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Strategic application of non persistent chemicals for control of Heliothis in processing peas

VG314

Know-how for Horticulture™

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FINAL REPORT

VG314

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STRATEGIC APPLICATION OF NON-PERSISTENT CHEMICALS FOR CONTROL OF HELIOTHIS IN PROCESSING PEAS. - VG314

Final report

1. Summary

(a) Industry Summary

Industry will benefit from the outcomes of these two trials in four main areas.

1. Alpha-cypermethrin, thiodicarb and esfenvalerate were clearly shown to be as good as or better than endosulfan for control of *Helicoverpa spp.*. Esfenvalerate is already registered for use on peas in Queensland and this new formulation appears to give better results than the older 'fenvalerate' formulation. Alpha-cypermethrin and thiodicarb are in the process of being registered and samples from previous trials were sent to the chemical companies for residue analysis.

2. Trends in the second trial showed that 60% flowering (when 60% of flowers have emerged) may be a more strategic time to apply sprays than at the 40% flowering. Field workers from processing companies were using 40% flowering as an indicator for first spray application at the time the research was started. This trend needs to be further investigated.

3. The use of these non-persistent chemicals on processing peas will mean that the extra returns from pea hay sales will not be at risk because of the residue of endosulfan. In combination with strategic application this will reduce costs and provide a safer product.

4. Processing companies require that damage to peas does not exceed 1% and treatments using all of these chemicals have demonstrated that control of less than 1% damage is achievable.

(b) Technical summary

1. Alpha-cypermethrin 20g ai/ha, thiodicarb 281g ai/ha and esfenvalerate 40g ai/ha applied twice and also alpha-cypermethrin 30g ai/ha, thiodicarb 375g ai/ha and esfenvalerate 25g ai/ha applied once, were as effective or more effective than endosulfan 700g ai/ha for control of *Helicoverpa spp.* in processing peas.

2. Samples of the peas and hay from alpha-cypermethrin and thiodicarb plots have been sent to various chemical companies for residue analysis and this should help the registration process. Esfenvalerate is a newer formulation of fenvalerate and appears to be more effective than old formulation and is already registered for this use.

3. Populations of Heliothis were so low that good data on infestation has not been possible and no real pattern of infestation related to growth patterns of peas has emerged. It was hoped that this data would point to a more effective application time.

4. The application of the first spray at 60% flowering was investigated to see if later timing of applications had any effect. Trends showed all treatments involving 60% flowering applications had better control than treatments using 40% flowering (these effects are not significant).

2. Recommendations

(a) Extension/Adoption by Industry

1. Copies of the report will be sent to the managers of field staff of processing vegetable companies which have provided funds and advice for this project.

2. Extension officers in DPI areas where peas are grown will also be sent copies of this report for use in future information packages and advisory work.

3. Results will be made available to chemical companies for use in submissions for registration to compliment the residue information obtained from samples provided from these trials.

(b) Directions for Future Research

At this stage no further funding has been sort to continue this research but further research should focus on the collection of data to demonstrate if infestation of peas by Heliothis is dependant on plant growth stages or the degree of flowering in the crop. This information may be used to determine the most strategic time to apply control and perhaps be used to determine infestation levels at which application of chemical sprays may not be necessary. Data from these trials showed that further investigations may be used to establish damage thresholds, based on the pod damage and its correlation with the damage to peas in the pod, as guide for control.

(c) Financial/Commercial Benefits

Use of non-persistent chemicals in control of Heliothis in peas will provide a crop which can be harvested both for peas and importantly for hay which does not have the risk of being rejected because of chemical residues. If the use of endosulfan is completely stopped on peas then the industry could reasonably guarantee a safe hay product to its markets.

Use of a 60% flowering spray application timing may produce a decreased use of the non-persistent chemicals and therefore reduce overall chemical usage.

