Current season potato crops

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Abstract

The potato/tomato psyllid (PTP) is a potentially significant new pest for the New Zealand potato industry. It causes significant yield losses and crop damage in North America, particularly in the southern states of the USA. Tuber symptoms include zebra stripe (a condition similar to internal fleck, which in turn causes distinct dark stripes in crisps), misshapen tubers with reduced size, premature sprouting with weak hair sprouts, shorter stolons, and rough skin. Numbers of small tubers are often increased. Tops are generally smaller with yellowing or purpling and can develop a blackened scorched appearance before premature collapse.

New Zealand has ideal temperate conditions for PTP. It has caused considerable losses to the potato breeding programme at Pukekohe in 2008, with lower trial yields and quality and greatly reduced selection frequency from the seedling populations. In 2009 with a much more intensive spray programme yields have not been affected but significant quality problems with zebra stripe symptoms in both raw and fried tubers has occurred. It has the potential to be a serious problem for the wider potato industry.

Growers may have been protected from serious psyllid damage in 2008 by regular applications of insecticide to control tuber moth but with increased and more widespread PTP populations widespread quality problems are likely throughout New Zealand. The problems associated with PTP are likely to be much greater than potato cyst nematode which caused huge disruption to the New Zealand potato industry after its discovery in New Zealand in 1972.

Introduction

The potato/tomato psyllid (*Bactericera cockerelli*) was first identified in glasshouses in New Zealand in the Auckland region in April 2006 and was identified in the field at the Pukekohe Research Centre in February 2007 (Peter Workman, pers. comm.).

The psyllid was one of the major topics of discussion at the Potato Association of America (PAA) meeting that I attended in Idaho Falls in August 2007.

This report outlines important findings from the 2007/08 and early season trials 2008/9 potato breeding trials at Pukekohe, which were severely affected by symptoms attributable to PTP infestation.

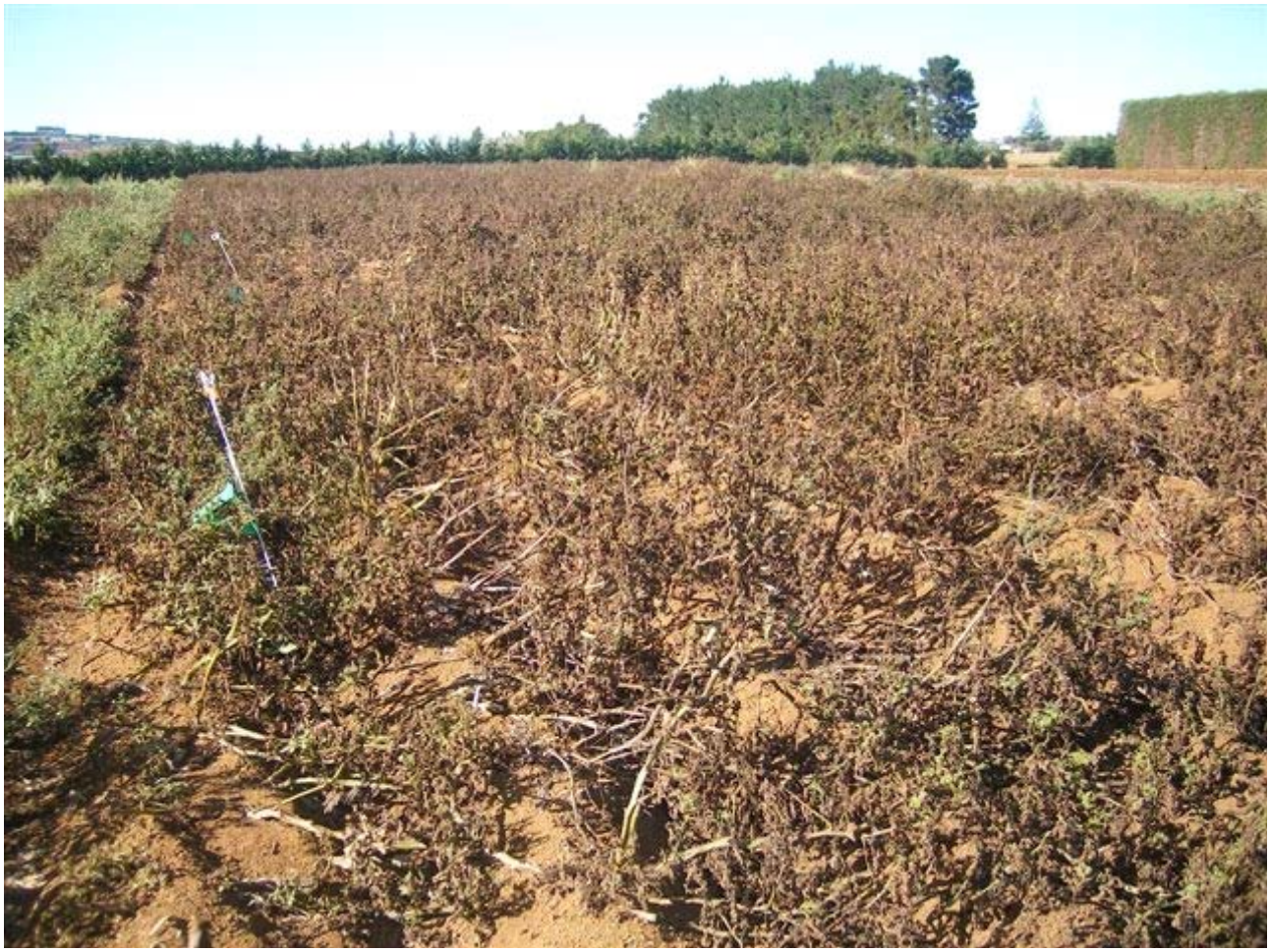
Effect of psyllids on Pukekohe potato breeding programme

