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# Pilot commercial crop monitoring for pests and diseases in WA seed potato crops

Stewart Learmonth
WA Department of Agriculture

Project Number: PT01040

**PT01040**

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Level 1
50 Carrington Street
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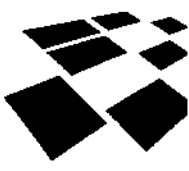
Telephone: (02) 8295 2300
Fax: (02) 8295 2399
E-Mail: horticulture@horticulture.com.au





Horticulture Australi

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# Pilot commercial crop monitoring for pests and diseases in WA seed potato crops

Stewart Learmonth

Western Australian Department of Agriculture

**PT01040**

Stewart Learmonth and Ian Guthridge
WA Department of Agriculture
Locked Bag 7
Manjimup
WA 6258
Tel (08) 9777000 Fax (08) 97770001 EMAIL slearmonth@agric.wa.gov.au

Purpose of the report:

Seed potato crops in Western Australia were monitored during the 2001/02 season to assist farmers protect their crops from pests. While the emphasis was on monitoring aphids with a view to managing leafroll virus, other insect pests were included. This report provides the results of the monitoring for pest abundance and recommendations concerning the future of monitoring seed potato crops in WA.

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18 November 2002

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## Media summary

Seed potato crops in Western Australia were monitored over one season for insect pests and disease.

The weekly monitoring and reporting back to growers with recommendations on the need for action against pests was planned to assist growers in reducing the abundance of insect vectors of virus diseases as a priority, and on other pests that might otherwise reduce crop health or yield. The program was to provide back-up for growers already monitoring for pests and to encourage other growers to introduce monitoring as a means of decision making for pest control actions.

The weekly reporting to seed potato growers of pest abundance in crops assisted in keeping pest numbers below levels that could affect the quality and yield of crops. Across the regions in WA where monitoring was undertaken, the timing and abundance of pests differed. The value of monitoring individual crops to provide crop specific advice was realised within this project. Growers gained information on the arrival time of pests for strategic spraying and a check on the effectiveness of spraying on target pests. For growers already undertaking a monitoring program, the information provided confirmation of their findings. Other growers gained confidence in the information provided and stated they were able to reduce the number of sprays required to protect their crops.

Seed potato growers welcomed the independent assessment of pest occurrence and abundance and the recommendations for action. The post treatment monitoring to report on the success of treatment provided useful information on treatment effectiveness and whether further action was required.

In end of season reviews of the monitoring, growers commended the monitoring as providing timely and relevant information to take appropriate action to protect their crops from pests. They also suggested that spray records be combined with the monitoring to provide feedback on the effectiveness of different pesticides.

A review of the costs of the monitoring program indicated that it is economically viable on an individual farm basis when considered on the context of total crop area per farm for which the monitoring is potentially relevant and possible reduction in pesticide use.

Based on growers' comments that the monitoring providing information they either found useful as a back-up or assisted in their pest control program, they suggested the program be continued for another season.

## Technical summary

The insect transmitted virus diseases potato leafroll virus and tomato spotted wilt virus occur in WA. Both virus diseases rely on insect vectors to introduce them to uninfected crops and spread them within crops. Also, both diseases can be introduced into crops through infected seed. Infection of WA seed potato crops in the past requires that seed potato growers be vigilant with respect to the abundance of these insect vectors. Only some seed potato growers in WA rely on a crop monitoring program to base their decisions on actions to protect their crops, both from insect vectors of virus and other pests. This project sought to introduce a pilot commercial crop monitoring program to support growers already monitoring and to encourage other growers in base decision making on monitoring to protect their seed crops.

Seed potato growers were invited to take part in the project. For each grower, one crop was monitored per month of planting per farm. Monitoring commenced at crop emergence and was undertaken weekly to crop senescence or spray-off. Monitoring consisted of (a) examining 50 lower leaves per crop, (b) tapping foliage over a container at 10 location per crop and (c) general observations for pests along a designated path, which varied with crop age. Pest abundance was recorded on a detail score sheet. Using this information, a summary report and recommendation for action as appropriate, was sent to the grower within 2 days of the monitoring.

The results of the monitoring showed that pest pressure and the need for action varied between regions and within regions on individual farms – as expected. In this sense the monitoring was regarded as being successful in providing farm specific information and recommendations. Pest control measures were implemented in a timely manner and excessive levels of pests were extremely rare. Although not all seed crops were monitored, growers reported that the information provided was useful in decision making for other nearby crops. Growers undertaking monitoring themselves found the information provided by the pilot program supported their own assessments.

The actual details of the monitoring were found to be adequate and no recommendations regarding changes to the monitoring program were suggested by growers at the end of season review of the project. If such an industry based scheme were to be repeated, growers suggested that details of pesticides applied be matched with pest abundance records to assess the effectiveness of control actions.

A review of the costs of the monitoring program including training of new staff and collating and reporting results to seed potato growers was presented. This indicated that the program was economically viable when total farm area for which the monitoring was relevant is taken into account, and assuming some reduction in pesticide use can be achieved through monitoring.

Seed potato growers found the monitoring program useful, both in support of their own monitoring or providing feedback on pest management based on their own assessment for control action or the recommendation from the current project. Growers were in favour of the program being run for another season.

