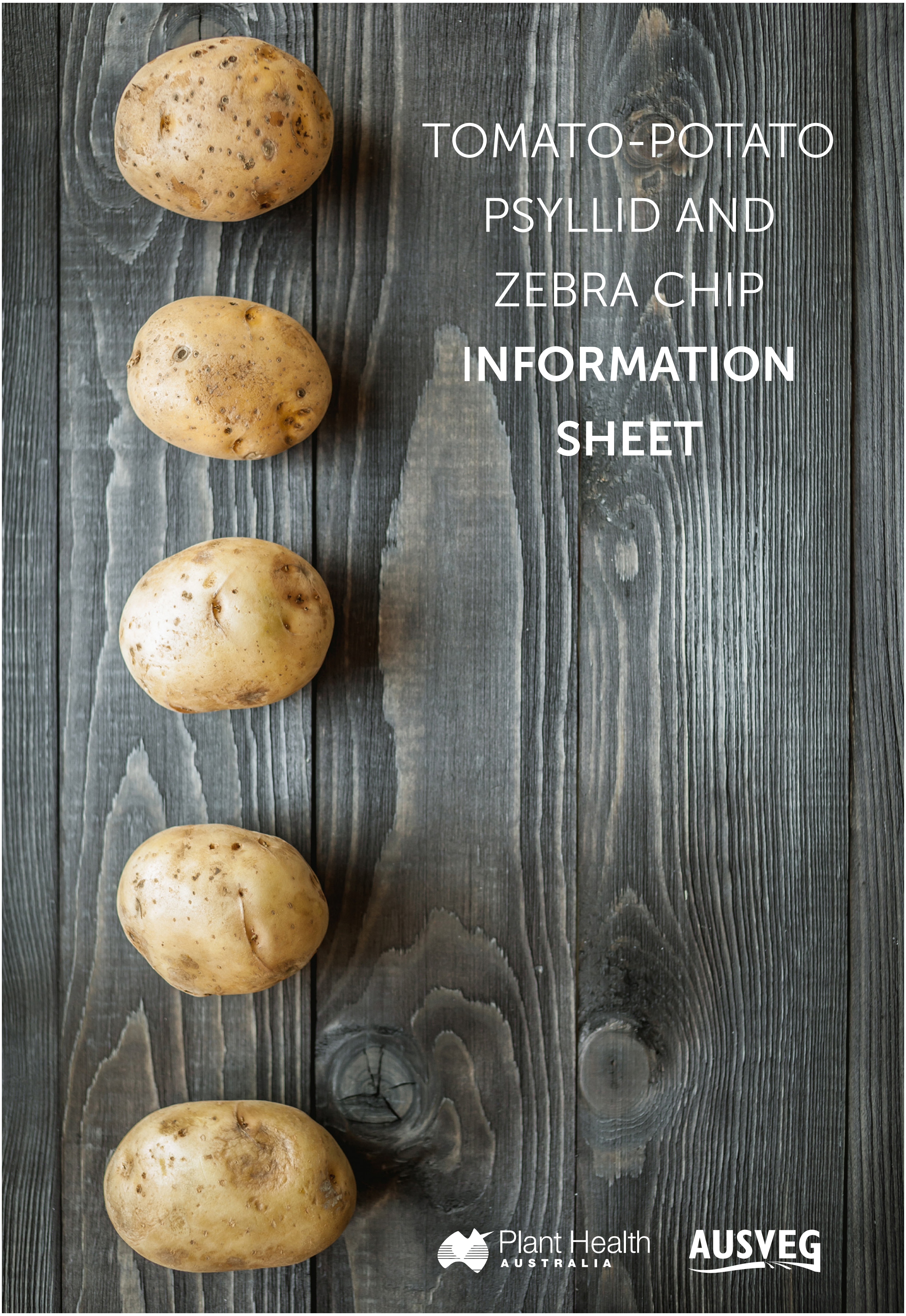
TOMATO-POTATO PSYLLID AND ZEBRA CHIP **INFORMATION SHEET**



Plant Health AUSTRALIA

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TOMATO-POTATO PSYLLID AND ZEBRA CHIP
INFORMATION SHEET


Adult TPP


TPP Nymphs

Tomato-Potato Psyllid

The Tomato-potato psyllid (TPP) (*Bactericera cockerelli*) is an insect from the United States that was spread to New Zealand in 2005-2006. It was not a major pest in the United States until 1999 when it began to spread from Mexico into California and Texas. It is believed that is was because of the emergence of a new, more invasive biotype of the psyllid. It is this type that was introduced to New Zealand, most probably on smuggled chillies from California.