Seedlings & Early generation trials

At Pukekohe between 10,000 and 18,000 seedlings are grown from true seed each year, transplanted into the field in early December and harvested individually in late March. Typically 10-15% of seedlings are selected each year. In the 2006/07 year, changes were made in the herbicide regime within the seedling block and seedling performance was very poor with only 4.8% of seedlings being selected. The poor performance was initially put down to herbicide damage. In 2007/08 we reverted to previous herbicide practices and early establishment and growth of the seedlings was good. However, they generally failed to continue growing well and at harvest, even after relaxed selection standards, only 2.8% were selected. The only possible reason we can see for this poor performance is psyllid damage (see below), and in retrospect the poor performance the previous year was probably at least partly due to the effect of the psyllid.

In 2008/9 an intensive insecticide programme was applied. Yields were good, but a significant number of seedlings, often with good yields were rejected because of zebra stripe symptoms visible in the field. Despite this 12% were selected, within the normal range.

The first clonal (C1) four tuber plots grown from the 2007/8 seedlings grew remarkably well considering the very poor seed tubers that were planted. There was a low transmission (about 5%) of secondary liberibacter symptoms from the seedling seed tubers.



2007/08 season main crop early April. Tops blackened suddenly.

Regional potato breeding trials

At Pukekohe there are three major regional breeding trials, the early trials harvested immediately before Christmas, the early-main trials normally harvested in February-March, and the main-crop trials harvested in May-June.