## Introduction

Virus diseases in potato crops can reduce the yield of potatoes and adversely affect the quality of tubers in susceptible varieties by causing discolouration in the flesh. In the case of seed potatoes, quality is judged also by the level of virus and limits exist under certified seed potato scheme rules (Anon (a), 2001). It is important that seed potato crops have no or minimal virus levels because these diseases can be introduced to the larger areas of commercial potato crops through infected seed.

The main virus diseases in WA crops are potato leafroll virus and tomato spotted wilt virus. These diseases can also be introduced into potato crops and spread within them by the insect vectors aphids and thrips respectively. Problems with virus infection of seed potato crops in WA in the past require that growers remain vigilant regarding the abundance of these insect vectors. For aphids, a threshhold for crop rejection and therefore a guideline as an action threshhold for applying insecticides to crops is included in the WA Certified Seed Potato Scheme rules (Anon (b), 2001).

While there are other important aspects to producing seed potatoes with minimal virus levels, the subject of this current project was minimising the abundance of insect virus vectors. In this way growers of seed potatoes and their customers will have more confidence that seed crops will at least have minimal virus spread within them by insects. The variation in aphid abundance in different cropping regions within WA, both within a season and among crops (Berlandier, 1997, 1999), indicates that individual crop monitoring for aphids is appropriate for growers to achieve effective aphid management. Apart from monitoring for disease vectors, other pests including disease could be assessed concurrently.

The aim of this project was to introduce a common monitoring service to seed growers to assist them with their monitoring program or, where growers did not regularly monitor their crops, to introduce them to the principle of regular, detail crop monitoring. The advantages of such an approach to pest management include spraying only when required, applying pesticides at the most appropriate time to control pests and therefore prevent pest damage, and consequently to reduce any increase in virus levels in seed crops should small levels of virus be present in infected seed used to bulk up the seed crops. This information would also provide feedback to growers on the effectiveness of particular control actions.

This project was undertaken with a view to the possible introduction of a commercial pest monitoring service for growers.

## Materials and methods

The monitoring program was set up by the WA Department of Agriculture, employing casuals to undertake most of the monitoring. Staff of the Department also undertook some of the monitoring and the overall supervision of the scheme.

For logistical reasons, the seed potato crops in WA were divided into five regions – Esperance, Albany (including Bremer Bay), Lower southwest (Manjimup, Pemberton and Scott River), Southwest (Rosa Brook, Busselton and Donnybrook) and Metropolitan (Perth and Gingin). Seed potato growers in each region were invited to be involved with the monitoring program, resulting in all regions except Metropolitan being included in the monitoring. One employee was responsible for crop monitoring in each region.

For each seed potato grower, one crop was selected for monitoring per month of planting per farm, from crop emergence to crop senescence or spray off. Crops selected for monitoring were the latest generation status, which was usually the largest area of planting for that month. Monitoring was undertaken weekly and where practicable was on the same day of the week. Persons undertaking the monitoring observed a crop hygiene protocol. Rubber boots were cleaned after and before each site - loose dirt/mud was removed and boots disinfected with Farm Cleanse @ 10ml/L water.

The procedure for monitoring was based on (a) examining 50 lower leaves, (b) tapping foliage over a container at ten locations and (c) general crop observations primarily for mobile insects not readily sampled by the other two methods and checking for disease.

The monitoring was along a predetermined path through the crop. Up to row closure, this path was a triangle through the crop. After row closure, monitoring was undertaken by walking around the edge of the crop and stepping into the crop up to about 20m at at least one point on each side of the crop. From crop die down to senescence or spray off, the triangular monitoring path through the crop was resumed.

Monitoring included scouting for insects and general observations to indicate disease outbreaks. In addition to this monitoring, pheromone traps for two species of looper (*Chrysodeixis argentifera* and *C. eriosoma*) were located at some of the crops being monitored to assess whether they were useful as a warning tool for pest occurrence. The score sheets and grower summary sheets used for the monitoring are included in Appendix 1 and 2 respectively.

Score sheets from Esperance and Albany regions were faxed to Department of Agriculture Manjimup in order to collate and review the monitoring data. Using the summary sheets, growers were advised of the main findings of the monitoring and any recommendations regarding the need to take action against pests were made. This information was sent to the grower by fax or, when action was contemplated, the grower was phoned to discuss control options, including the need for control. The final decision on action was the grower's responsibility. Also, the grower was responsible for taking any appropriate action in other seed crops on his farm that were not part of the monitoring program.

The monitoring program was reviewed at grower meetings at the end of the season. Key questions were whether growers valued the service, had any comments to improve the program and whether the monitoring program should be continued.

The main costs of the program, wages and travel, were recorded for the purpose of undertaking a benefit/cost analysis of the project.

## Results

The number of growers from each region involved in the monitoring and other information on the size of the monitoring program are given in Table 1. Of the growers invited to participate in the monitoring program, only three declined. The Albany region, being the principal seed potato producing area with the greatest number of growers accounted for most of the visits.

The pests found for which either a recommendation to apply insecticide was made or where action was considered but not necessarily undertaken were: aphids, loopers, Rutherglen bug, potato moth, heliothis, thrip and wingless grasshopper. The number of times such occasions arose for each pest is shown in the following tables (see Tables 2 to 4). Also included in these tables is the proportional representation of these occasions in relation to the total number of farm visits made within each region, to take into account the large differences in crop visits among the regions.