Cost benefits to growers are obvious in that sale of hay from peas and reduced chemical usage both increase profitability. The impact of the decreased use of endosulfan on the wider environment cannot not be under estimated. Profitability in peas also means that local supply is more reliable and this has benefits by decreasing the need for imported product.

New chemicals to control *Helicoverpa spp.* on processing peas *Pisum sativum*, in South East Queensland.

by

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ABSTRACT

Current trials confirmed the results of previous trials, where it was shown that thiodicarb 750g ai/ha and alpha-cypermethrin 20g ai/ha were as effective as endosulfan 700g ai/ha for control of *Helicoverpa spp.* (Heliothis) on processing peas. Both chemicals could replace endosulfan which has the potential to be toxic to stock when the residue of the pea crop is sold as hay. Also the newer formulation esfenvalerate is more effective than endosulfan and the older fenvalerate.

INTRODUCTION

Processing peas in the Lockyer district of South East Queensland are attacked by *Helicoverpa spp.* (Heliothis), mostly from the flowering period until maturity. The standard chemical control is a single application of endosulfan. After the pods are harvested the crop residue is baled and sold as fodder for stock and this adds to the returns for the crop. Endosulfan is highly toxic to stock and consequently the withholding period on pea hay is 28 days.

Recent tests have shown that higher than recommended residues of endosulfan have occurred in some pea hay. This problem is compounded because the residue is concentrated during the haying off period and also, since aerial application of endosulfan is most common, the oil based ULV formulation is known to have a higher residual life than the EC formulation.

The Processing Vegetable Technical Discussion Group, which represents growers, processors and DPI, has made a recommendation to pea growers in the Lockyer that, to avoid this problem, they should voluntarily cease use of endosulfan on peas. Two other chemicals are registered for use against Helicoverpa in peas but each has a drawback when used alone. Methomyl has a limited residual action thus sometimes needing several applications, while fenvalerate does not give good control against larger larvae.

Three trials (Trials A, B and C) were done to obtain efficacy data for the current registrations and prospective new, safer chemicals (thiodicarb and alpha-cypermethrin) and to collect samples for analysis of residue of for these new chemicals.

Later trials (Trials 1 and 2 - Industry and HRDC funded) were carried out to look at the best chemicals and strategies and to collect data on infestation for use in determining strategies.

MATERIALS AND METHODS

Design

In trials A, B and C cultivar "SS Freezer" was planted, while in later trials 1 and 2 "Bounty" was used and all trials were designed as five randomised blocks each containing 10 treatments. Each plot was 6.25m by 1.6m (10.0 m^2) with 0.75m guard areas between blocks and, plots within rows.

Treatments

Treatments in Trials A, B and C were designed to obtain efficacy data for the current registrations and prospective new, safer chemicals (thiodicarb and alpha-cypermethrin) and to collect samples for analysis of residue of these chemicals (see Table 2). Fenvalerate was replaced with a newer formulation named esfenvalerate while these trials were in progress. For Trail B the treatment design was to collect residue data for thiodicarb on the green peas and to test alpha-cypermethrin for control. The treatments in Trial C were again designed for analysing residues of thiodicarb, but this time on pea hay. Samples were also taken for alpha-cypermethrin residues on green peas. The new esfenvalerate formulation of fenvalerate was used in this trial because it was replacing the older formulation.

Trials 1 and 2 had treatments which looked at the best chemicals and strategies (see Table 1)

Application

Sprays were applied using a motorised knapsack sprayer fitted with hollow cone nozzles delivering 1000 litres of spray per hectare at the operating pressure of 800 kPa. All first sprays were applied at 40% flowering (when 40 % of flowers had emerged) except in Trial 2 where some treatments had the first spray at 60% flowering (when 60% of flowers had emerged). Second applications were done at first full pod (when a full pod of mature peas could be found in the patch).

Sampling of damage

Damage to peas by Helicoverpa was assessed only at harvest, by collecting a random sample of approximately 100 pods from each plot and counting damage to pods first and then examining individual peas for damage.

