

**Virus Monitoring of  
Victorian Certified  
Seed Potato Authority  
Inc (ViCSPA) Seed  
Plots**

Keith Blackmore  
Victorian Certified Seed  
Potato Association Inc

Project Number: PT05010

## **PT05010**

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## **Project PT05010**



# **Virus Monitoring of ViCSPA seed plots Final Report**

**Report Compiled by Keith Blackmore, Manager ViCSPA**  
October 2006



**PT05010**  
**VIRUS MONITORING OF**  
**VICSPA GROWERS'**  
**SEED PLOTS**

**Virus monitoring of seed plots to be used for future production of healthy certified seed potatoes.**

Keith Blackmore  
Manager ViCSPA

**October 2006**

**PT05010****VIRUS MONITORING OF ViCSPA SEED PLOTS****Virus monitoring of all seed plots to be used for future production of healthy certified seed potatoes.**

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- ⊕ ViCSPA Certification Officers

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**Over 30,000 leaves were collected and tested for five viruses using the ELISA method. The project involved collecting 500 leaves in bags of 20 leaves across all Generation 3 and or Generation 4 plots for each grower.**

## Media summary

Virus monitoring of seed plots to be used for future production of healthy certified seed potatoes.

Potato virus diseases do not effect humans but can have a significant effect on the yield and quality of potato crops and processed potato products.

These viruses are spread to potato plants via the mother seed tuber, insects (mostly aphids & thrips) and/or mechanically by contact. Infected seed tubers when planted give rise to infected plants.

The certified seed potato schemes in Australia are all derived from pathogen tested stocks that are tested for all known pathogens (diseases).

As the seed stocks are multiplied in the field over a period of up to five years they are potentially exposed to reinfection with the plant viruses - Potato leaf roll virus (PLRV), Tomato Spotted Wilt Virus (TSWV), Potato Virus Y (PVY), Potato Virus X (PVX) and Potato Virus S (PVS). Each year the crops are inspected in the field and must meet the specified National Standard before further multiplication or sale as certified seed potatoes. Some virus infections can reach a significant level in one season.

Crop rejections due to virus diseases have had a significant economic effect on some seed growers and their buyers. The shortage of certified seed potatoes to sell to buyers and for buyers to plant to fill their contracts is an important economic problem.

By checking the health status of the seed plots that the growers will use to plant next years crops growers can avoid planting problem lines of seed and replace them with healthy seed.

The survey results demonstrate that the overall health of the seed plots is, with a few exceptions, very good. No PVX was found and low levels of PLRV, TSWV and PVY were present. However there is a need to improve management practices to reduce the amount of PVS in some growers lines. The common strain of PVS is not known to have a significant yield effect and it does not show plant symptoms and therefore its presence is not taken into consideration during certification. ViCSPA will also use the survey results to develop future policies for virus monitoring of growers stocks.



**A healthy crop of Catani certified seed potatoes.**

## Technical Summary

All modern certified seed schemes are based on the multiplication of seed tubers that are derived from stocks that have been tested for a range of pathogens. The seed stocks are multiplied in managed schemes, which endeavour to limit the reinfection of the seed by disease. Tools used to grow healthy seed stocks include isolation, hygiene and limiting exposure to disease spreading insect vectors. Each year during the field multiplication, independent agencies visually inspect each lot of seed to ensure that it meets the rules for multiplication and meets the prescribed standards for disease and impurities. The National Standard ([www.vicspa.org.au](http://www.vicspa.org.au)) describes the protocols and standards.

Potato viruses have caused yield and quality losses across southern Australia especially during the last five years. Potato Leaf Roll Virus (PLRV) and Tomato Spotted Wilt Virus (TSWV) have been the two major concerns. PLRV causes significant yield loss and can result in severe cooking quality problems in potatoes that are processed out of storage. TSWV has caused significant loss in susceptible varieties that are used for processing. TSWV can also cause quality problems in ware potatoes. Potato Virus Y (PVY), Potato Virus S (PVS) and Potato Virus X (PVX) are also known to be present in Australia.

Rejections of crops grown to produce Certified seed potatoes cause significant losses to the seed growers as well as shortages of quality seed tubers for the commercial growers. Low levels of disease in crops can act as a reservoir of disease, which then spreads to other commercial and certified seed crops. This project aims to improve the consistency of Certified seed quality by conducting an extensive survey that will benchmark the virus levels in potato seed plots that the Certified generation is grown from. Similar surveys in Tasmania and Western Australia have demonstrated the benefit of such survey work.