The pest most commonly the subject of recommendations for action was aphids. Their abundance in the four regions varied among regions and during the season – see Fig. 1 (two parts). In general terms, aphids were most abundant in spring and autumn, with some crops infested during summer. This seasonal abundance of aphids is consistent with results from monitoring WA potato crops in other years (Berlandier, 1997, 1999). In general, aphid abundance was held in check at levels below the WA Seed Potato Scheme threshhold (Anon. (b), 2001). Where this was not achieved were situations of heavy aphid pressure in the case of one crop in Albany in summer and an Esperance crop in autumn. For one crop in the lower south west, aphids invaded at the time of crop spray off with herbicide and control was not considered necessary.

Table 1. Information to indicate the size of the monitoring exercise undertaken in WA seed potato crops in the 2001/02 season.

| Region | Crops monitored | Weekly visits | *Plot visits | Leaves checked |
|---|---|---|---|---|
| Esperance | 7 | 46 | 49 | 2450 |
| Albany | 40 | 161 | 326 | 16300 |
| Lower southwest | 8 | 74 | 79 | 3950 |
| Southwest | 9 | 79 | 99 | 4950 |
| **All areas** | **64** | **360** | **553** | **27650** |

* Plot visits included where a visit to one farm was made but more then one crop was monitored where they were planted in different months.

Table 2. The number of occasions when action was considered for control of aphids and thrips, and the proportion of crop visits this represents during the crop monitoring program.

| Region | Aphids | | Thrips | |
|---|---|---|---|---|
| | No. | % crops monitored | No. | % crops monitored |
| Esperance | 5 | 10 | 0 | 0 |
| Albany | 27 | 8 | 0 | 0 |
| Lower southwest | 4 | 5 | 0 | 0 |
| Southwest | 0 | 0 | 1 | 1 |
| **All areas** | **36** | **7** | **1** | **1** |

Table 3. The number of occasions when action was considered for control of loopers, potato moth and heliothis and the proportion of crop visits this represents during the crop monitoring program.

| Region | Loopers | | Potato moth | | Heliothis | |
|---|---|---|---|---|---|---|
| | No. | % crops monitored | No. | % crops monitored | No. | % crops monitored |
| Esperance | 0 | 0 | 0 | 0 | 0 | 0 |
| Albany | 15 | 5 | 3 | 1 | 4 | 1 |
| Lower southwest | 0 | 0 | 0 | 0 | 0 | 0 |
| Southwest | 0 | 0 | 3 | 3 | 0 | 0 |
| **All areas** | **15** | **3** | **6** | **1** | **4** | **1** |

Table 4. The number of occasions when action was considered for control of Rutherglen bug and wingless grasshopper and the proportion of crop visits this represents during the crop monitoring program.

| Region | Rutherglen bug | | Wingless grasshopper | |
|---|---|---|---|---|
| | No. | % crops monitored | No. | % crops monitored |
| Esperance | 0 | 0 | 1 | 2 |
| Albany | 13 | 4 | 0 | 0 |
| Lower southwest | 2 | 2 | 0 | 0 |
| Southwest | 0 | 0 | 0 | 0 |
| **All areas** | **15** | **3** | **1** | **1** |

Thrips were considered to be important in one crop only. The insects were present in high numbers at crop emergence and at this time can reduce plant vigour, thereby affecting the potential yield. The species of thrips most commonly recorded in WA potato crops is onion thrips. While this species can transmit tomato spotted wilt virus, this disease is of minor importance in WA crops at this time.

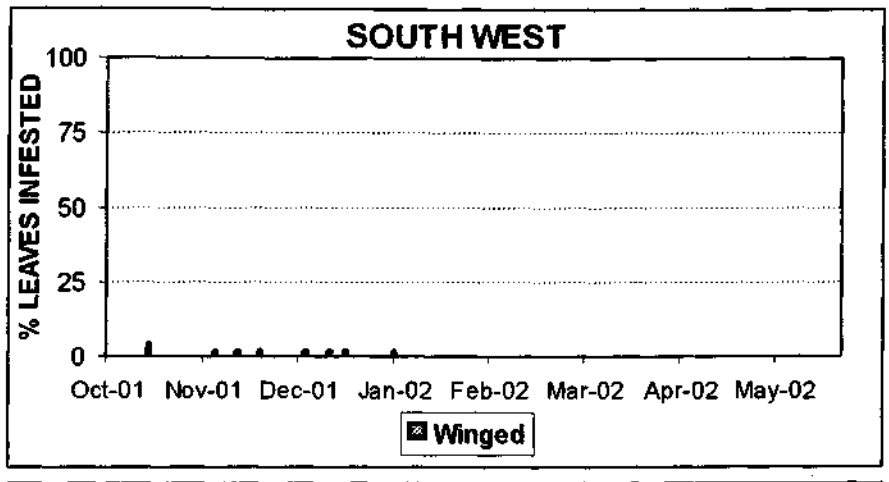
The monitoring for the two species of looper moths using pheromone traps and eggs and larvae from the in-field monitoring are given in Fig. 2. *C. argentifera* was present earlier in the season when looper larvae were more abundant. However, the abundance of looper moths in traps did not appear to provide a good indicator of the presence of eggs and larvae in crops for all regions. Recommendations for growers to inspect crops with a view to closer inspection and possibly applying insecticide were made only for Albany crops, yet moth catches were of similar magnitude for other regions where no such recommendations were made (see Table 3). Later in the season when *C. eriosoma* was the dominant species, the relationship between moth catch and looper abundance in crops was even less clear.