In Trials 1 and 2 eggs and larvae were counted on 50 plants from unsprayed areas. These samples were taken 3 times each week.

RESULTS

Trials A, B and C - See Table 2

Trial A showed that thiodicarb 281g ai/ha gave the same control as the endosulfan 700g ai/ha as did a single application of fenvalerate 100g ai/ha. Thiodicarb at 375g ai/ha gave significantly better control than endosulfan 700g ai/ha. Two applications of methomyl 337g ai/ha gave equivalent control to endosulfan 700g ai/ha but a single application of methomyl 472g ai/ha was inferior to endosulfan 700g ai/ha.

For Trail B infestation was heavy and results reflected those of Trial A except that alpha-cypermethrin at both rates gave good control.

Results of Trial C showed that a single applications of alpha-cypermethrin 30g ai/ha and esfenvalerate 25g ai/ha gave good control but thiodicarb 281g ai/ha was only equivalent to esfenvalerate 25g ai/ha but not to alpha-cypermethrin 30g ai/ha. In future trials single applications of thiodicarb would be at 375g ai/ha.

Trials 1 and 2 - See Table 1

In Trial 1 analysis showed all treatments, except a single spray of methomyl 472g ai/ha, gave equivalent control when pea damage was compared. Esfenvalerate at 20g ai/ha twice and 25g ai/ha once as well as alpha-cypermethrin 20g ai/ha twice gave more less than one percent damage which is the level that contracts specify.

Trail 2 showed all treatment gave equivalent control for pea damage. One trend was that all treatments involving sprays at 60% flowering except alpha-cypermethrin at 20g ai/ha twice gave less than one percent damage.

The number of peas per pod was analysed in each trial to show the loss due to damage when no treatment was applied. This pattern was only obvious in Trials B and C and the treatment difference were only slight (although statistically significant). These treatment differences probably would not be relevant in the overall industry as yields per hectare vary from season to season.

Results of sampling of pest infestations in both Trials 1&2 revealed very poor figures which were difficult to use for trend interpretation (see Figures 1 and 2).

Figure 3 shows the relationship between pea damage and pod damage and the 1% damage tolerance equates to a 5% pod damage.

DISCUSSION

It is clear from the results that these new chemicals, alpha-cypermethrin and thiodicarb as well as the new formulation of esfenvalerate, are at least as good as and can be used to replace endosulfan, reducing the risks posed by residues in the pea hay. The trend which showed that application at 60% flowering appeared to be better will need more investigation to see if it can be demonstrated repeatedly and a significant result obtained.

Data from these trials indicate that the correlation of pea and pod damage could be used as an indicator for field staff. If 1% damage is indicated by the 5% damage to pods then this may then be used to determine the need and timing for spray applications.

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Acknowledgment is given to field staff of Edgells and Golden Circle for their cooperation in supplying seed and technical information for the trial and to Duncan Macgregor (Rhone-Poulenc), Brad Wells and Russell Thompson (Shell Chemicals) for supply of chemicals for application.

Table 1 - Results of later trials for Helicoverpa spp. control in processing peas in South-east Queensland.

Trial 1

Treatment		% Pods damaged	% Peas damaged	Peas per pod
no treatment		21.75 a	5.72 a	5.91 a
alpha-cypermethrin (x2)	20g ai/ha	1.26 e	0.22 d	5.73 a
alpha-cypermethrin	30g ai/ha	3.39 e	1.34 bcd	5.60 a
endosulfan	700g ai/ha	10.98 bc	2.46 b	5.66 a
esfenvalerate (x2)	20g ai/ha	2.10 e	0.36 d	5.93 a
esfenvalerate	25g ai/ha	5.06 de	0.92 d	5.56 a
methomyl (x2)	337g ai/ha	7.74 cd	1.27 bcd	5.88 a
methomyl (x2)	472g ai/ha	15.76 b	2.29 bc	5.99 a
thiodicarb (x2)	281g ai/ha	4.56 de	1.13 cd	5.93 a
thiodicarb	375g ai/ha	5.08 de	1.36 bcd	5.71 a

