt (kg)	Vined wt (kg)	% of untreated	Maturity (TR)
1 Visible bud	36.53	4.56	94.0	91.8
2 First pod	39.50	4.73	97.5	90.5
3 Pod fill	37.27	4.63	95.5	92.3
4 Untreated	38.80	4.85	100.0	91.3
SED	1.51	0.26		1.4

Site 2 - Gedney Hill

% aphid infested shoots

Treatment	29/6	8/7	11/7	15/7	23/7
1 Late vegetative stage	-	6.7	18.3	28.3	16.7
2 Visible pod	-	25.0	6.6	16.7	6.7
3 First flower	-	-	26.7	11.7	6.7
4 First pod	-	-	-	55.0	5.0
5 Untreated	14.0	18.0	38.3	53.0	5.7

Yield and maturity (5/8)

Treatment	Total haulm wt (kg)	Vined wt (kg)	% of untreated	Maturity (TR)
1 Late vegetative stage	33.08	4.79	101.6	102.3
2 Visible bud	33.25	4.71	100.0	100.0
3 First flower	35.78	5.38	114.2	100.8
4 First pod	33.67	4.99	105.9	99.3
5 Untreated	34.65	4.71	100.0	98.0
SED	2.24	0.38		3.98

Site 3 - Crimplesham

% aphid infested shoots

Treatment	5/7	10/7	16/7	25/7		30/7	
	Pea aph	Pea aph	Pea aph	Pea aph	31 aph	Pea aph	31 aph
1 Late veg stage	-	27.2	56.0	3.3	26.4	0.3	18.4
2 Enclosed bud	-	72.3	12.0	5.6	30.4	3.2	20.8
3 First flower	-	-	96.0	1.6	26.4	0.3	18.4
4 First pod	-	-	-	10.4	23.2	1.6	4.8
5 Untreated	30.0	77.6	98.4	12.0	12.0	4.8	7.2

Yield (8/8)

Treatment	Total haulm wt (kg)	Vined wt (kg)	% of untreated
1 Late vegetative stage	25.3	5.16	124.0
2 Enclosed bud	26.31	5.12	123.1
3 First flower	24.88	4.68	112.5
4 First pod	24.0	4.67	112.3
5 Untreated	22.84	4.16	100.0
SED	1.15	0.33	

Site 4 - Carrington

% aphid infested shoots

Treatment	10/7	15/7		17/7		19/7	26/7
	All	Pea aph	All	Pea aph	All	Pea aph	All
1 Late veg stage	41.6	14.4	52.8	6.4	44.8	12.8	5.6
2 Visible bud	-	64.0	72.0	4.0	12.8	4.8	2.4
3 First flower	-	-	-	67.2	79.2	3.2	4.8
4 First pod	-	-	-	-	-	56.0	1.6
5 Untreated	39.2	55.2	78.4	65.6	82.4	48.8	12.8

Yield (12/8)

Treatment	Total haulm wt (kg)	Vined wt (kg)	% of untreated
1 Late vegetative stage	34.8	7.98	98.8
2 Visible bud	34.4	8.22	101.7
3 First flower	35.4	8.34	103.2
4 First pod	34.4	7.92	98.0
5 Untreated	34.2	8.08	100.0
SED	1.44	0.29	

1992 EXPERIMENTS

Site 1 - Gorefield

% infested shoots (ang. tr.)

Treatment (growth stage)	2/6	7/6	9/6	15/6	18/6
1 107		14.7	6.7 (11.3)	38.7 (37.3)	9.3 (13.6)
2 202		37.3	1.3 (3.0)	12.0 (17.8)	0
3 203		-	36.0 (36.2)	21.3 (24.6)	5.3 (10.3)
4 204		-	22.7 (27.9)	70.1 (61.2)	5.3 (10.3)
5 untreated	50.0	40.0	34.7 (34.5)	77.3 (64.8)	40.0 (37.7)
SED		-	11.3 (7.8)	11.3 (8.9)	9.9 (7.8)

Yield and maturity (3/7)

Treatment (growth stage)	Total plot weight (kg)	Yield t/ha	% of untreated	Maturity (TR)
1 107	21.3	3.26	106	120.6
2 202	21.8	3.78	123	120.9
3 203	21.9	3.71	121	121.3
4 204	21.6	3.57	117	121.7
5 untreated	21.7	3.06	100	118.3
SED	NSD	0.20		NSD

Site 2 - Moulton-Seas-End

% infested shoots (ang. tr.)

Treatment (growth stage)	18/6	26/6	2/7	14/7	23/7
1 107	-	34.7	4.0 (5.3)	2.7 (6.0)	0
2 202	-	62.7	1.3 (3.0)	2.7 (6.3)	0
3 203	-	-	2.7 (6.0)	1.3 (3.0)	0
4 204	-	-	2.7 (6.0)	2.7 (6.0)	0
5 untreated	10.0	30.7	5.3 (8.3)	6.7 (11.3)	0
SED			NSD NSD	NSD NSD	

Yield and maturity (3/8)

Treatment (growth stage)	Total plot weight (kg)	Yield t/ha	% of untreated	Maturity (TR)
1 107	34.2	5.95	98	108.5
2 202	35.6	6.06	100	109.5
3 203	33.6	5.95	98	109.1
4 204	32.8	5.76	95	107.8
5 untreated	34.0	6.07	100	109.9
SED	NSD	NSD	NSD	NSD

Site 3 - Thorney

% infested shoots (ang. tr.)

Treatment (growth stage)	10/6	22/6	26/6	6/7	14/7
1 107		24.3 (29.7)	50.3 (45.5)	38.3 (73.3)	99.2 (87.7)
2 202		53.6 (47.2)	13.6 (21.5)	37.6 (37.5)	88.0 (70.7)
3 203		-	79.2 (63.7)	25.6 (29.6)	85.6 (68.4)
4 204		-	- -	90.4 (73.9)	75.2 (60.7)
5 untreated	15.0	68.8 (59.6)	64.8 (54.8)	88.8 (71.4)	100.0 (90.0)
SED		11.8 8.3	8.6 5.6	7.8 6.6	4.7 3.9

Yield and maturity (21/7)

Treatment (growth stage)	Total plot weight (kg)	Yield t/ha	% of untreated	Maturity (TR)
1 107	32.7	4.46	120	98.9
2 202	38.5	5.40	145	95.2
3 203	35.6	5.23	141	96.1
4 204	33.3	4.36	117	95.0
5 untreated	31.3	3.72	100	96.9
SED	2.8	0.49		NSD

Site 4 - Crimplesham

% infested shoots (ang. tr.)

Treatment (growth stage)	22/6	26/6	6/7	14/7	22/7
1 107		16.0 (23.0)	9.6 (16.0)	16.0 (22.9)	0
2 202		64.8 (53.8)	10.4 (15.3)	5.6 (10.3)	0
3 203		-	43.2 (40.7)	10.4 (17.5)	0
4 204		-	-	33.6 (34.6)	0
5 untreated	32.0	56.8 (49.0)	45.6 (42.4)	33.6 (34.9)	0
SED		4.6 2.9	6.6 4.3	6.8 5.5	

Yield and maturity (31/7)

Treatment (growth stage)	Total plot weight (kg)	Yield t/ha	% of untreated	Maturity (TR)
1 107	28.8	8.27	113	148
2 202	29.6	8.21	112	143
3 203	28.1	8.32	114	147
4 204	27.7	7.73	106	143
5 untreated	27.6	7.32	100	140
SED	0.9	0.21		1.9

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