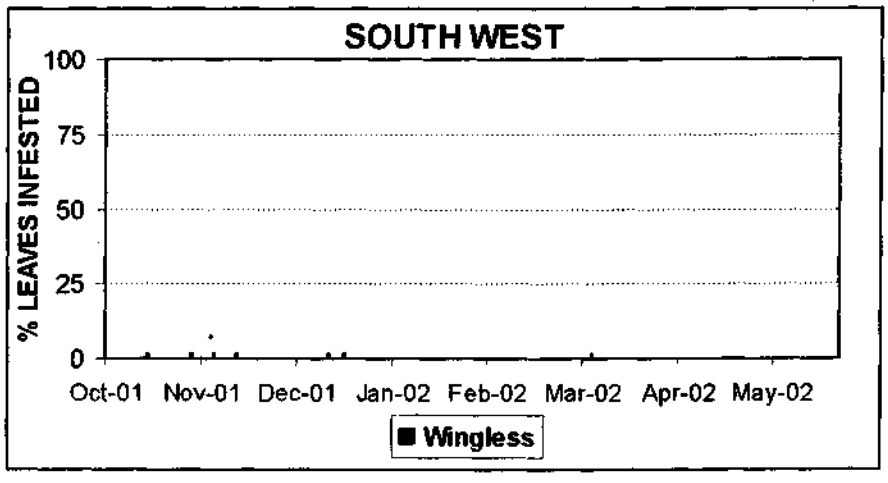
The other pests mentioned were of local concern only and occurred in few crops.

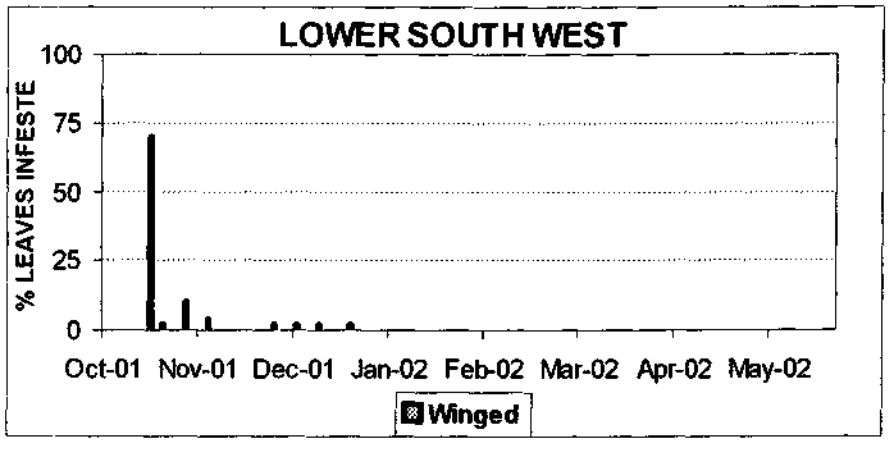
Information from the monitoring was sent to growers within two days of the monitoring and growers were satisfied that they were advised of the results in a timely manner. In situations where insect pests were near levels that might require insecticide use or where they were present at levels that did require insecticide use, the grower was contacted by phone. In these cases, the grower was advised to either inspect the crop in a day or two to take appropriate action, or to spray the crop as soon as practicable to protect it from the pest present.

During the 2001/02 season, no seed potato crops were rejected by seed inspectors on the basis of excessive aphid numbers (M. Holland, Manager AgWest Plant Labs., pers. comm.) In the situations where aphid pressure was present at excessive levels during crop growth, numbers were reduced as soon as practicable before inspection. This is considered acceptable in view of the fact that aphids acquire and transmit potato leafroll virus over a few days.

There were no occasions where foliar diseases that might have been important to crop health were noted.