The TPP is a winged insect that is black with a white stripe on its back and is about twice the size of an aphid. They primarily feed on potatoes, tomatoes and capsicums, but can live off, or at least shelter on, a large number of other plants (approximately 20 plant families). Other hosts that are preferred by the psyllid can include additional solanaceous crops (eggplants and tamarillos), sweetpotato and weeds, such as nightshade and boxthorn. A clear indicator of the psyllid's presence on a crop is the crystals of honeydew that the young (nymphs) produce. These are a waste product that looks like caster sugar and are found on the leaves of an infested plant. The nymphs are small, oval and green-yellow in colour and do not move very much. The adults are likely to jump away off the plant if disturbed and, as such, are more difficult to see.


Psyllid sugars


Zebra chip on leaves


Zebra chip in tubers

Zebra Chip

The TPP can carry in its gut a bacteria called *Candidatus Liberibacter solanacearum*, which can cause Zebra chip (ZC) in potatoes. Along with psyllid feeding damage, ZC is a major problem for potato growers. If the psyllid feeds on a plant infected with the bacterial disease, it will carry it to the next plant it feeds on. It only takes 1-2 hours of feeding on sap for the psyllid to infect the new plant. Zebra chip disease results in reduced crop yield and crop health, stem death, chlorosis of leaf tissue and misshapen tubers. Foliage symptoms in potato plants include stunting, chlorosis and swollen nodes, causing a zig-zag appearance of the upper growth, a greater number of auxiliary buds and leaf scorching leading to early dieback.

Fresh, process and seed potatoes with the ZC bacteria are affected differently. Symptoms are less severe for fresh potato, but there is a reduction in yield and the bacteria is perceived to affect the taste and cut appearance of the potato. For process crops, the bacteria lowers the "... specific gravity that increases the water content of tubers, thus rendering them more expensive to process as French fries."[1] The infection also causes a brown discoloration in the potato, and when it is fried, this is more noticeable. This results in rejection of the crop, as they cannot be used for chips because of the 'burnt' appearance and a perceived effect on taste.

In New Zealand an average of 1.5-2% ZC will result in rejection by the factory of the entire crop. A similar rate of rejection exists for seed growers, which has meant that they are no longer grown in the North Island of New Zealand and there is increasing pressure on the remaining seed industry in the South Island. There are also New Zealand Seed Potato Certification Authority requirements for rogues to be recorded and removed in order for the number of ZC infected seed potatoes to be reduced.

The effects of ZC in North America production have been drastic. In one case, the arrival of ZC resulted in the destruction of "... the seed potato production industry in the central plateau of Mexico."[2]

ZC has also resulted in many New Zealand tamarillo growers exiting the industry because once a perennial crop is infected with the disease, it can result in over 50% tree loss.

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Psyllid Yellows

Psyllid yellows

Psyllid yellows are another consequence of the arrival of the TPP. They can show up without the symptoms of ZC being obvious from psyllid feeding. In potatoes, some of the symptoms are 'yellowing and upward rolling or cupping of leaves' and defective tubers. Psyllid yellows are also a major issue for tomatoes and capsicums, resulting in less fruit, reductions in fruit size and changes in the texture of the skin.

Spread in New Zealand

It is believed that the TPP arrived in New Zealand at some point in 2005. A confirmed identification was done in May 2006 in Auckland, but by that point it was being found in many tomato glasshouses in the Auckland area. One month after its discovery it was found in potatoes in South Auckland and in a capsicum glasshouse in Taupo, 240 kilometres away from Auckland. It was decided that its eradication would not be possible. These early discoveries did not show symptoms of psyllid yellows on crop leaves, only the distinctive sugars from feeding.

As the psyllid spread, its effect grew. This began with the increased use of broad spectrum insecticides to try and combat its growth, resulting in the destruction of a large number of Integrated Pest Management (IPM) systems that had been developed in various glasshouse operations. The next season saw severe yield losses in outdoor tomato crops on the eastern coast of the North Island. Symptoms of the bacteria in glasshouse tomatoes were observed in January 2008 in Auckland and, later in the year, the first visual symptoms of ZC in processing potatoes were recorded in Pukekohe, just south of Auckland. It was concluded that the ZC causing bacteria had most likely arrived with the initial psyllid outbreak in New Zealand; however, the delay in crop symptoms after the arrival of the psyllid may mean that it arrived during a later incursion.

Although the TPP quickly spread to the South Island, symptoms of ZC were only evident from the 2013-2014 growing season. Currently, the symptoms of ZC are visible in raw tubers in South Island crops. It was hoped that the cold weather conditions of the South Island would kill TPP in the winter, but research shows that they are able to tolerate sub zero temperatures. Recent reports state that the numbers of TPP found in crops in the South Island have continued to grow, year on year, to be similar to, and now exceeding, the numbers found in the North Island.[3]

Initial Response

When reflecting on the way New Zealand handled the arrival of the TPP, a number of issues emerge. There had not been any risk assessments done on its potential to arrive in the country from America and there was an underestimation of the economic damage that would result upon arrival. In New Zealand, the affected vegetable industries were fragmented, and this "…. compounded the challenge of mounting a cohesive and coordinated response."[4] As the threat became better understood, a degree of cooperation emerged. Processing companies were willing to share the data that they had gained from their in-house trials at conferences and grower meetings, as well as with competitor processors.