ELISA testing of potato tissue is routinely used to identify plants that are virus infected. The survey aimed to collect 500 leaves from the seed grower's property. The 500 leaves were collected from plots that were to be used to grow next year's certified seed potatoes. The samples were tested in groups of 20 leaves for the presence of PLRV, TSWV, PVY, PVS and PVX. Based on the sampling strategy an estimate of virus infection levels at each property was possible with a 95% confidence level. A total of 1547 samples (more than 30,000 leaves) were tested for the five viruses and the key findings were:

- No PVX was detected in any sample
- PVY was found in six of the samples
- PLRV was found in 9 samples
- TSWV was found in 23 samples and
- PVS was found in 219 samples

The non- detection of PVX was an excellent result and indicated the clean health status of the potato seed plots tested as this virus is readily transmitted by touch, including farm machinery and seed cutters.

The low levels of PLRV and PVY were to be expected based on "virus problems" in recent seasons. Future surveys will determine whether these viruses are an on-going problem or isolated problems due to aphid flights or spread from infected commercial crops.

TSWV is more difficult to control as there is no effective chemical control of the thrips, which spread this disease. Crops can be sprayed one day only to have thrips present on the crop and transmitting TSWV to healthy plants on the next day. Fortunately some varieties show more resistance to TSWV than others. Avoiding planting during known periods of high thrips activity is one control option as is growing seed potatoes in districts that have a known low level of thrips activity.

PVS was found to be wide spread across the districts with one district having a higher infection rate. Varying levels of yield loss due to this virus has been reported in the literature. PVS does not usually show visual symptoms and causes no observable yield loss unless



combined with other viruses. The higher levels of PVS have also been measured in another seed scheme.

This project has been most worthwhile and the following recommendations have been made:

- Repeat the project in 2006/2007 crops to confirm the results and focus growers on improved management practices
- Infected lines of seed have been identified and actions taken to prevent the transfer of virus into new season seed crops.
- Growers have been advised to review their management of early generation seed plots by focusing on hygiene practises, isolation from other crops and only using clean machinery and clothing when working in seed potato plots.

### **Introduction:**

While ViCSPA has a policy of compulsory leaf testing of certified seed potato crops for some viruses in higher risk situations there has been no planned testing of the plots to be used to produce the following years certified seed potatoes. Over the last few years both the Tasmanian and Western Australian Certified seed schemes have successfully conducted surveys to identify problem lots of seed and target improvements in management practices.

The ViCSPA virus survey project is along similar lines to that successfully carried out by WA and Tasmania. The project involved ViCSPA Certification Officers collecting up to 500 leaves at random from every seed grower's plots. The project sampled the plots that are to be planted to grow Certified seed in the following year.

In some cases this was Generation 4 (G4) plots while in others it was G2 or G3. The leaves were collected at the final field inspection. The leaves were stored in labelled bags and express posted to the Department of Primary Industries laboratory at Knoxfield for diagnostic assessment using the ELISA method. Each sample was tested for PLRV, TSWV, PVX, PVY and PVS. The results were faxed to the grower and ViCSPA. The results were used to identify seed lots with virus infections that should not be further multiplied for Certified Seed.

### **Materials & Methods**

1. Leaf samples were taken from seed plots in the year prior to certification. For example if a crop of Coliban is normally grown for certified seed at generation (G5) then the leaf sample was taken from the G4 Coliban plot
2. The aim was to collect 500 leaves from each grower's plots. If there were 10 plots then 50 leaves will be collected from each plot. 500 leaves were collected from areas up to 10 hectares
3. If the area of plots was greater than 10 ha an additional sample was collected
4. If the plots were in more than one paddock – a sample was collected from each area / paddock. A record was kept of where each sample was collected. This assisted in relating positive results back to areas of the paddock.
5. The samples were collected during the last field inspection of the plots. Growers were advised to consider top removal to prevent virus infection after their negative test results have been received.
6. The samples were submitted for testing using the ViCSPA numbered sample submission record sheets. The sample number in the top right hand corner of the record sheet was put on each bag.
7. The Department of Primary Industries Crop Health Services laboratory provided the diagnostic testing.
8. Grower assistance with the sampling was appreciated. The project was a major task for the Certification Officers with samples collected at the busiest time of the season.

9. The results were forwarded to growers and ViCSPA and remained confidential. Grower results will be included in an overall summary of the testing results.

The future role of such testing will be reviewed after the results of this year's project are analysed.



**Potato Leaf Roll Virus is a major cause of yield and tuber quality problems around the world. If PLRV is left to spread in a crop there is a reduced yield and reduced tuber size. PLRV can cause tuber discolouration in processing varieties after storage.**

## RESULTS:

1549 samples were tested.