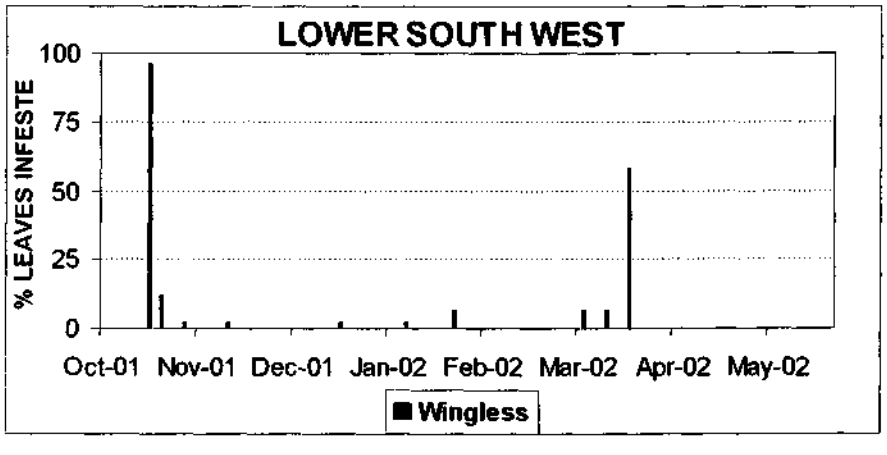
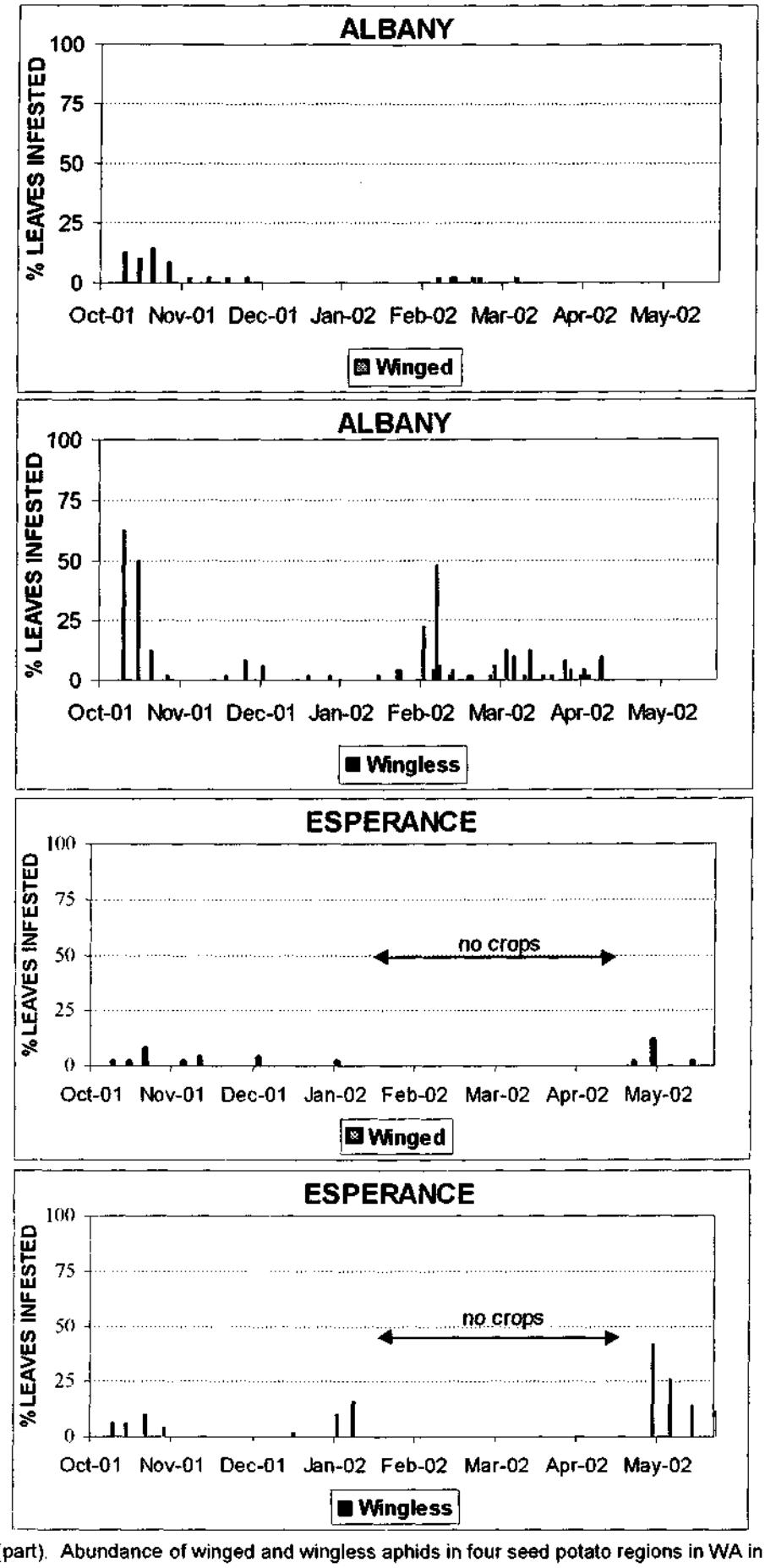




Fig. 1 (part). Abundance of winged and wingless aphids in four seed potato regions in WA in 2001/02.