The need for funding for emergency research was recognised and put together, sometimes through grower donations. There was great pressure on scientists to provide timely and clear results and there was also some difficulty in extending the knowledge gained back to growers. These issues were partially resolved by having a Potatoes NZ Psyllid Co-ordinator role created that would direct the strategic response to the TPP/ZC spread.

Costs

In 2006, the initial outbreak in three Auckland glasshouses cost the growers NZ $1 million, with the cost to industry then growing exponentially from there. The major factors were the imposition of an emergency cessation of trade for tomato and capsicum export in 2008. This was later removed, but methyl bromide treatment is mandatory and this "... detrimentally affects product quality by increasing rots and browning of green stems."[5] Fresh potatoes from New Zealand are unable to be exported to Australia. Yield loss from feeding and disease are another cause of financial harm, in addition to the large cost of additional sprays. Seed potato crops are sprayed with an insecticide every seven days and process potato crops will usually have 10-15 applications of insecticide per season. The cumulative cost to the potato industry up until 2011 was estimated to be NZ $120 million. Current estimates of the costs of the Tomato-potato psyllid to industry vary from $28-62 million per annum.

Potential Spread to Australia

Australia would provide a very supportive environment for TPP if it were to arrive. "The widespread distribution of host plants of *B. cockerelli* (TPP) and '*Ca. L. solanacearum*' (the bacterial cause of ZC) in many parts of Australia would assist their spread were they to become established..."[6] Although we think about commercial crops as the primary host for TPP, because of the value they have to growers, there are many non-crop host plants that also have the potential to be a host for the ZC bacteria. TPP and ZC could feed and grow in these plants all year round and move into a commercial crop nearby when they are emerging. An additional difficulty is that non-crop hosts with the bacteria mostly do not show signs of infection but would serve as a reservoir for the disease. Some weeds that serve as a host include nightshade, boxthorn, Jerusalem cherry, field bindweed and thorn apple.[7]

The psyllid could arrive through accidental or intentional introduction or by natural dispersal. Psyllid eggs are tiny and are very difficult to see with the naked eye. Leaves with eggs on them could be brought in. Similar means of introduction to what happened in New Zealand may also apply to Australia. Individuals may smuggle chilli peppers into the country "... as enthusiasts may be fixated on particular fruit characteristics"[8] Ineffective fumigation is another possibility. In terms of natural dispersal, there is a precedent with Current lettuce aphids being blown from the South Island over to Tasmania in 2004 during a cyclone. They survived the flight and became a major pest in Australian lettuce crops.

Chemical and Culture Management


Brown lacewing

A large part of the cost in dealing with TPP has been in the use of chemicals to control their numbers and the spread of the ZC disease. It has been argued that the currently used spray regimes in New Zealand are unsustainable, both because of costs and because of the potential for the development of resistance to certain spray types. There is some evidence that the latter is already happening. Some ways to limit these issues with insecticides are to conduct research into spray effectiveness, spray persistence, threshold indicators for application and the effectiveness of selective sprays. To take each of these in order, based on NZ research:

- Initial chemical trialling found that many chemicals had a low mortality rate against the psyllid (mostly well below 40%) or took a couple of weeks to kill, with the latter being a problem because of the potential to spread ZC before death. Abamectin (MOA 6) and oil, and bifenthrin (3A) were the most effective against TPP with high mortality rate over 3 days.[9]


Common spotted ladybird

- Abamectin (6), cyantraniliprole (28), spinetoram (5) and sulfoxaflor (4C) have a greater persistence of up to 14 days.[10]

- Thresholds to begin application of chemicals have a level of promise. These can either be determined by using yellow sticky traps to monitor for when there is an average of three TPP in traps for a given site, or carrying out degree-day calculations to arrive at a spray commencement date. Both can limit the number of applications without adverse yield effects.

- There are a number of insect predators that attack TPP, including lacewing, hoverfly and ladybirds, but these are killed by full spectrum insecticides. Abamectin (6), cyantraniliprole (28), and spirotetramat (23) do not do much harm to beneficial predators, while spinetoram (5) will kill some species.[11]


Green lacewing

Utilising the research that has been conducted on the effective and efficient use of insecticides, complementary applicants and the appropriate timing of sprays will help Australian growers to respond more effectively to any potential future incursion of the psyllid. Hopefully, it will not come to that, but learning from the harsh experiences gained by New Zealand growers and researchers will put Australia in a much better position to successfully handle its arrival.

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Images

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