Plant Virus	PLRV	TSWV	PVS	PVY	PVX
No. Positive samples	9	23	219	6	0
% infected	0.58%	1.49%	14.16%	0.39%	0.00%

While all districts recorded some reinfection with PVS one later production area had a higher percentage of PVS. Samples from 6 growers were lost in the post.

No PVX was detected.

The detections of PLRV and TSWV were at a low level. These detections are mostly a carryover from infections in previous seasons. The risk of PLRV infections can be reduced by timing planting to avoid aphid flights; aphid monitoring and top removal and chemical controls to avoid spread in the plots.

TSWV is more difficult to control as chemical treatment of the growing crop cannot stop the spread of the thrips. Time of planting and the district history of TSWV are also important. Most varieties do not have a high carryover of this disease to the daughter tubers.

PVY was also at a very low level. PVY is readily spread by many aphid species and cannot be readily controlled. Clean seed, good hygiene, suitable districts and top removal are tools to minimise its spread. Atlantic, the ViCSPA scheme's most popular variety is very susceptible to PVY.

The PVS levels are significant but not as high as previous surveys (J Moran, DPI Pers. Comm.). Seed growers with infected G3 or G4 plots will be advised to focus on isolation and hygiene issues to lower the risk of re-infection of early generation seed stocks as they are

multiplied up from minitubers. PVS is apparently easily transmitted from infected stocks to early generation plots. Growers will need to grow the G1 in isolation from existing stocks and continue to keep it isolated from the old stocks as it is multiplied in the field.

## Benefits:

- ❑ Approximately 450 seed potato plots were leaf sampled by ViCSPA Certification Officers.
- ❑ More than 30,000 leaves were collected in-groups of 20 and sent to the testing laboratory for ELISA testing for five viruses.
- ❑ Growers with infected seed plots were able to replace the infected seed to ensure healthy certified seed potatoes next season
- ❑ Crop rejections due to virus diseases carried over in seed plots will be minimised.
- ❑ With less virus present the overall health of Certified seed will improve
- ❑ Seed growers will benefit from reduced crop rejections and a more reliable income
- ❑ Seed buyers will financially benefit from a more consistent supply of quality seed



**Virus diseases can severely effect plant growth and subsequent yield and quality of tubers. An Atlantic plant with Tomato Spotted Wilt Virus is shown**

The virus survey of the plots will also

- ❑ Aid the development of future industry funded sampling protocols
- ❑ Assist with the education of growers in management methods to minimise re-infection of their plots with virus by personal visits, newsletters and district meetings.
- ❑ Improved regularity of supply of quality certified seed potatoes.
- ❑ Reduce field rejections caused by viruses and improved health of certified seed potatoes

Indications of the longer-term benefits of the project are:

1. A 70% reduction in crop rejections caused by viruses over a two-year period. Every one hectare of seed plot that is identified and not grown on represents a potential 180 tonne of certified seed potatoes worth \$90,000 that would have been rejected for seed use.
2. An increase in the value of certified seed potatoes produced by ViCSPA growers of \$1,000,000 in the second year
3. Plots that are infected with serious virus diseases will be identified and not grown on in the certified seed potato scheme
4. The seed potato industry will identify and accept the benefits that are derived from plot sampling leading to a self funded on-going program of plot testing.
5. The buyers will have more confidence when purchasing certified seed potatoes.

## **RECOMMENDATIONS**

The survey results demonstrate that the overall health of the seed plots is with a few exceptions very good. However there is a need to improve management practises to minimise the risk of reinfection with all virus diseases. Growers with PVS will need to focus on improved isolation for future early generation seed plots. These practices may also benefit control of other virus diseases if conditions were favourable for their multiplication.

As the scheme is based on visual inspection of crops and PVS does not show visual symptoms in crops and it is not included in the Certification standard. Growers with PVS infected plots will be advised on methods to minimise future re-infection of their seed stocks.

ViCSPA will use the survey results to develop future policies for virus monitoring of growers stocks. It is likely that the seed industry will be asked to finance the future testing on a similar basis for the next few years.

A significant advantage of the pathogen tested seed schemes is that each year there is a new lot of G0 produce (mostly minitubers) entering the scheme as the older certified seed leaves the scheme. Hence there is an annual replacement of stocks.

## **COMMUNICATIONS/EXTENSION ACTIVITIES**

- ❑ Discussion of the results and future actions at district seed grower meetings
- ❑ Discussion of the results with individual growers as required
- ❑ ViCSPA Annual Report to members. Written report and PowerPoint photos to members at the ViCSPA Annual General Meeting.
- ❑ An article will be prepared for the next Eyes on Potatoes or Potato Australia

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