Trial 2

Treatment		% Pods damaged	% Peas damaged	Peas per pod
no treatment		16.65 a	4.00 a	6.67 a
alpha-cypermethrin (x2)#	20g ai/ha	3.62 bcd	1.25 b	6.36 a
alpha-cypermethrin (x2)	20g ai/ha	8.37 b	1.87 b	6.80 a
alpha-cypermethrin *	30g ai/ha	3.11 d	0.52 b	6.50 a
esfenvalerate (x2)#	20g ai/ha	3.62 cd	0.87 b	6.56 a
esfenvalerate (x2)	20g ai/ha	8.79 b	2.06 b	6.44 a
esfenvalerate *	25g ai/ha	2.87 d	0.90 b	5.97 a
thiodicarb (x2)#	281g ai/ha	4.05 cd	0.91 b	6.22 a
thiodicarb (x2)	281g ai/ha	7.08 bc	1.90 b	6.66 a
thiodicarb *	375g ai/ha	5.24 bcd	0.83 b	6.60 a

Single and first applications at 40% flowering (40% of flowers have emerged) and second at first full pod
- first application at 60% flowering
* - single application at 60% flowering
Values followed by the same letter do not differ at the P=0.05 level of probability

Table 2 - Results of early trials for Helicoverpa spp. control in processing peas South-east Queensland.

Trial A

Treatment		% Pods damaged	% Peas damaged	Peas per pod
no treatment		15.42 a	3.93 a	6.18 a
endosulfan	700g ai/ha	4.37 e	1.35 c	6.26 a
fenvalerate	100g ai/ha	6.39 cde	1.99 bc	6.20 a
methomyl	472g ai/ha	10.83 b	2.92 ab	6.43 a
methomyl (x2)	337g ai/ha	5.53 de	1.14 c	6.36 a
thiodicarb	187g ai/ha	8.44 bcde	1.72 bc	6.54 a
thiodicarb	281g ai/ha	10.37 bc	2.50 abc	6.33 a
thiodicarb	375g ai/ha	9.33 bcd	2.95 ab	6.16 a
thiodicarb	562g ai/ha	8.36 bcde	2.47 abc	6.40 a
thiodicarb	1125g ai/ha	7.56 bcde	1.47 bc	6.34 a

Trial B

Treatment		% Pods damaged	% Peas damaged	Peas per pod
no treatment		79.60 a	19.55 a	4.94 c
alpha-cypermethrin	20g ai/ha	29.48 ef	4.47 ef	6.42 ab
alpha-cypermethrin	30g ai/ha	24.31 f	2.96 f	6.31 ab
endosulfan	700g ai/ha	34.85 de	6.23 cdef	6.43 ab
fenvalerate	100g ai/ha	23.63 f	3.39 ef	6.69 a
methomyl	472g ai/ha	60.86 b	10.30 b	6.33 ab
methomyl (x2)	337g ai/ha	32.26 def	5.50 def	6.29 ab
thiodicarb	281g ai/ha	51.03 c	7.80 bcd	6.28 ab
thiodicarb	375g ai/ha	38.40 d	9.38 bc	5.81 b
thiodicarb	562g ai/ha	38.00 de	6.15 def	6.29 ab

Trial C

Treatment		% Pods damaged	% Peas damaged	Peas per pod
no treatment		25.58 a	8.36 a	6.00 d
alpha-cypermethrin	20g ai/ha	3.23 ef	0.91 d	6.34 c
alpha-cypermethrin	30g ai/ha	3.28 ef	0.45 d	6.27 cd
endosulfan	700g ai/ha	12.65 bc	2.85 bc	6.56 abc
esfenvalerate	25g ai/ha	7.73 cde	2.00 bcd	6.79 ab
esfenvalerate (x2)	20g ai/ha	2.19 f	0.68 d	6.87 a
methomyl	472g ai/ha	13.62 b	3.65 b	6.48 c
methomyl (x2)	337g ai/ha	6.52 def	1.51 cd	6.46 c
thiodicarb	281g ai/ha	11.46 bcd	3.01 bc	6.51 bc
thiodicarb	562g ai/ha	6.84 def	1.95 bcd	6.37 c