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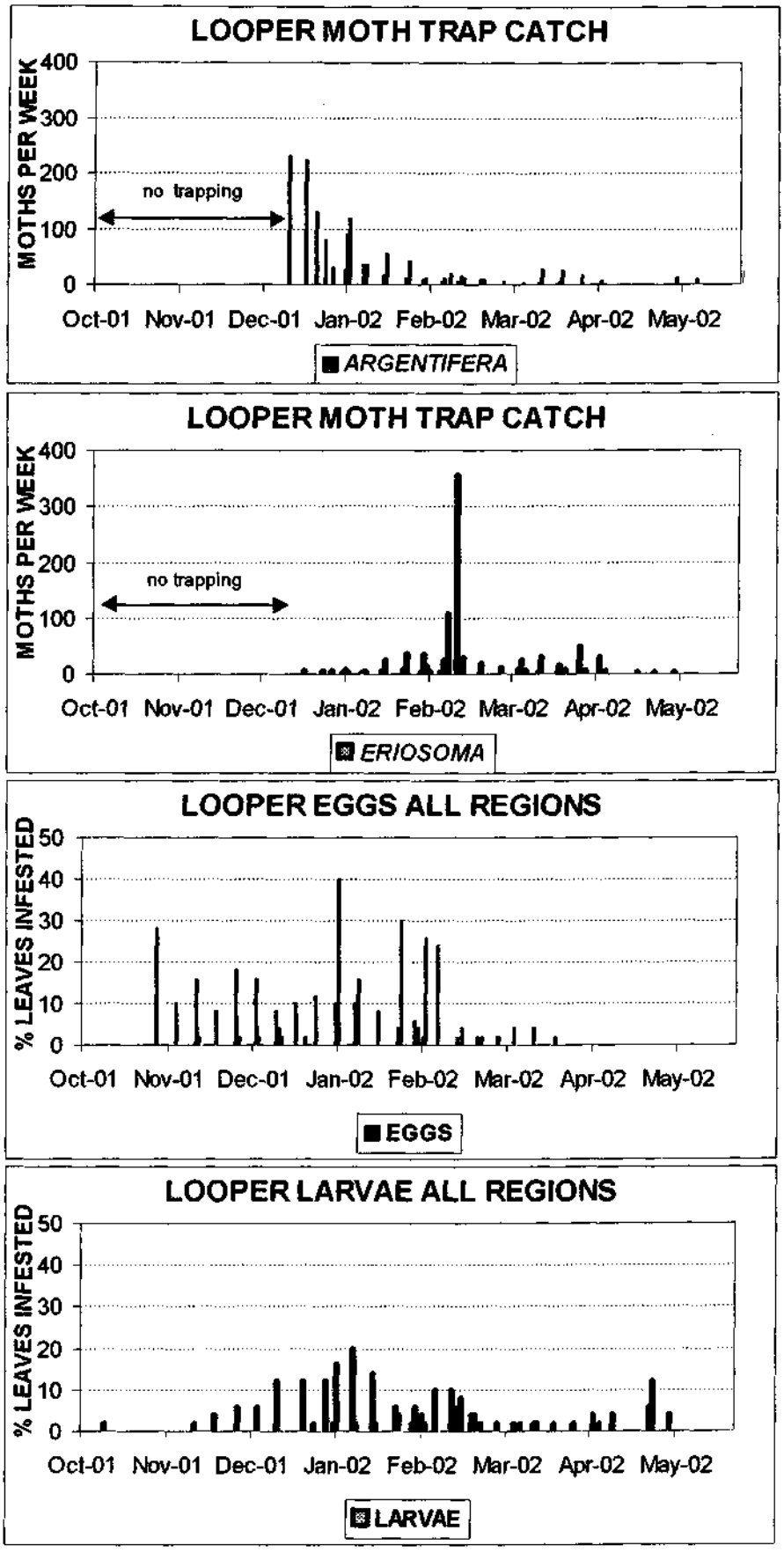


Fig. 2. Abundance of looper moths and larvae in seed potato regions in WA in 2001/02.

Reviews of the monitoring were held with seed potato growers in Albany and Manjimup. Not all growers were able to attend these reviews, but those that did recommended that the monitoring be continued for the next season. Some growers commented that the availability of score sheets on aphid abundance for the life of a crop was a sales advantage in convincing buyers that aphid abundance was low or non-existent. Although growers made no comments on the process involved with the monitoring, reporting or recommendations, they requested that information on pesticide use for aphid control be gathered. They suggested that this information would be useful to them to confirm the relative effectiveness of the different registered products.

The requested funding for the monitoring program was $8,461 less than the actual costs. This shortfall in funds required for the monitoring was covered by the WA Department of Agriculture. Most of the shortfall in funding was due to the time devoted to the training requirement of the external casual wages staff and time required to collate and report information to growers that had not been adequately allowed for in the original funding estimate.

The details of the time spent on various activities in relation to this project are included in Appendix 3. These were used to estimate the costs of monitoring and total costs per visit and per crop in Table 5.

The greater costs per visit are a reflection of the greater travel time to reach potato farms from the base location, with the greatest amount of travel being for crops in the south-west region. The administration costs of the monitoring, which relate to training casual staff and collation the monitoring data and making recommendations to growers, were the responsibilities of the WA Department of Agriculture. These costs are included in the south-west region, because these activities were undertaken in combination with the monitoring for this particular region.

The average number of visits per crop varied between 7 and 11. Some of this difference is related to when crops were first visited, with some crops being at an advanced age when the monitoring began. Ideally the commencement of the monitoring for all crops should have been at emergence, but this was not achieved because the program did not start in July.

The average cost for the monitoring was $543 per crop. This figure does not take into account the relatively small cost of monitoring equipment. In terms of crop yield, which varies across regions and planting times, this amounts represents a range of between 3 and 7% of gross return on a per hectare basis. The economics of the monitoring are considered more fully below in the Discussion section.

Table 5. Cost of the monitoring per plot and crop (see Appendix 3 for details of the monitoring on which the figures in this table are based).

| REGION | Cost of monitoring per plot per visit | *Total cost per plot per visit including training and data collation | Average number of visits per crop | Total cost per crop |
|---|---|---|---|---|
| ESPERANCE | $47 | $47 | 7 | **$330** |
| ALBANY | $34 | $34 | 8 | **$277** |
| LOWER SOUTH-WEST | $64 | $64 | 10 | **$629** |
| SOUTH-WEST | $100 | *$165 | 11 | **$1,813** |
| **AVERAGE** | **$51** | **$63** | 9 | **$543** |

*All training and collation of monitoring data was handled out of the WA Department of Agriculture Horticultural Research Institute and assigned to the SOUTH-WEST REGION.

The costs of the monitoring program were greater than allowed for in the budget (see Table 6). The shortfall was covered by Consolidated Fund of the WA Department of Agriculture.

Table 6. Total project costs (see Appendix 3 for details of the monitoring on which the figures in this table are based).

| REGION | ESPERANCE | ALBANY | LOWER SOUTH-WEST | *SOUTH-WEST | TOTAL |
|---|---|---|---|---|---|
| TOTAL 2001/02 | $2,310 | $11,080 | $5,030 | *$17,314 | $35,734 |
| | | | | BUDGET 2001/02 | $27,273 |
| | | | | SHORTFALL | $8,461 |

* An allowance of $1,000 for monitoring equipment is included.

## *Discussion*

A major consideration with respect to quality of seed potatoes for both growers and buyers is the level of tuber borne virus. Tests to confirm the level of virus in seed potatoes are time consuming and expensive. Such tests, also known as virus indexing, are not conducted routinely on WA seed potatoes. Also, prevention of unacceptable virus levels in seed potatoes is far more important than knowing that high levels are present and the crop is not available for sale as seed. Depending on the variety and virus infection level, tubers also may not be of acceptable quality for sale for consumers, for example for processing where net necrosis from leafroll virus results in unacceptable spotting of the cooked potato.

For potato leafroll virus, which has been of concern in the WA seed potato scheme, monitoring and controlling the most important vector, green peach aphid is a mandatory part of growing quality seed. The current project sought to expose growers to a monitoring service to assist in growing crops with aphid levels below the locally accepted threshhold of aphid abundance (Anon. 2001).

With the exception of two crops where aphid pressure was high and required multiple insecticide applications to achieve these desired aphid levels, normal grower practice resulted in good aphid control. This was achieved both in response to the monitoring and by growers adopting their usual aphid control program. In the case of the latter approach, it is a challenge for a monitoring scheme to build confidence in seed potato growers that reduced levels of spaying can be undertaken by relying on aphid presence and abundance obtained from a monitoring program.

By continuing such an industry funded program, growers' confidence can be enhanced to the point where spray on demand becomes an acceptable practice. This not only applies to managing aphids, but for other pests as well. The importance of this aspect is seen where other pests invade crops and other control options, including different insecticides, can be selected. In this way, treatment on demand can incorporate the specialist approach to pest management with the objective of reduced use of broad spectrum insecticide use.

The results from using pheromone traps for looper moths was not found to be a reliable indicator of pest pressure and consequent need to apply insecticide. It is suggested that in-field monitoring is sufficient to determine the need to protect crops from looper infestations.

The cost of the monitoring program was estimated to be $543 per crop, irrespective of the area involved. Naturally for very large areas of single varieties the cost would be greater because they would take longer to monitor. Based on an average area of a seed crop of 4ha, the cost per crop was estimated to represent between 1 and 2% of the gross return per hectare of potatoes. Also, the monitored crop was designed to be used as a sentinel crop for other crops on the seed potato grower's property planted in the same month. Therefore

the cost of the monitoring can be spread over a larger area of potatoes than simply that crop being checked. When considered in these terms, the cost of the monitoring program was thought to be good value for money.

Another way of evaluating the benefit of the monitoring is to consider its cost in relation to the cost of aphicides. For the three most commonly used insecticides for aphid control, the average cost is $50 per hectare (see Appendix 3). If the monitoring were to save one insecticide application per crop of 4 ha, the total saving on insecticide alone would be $200, or approximately 40% of the cost of the monitoring.

Other benefits of the monitoring which have not been quantified in dollar terms include seed potato customer confidence in crops with minimal virus levels achieved through the detailed knowledge of aphid abundance through the life of the crop. This benefit would apply to both domestic and overseas customers. Also, the enhanced environmental benefit which would follow from reduced insecticide use, was not included in the economic consideration.

Seed potato growers involved in the monitoring program suggested that in future, detailed spray records be kept for all crops monitored. In this way, added benefits of reduced spray use can be included in the economic assessment of the monitoring. Also, growers were keen to use the results of the monitoring as an indicator of efficacy of different pesticides, especially aphicides.

Any continuation of a monitoring program as reported here need to take into account the full cost of training monitoring staff, and collating and reporting information to growers.

## Technology Transfer

This pilot monitoring program was devised for the benefit of WA seed potato growers. They were provided with information on pest abundance and related management recommendations on a weekly basis throughout the season.

The monitoring program was reviewed at two grower meetings – in Albany and Manjimup - at its conclusion.

## Recommendations

- The monitoring program be continued for a further season, with greater emphasis on training seed potato growers to accept a greater responsibility for monitoring.

- Encourage the WA seed industry to be responsible for a pest monitoring program as a basis for producing quality seed potatoes with minimal virus levels.

- In future pest monitoring programs, include information on pesticides used to gain further information on the relative effectiveness of different products in controlling pests and a more detailed assessment of the economic viability of the program in terms of reduced spray usage.

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The co-operation and interest of the WA seed potato growers involved in the project made it that much more satisfying to implement and review the monitoring program.

The interest and enthusiasm of Geraldine Janicke, Esther Spense, Sonya Congrieve and Steven Meyer who undertaking the monitoring, contributed to the smooth running of the project.

Paul Mattingley, Economist with the WA Department of Agriculture provided helpful comments on the economic benefits of the project. Peter Dawson and Mark Holland of the WA Department of Agriculture provided useful comments on this report.

Appendix 1. Field score sheet used in the monitoring program.

**POTATO SEED CROP MONITORING**

FARM: _____ VARIETY: _____ PLOT/PADDOCK: _____

FAX. DATE.