Single and first applications at 40% flowering (40% of flowers have emerged) and second at first full pod.
Values followed by the same letter do not differ at the P = 0.05 level of probability.

Figure 1 - Populations of *Helicoverpa spp.* per 50 plants in Trial 1

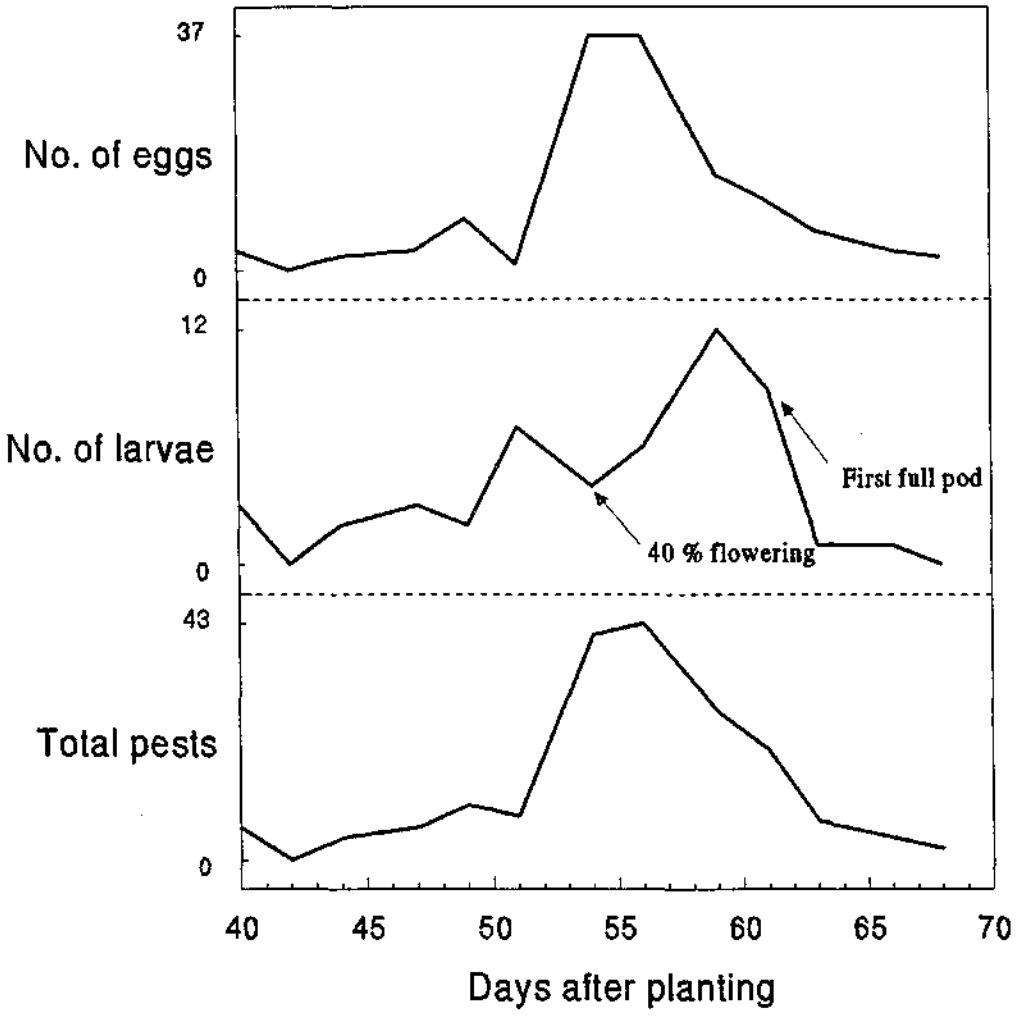

Figure 2 - Populations of *Helicoverpa spp.* per 50 plants in Trial 2

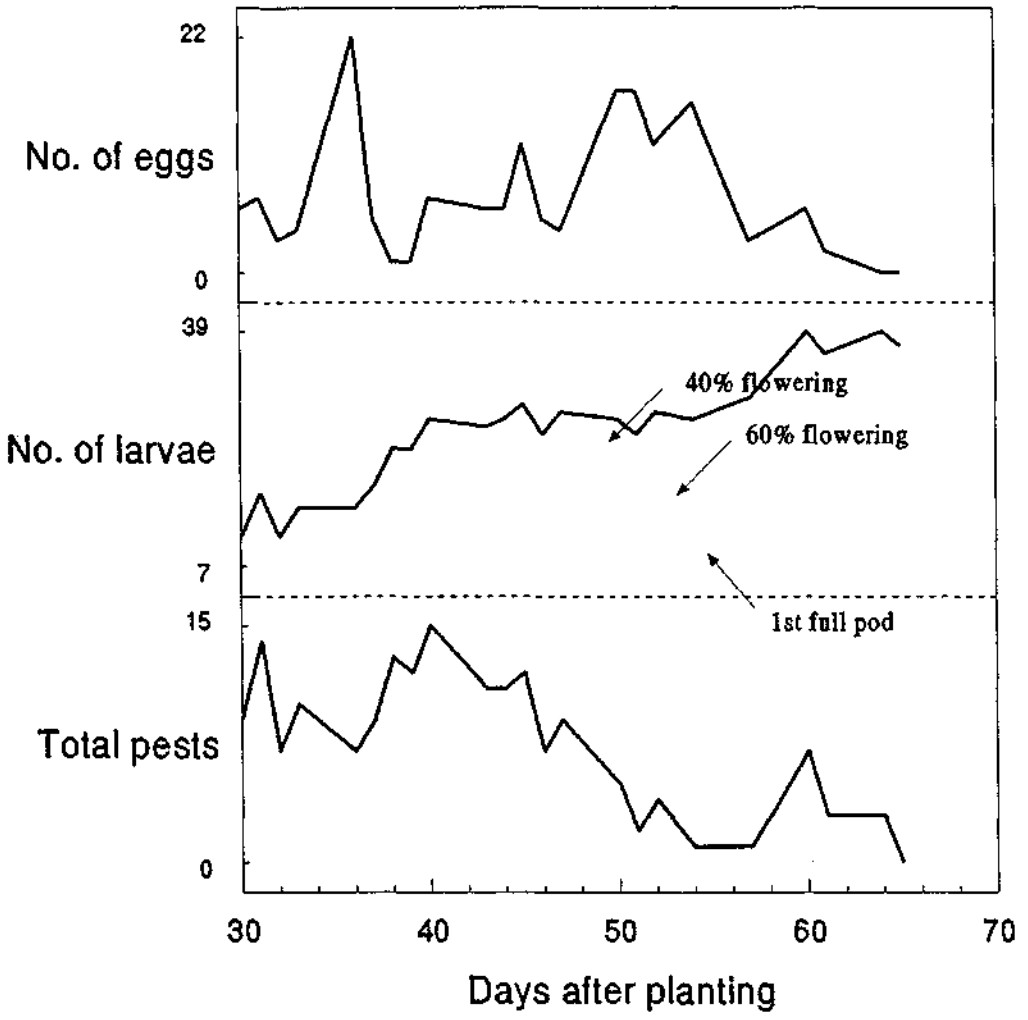

Figure 3 - Scatter plot of relationship of 1% pea damage to pod damage