Pheromone traps (where placed): ERI= ARG =

TRANSECT / EDGE MONITORING
(circle monitoring method)

***LOWER LEAVES***

| Leaf | APHIDS | | | | | | | | | | | | | | | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | W | W/L | M | pm | tble | tblg | heli | rb | tp | lh | wgh | wf | | | | |
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | |
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| 47 | | | | | | | | | | | | | | | | |
| 48 | | | | | | | | | | | | | | | | |
| 49 | | | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | | | |
| Average / 100 leaves | | | | | | | | | | | | | | | | |
| % Leaves infested | | | | | | | | | | | | | | | | |

***Insects per Container***

| Bash | APHIDS | | | | | | | | | | | | | | | OTHER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | W | W/L | M | pm | tble | tblg | heli | rb | tp | lh | wgh | wf | | | | |
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | | |

**COMMENTS:**

Appendix 2. Summary recommendation sheet for seed potato crop monitoring.

**WA SEED POTATO CROP MONITORING 2001/02 - An Industry Initiative**

WA POTATO PRODUCERS' COMMITTEE

FARM: _____ DATE: _____

FAX: _____

Insect numbers scoring system:

| | |
|---|---|
| | Absent |
| X | Present at very low numbers: 1 to 10% leaves infested |
| XX | Moderately abundant : 10 to 40% leaves infested |
| XXX | Widespread and easily found >40% leaves infested |

Enquiries:
Ian Guthridge Tel. 97770139; 0427 779039
Stewart Learmonth Tel. 97770167, 0417 959319.

| Paddock name | Sowing month | APHIDS | | | OTHERS | | | | | | | | | | | | | Monitoring method (tick box) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | winged | wingless | *mummy | potato moth | looper egg | looper grub | heliothis | Rutherglen bug | thrip | leafhopper | wingless grasshopper | white fly | | | | | TRANSECT | EDGE |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
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*mummy = aphid parasitised by a wasp

SUMMARY OF INSECT NUMBERS:

ACTION RECOMMENDATION:

Appendix 3. Details of activities for calculating costs of the monitoring.

**TIME TAKEN (HOURS) PER ACTIVITY**

| REGION | TRAINING | PREPARATION | MONITORING | DATA COLLATION / RECOMMENDATIONS | MEETINGS | TOTAL |
|---|---|---|---|---|---|---|
| ESPERANCE | 0 | 4 | 60 | 0 | 2 | **66** |
| ALBANY | 0 | 4 | 370 | 0 | 2 | **376** |
| LOWER SOUTH-WEST | 0 | 4 | 152 | 0 | 2 | **158** |
| SOUTH-WEST | 92 | 34 | 181 | 76 | 10 | **393** |
| **TOTAL** | **92** | **46** | **763** | **76** | **16** | **993** |

**TIME TAKEN PER VISIT PER PLOT**

| REGION | PLOT VISITS | MONITORING HRS / PLOT / VISIT | ALL JOBS HRS/PLOT/VISIT |
|---|---|---|---|
| ESPERANCE | 49 | 1.2 | 1.3 |
| ALBANY | 326 | 1.1 | 1.2 |
| LOWER SOUTH-WEST | 79 | 1.9 | 2.0 |
| SOUTH-WEST | 99 | 1.8 | 4.0 |
| **TOTAL** | **553** | **1.4** | **1.8** |

**VEHICLE USE**

| REGION | DAYS |
|---|---|
| ESPERANCE | 11 |
| ALBANY | 28 |
| LOWER SOUTH-WEST | 18 |
| SOUTH-WEST | 23 |
| **TOTAL** | **80** |

**#COST PER ACTIVITY**

| EGION | TRAINING | PREPARATION | MONITORING | DATA COLLATION / RECOMMENDATIONS | MEETINGS | TOTAL |
|---|---|---|---|---|---|---|
| SPERANCE | $0 | $100 | $2,160 | $0 | $50 | **$2,310** |
| LBANY | $0 | $100 | $10,930 | $0 | $50 | **$11,080** |
| OWER SOUTH-WEST | $0 | $100 | $4,880 | $0 | $50 | **$5,030** |
| OUTH-WEST | $3,496 | $1,292 | $8,258 | $2,888 | $380 | **$16,314** |
| **TOTAL** | **$3,496** | **$1,592** | **$26,228** | **$2,888** | **$530** | **$34,734** |
| ***TOTAL** (including consumables) | | | | | | **$35,734** |

#Based on labour costs (@ $25/hr for casual wages staff & $38/hr for WA Department of Agriculture staff and vehicle use @ $60 /day.

*the cost of consumable items was estimated @ $1,000.

**APHICIDE COST of products registered for use in WA** (as at early Nov 2002)

| Insecticide | Product (example) | Rate (/ha) | Cost(/ha) |
|---|---|---|---|
| dimethoate | Saboteur | 750ml | $7.95 |
| [2.] disulfoton | Disulfoton | 28kg | $372.40 |
| endosulfan | Thiodan | 2.1L | $31.08 |
| [1.] imidacloprid | Confidor | 300ml | $78.90 |
| [1.] methamidophos | Nitofol | 550ml | $21.67 |
| omethoate | Folimat 800 | 750ml | $36.00 |
| [2.] phorate | Thimet 100 | 29kg | $232.00 |
| [1.] pirimicarb | Pirimor 500 | 1kg | $51.20 |
| pymetrozine | Chess 250WP | 400g | $52.40 |

[1.] These insecticides are the main ones used by WA seed potato growers.

[2.] These insecticides are applied with the sett at planting and are not commonly used.