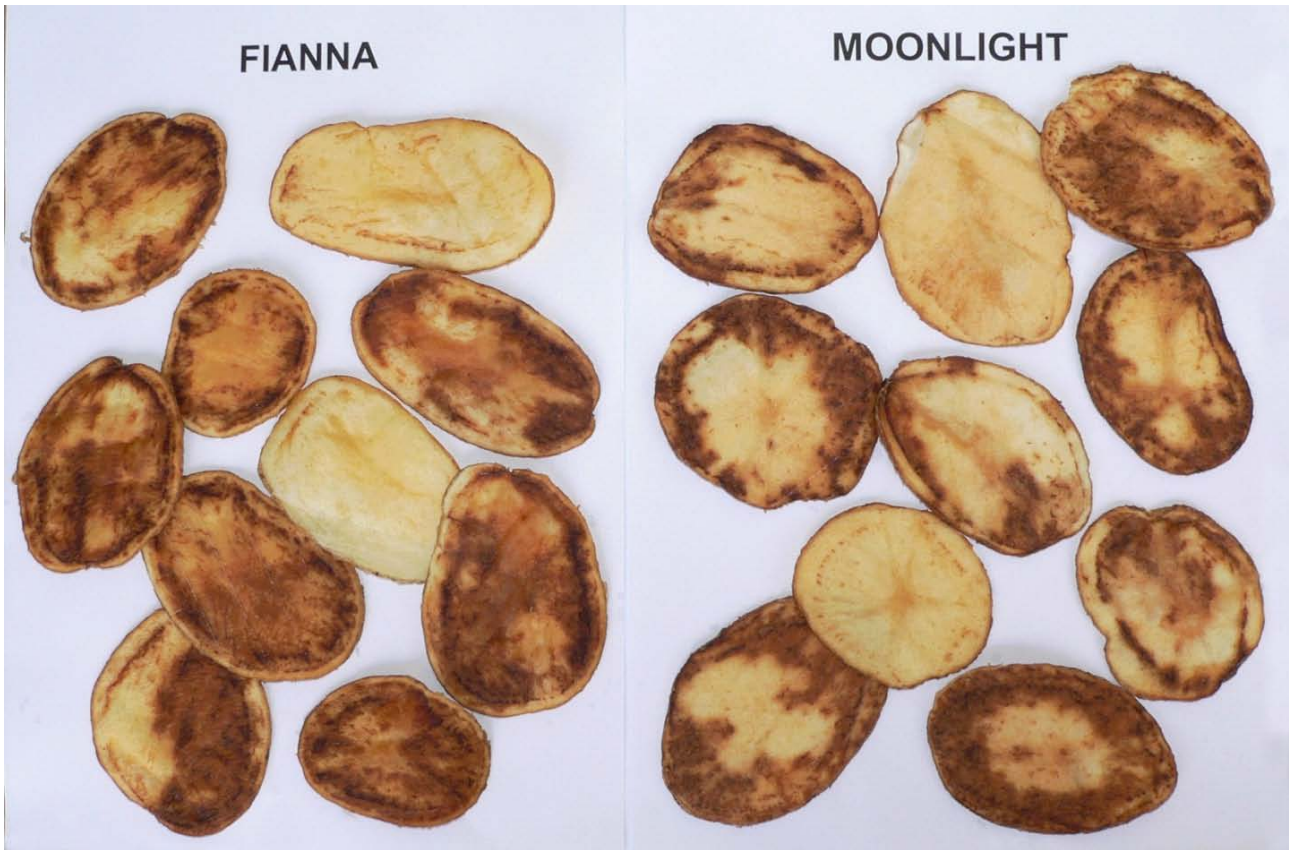
In the 2007/08 season, early trial performance was fine with yields and overall quality of the potatoes being good and well within the expected range. The entomologists were detecting low psyllid populations in the field from late December. Yields of the early-main crop harvested at the end of February were around half to two-thirds of expected levels with slightly lower dry matter levels than expected, but apart from slightly smaller tuber size, quality was as expected. A delayed planting due to wet weather may have contributed in part to the lower yield of this trial, but psyllid infestation was also likely to have been a major contributor.

Extremely high psyllid nymph infestation on leaves.

However, in the main-crop trials harvested in late May, tuber yields and dry matter levels were both extremely poor, both being substantially lower than in the early-main trial for every line common to both trials. Nadine was the only line with a dry matter level approaching normally accepted standards, having a dry matter level in the top 20% whereas normally it would be expected to be near the lowest dry matter. Tuber quality was generally extremely poor with small size, a heel or stolon attachment common, irregular shape, excessive sprouting and in some tubers indications of symptoms of zebra stripe. Tuber numbers were high, with many small marbles produced by many lines. Fry colour (Agtron score) was also darker in all lines, and considerably darker in some, suggesting much higher reducing sugar levels. All of these symptoms (except for the lower dry matter) are recorded as typical symptoms of psyllid infestation in the USA. Vigour was slightly lower than expected when the trials were scored for maturity in mid March, and the tops of all lines blackened off in early April about the time when the shorter maturing lines would have died off. Yield and quality data for Pukekohe trials in 2007 and 2008 are presented in Table 1.

MAF Biosecurity took samples from the trials that had symptoms of zebra stripe and confirmed the isolation of the bacterium Candidatus liberibacter, the first time this had been recognised in potatoes (Liefting et al., 2008).

We routinely used much lower levels of insecticide than most growers. We are less concerned with a low level of tuber moth damage as we do not market our potatoes and are looking for an indication of resistance. The only insecticide applied was two applications of Karate, a synthetic



Variation in ZC expression in tubers.

pyrethroid. I was taken by surprise at the serious effect that psyllids had on the 2007/8 trials and decided to use a much more intensive insecticide programme aimed directly at the psyllid in 2008/9.

In the 2008/9 season early trials harvested in December again had satisfactory yield and quality. Regular weekly insecticide applications commenced in early December when the number of adult PTP caught in sticky traps exceeded one PTP/trap/week. Despite this numbers of adults caught per trap reached 100/week but the numbers of nymphs on the plants remained low. The first four weeks insecticide applications were of imidacloprid which work by Walker & Berry (2008) suggests may have low efficacy on PTM, at least on nymphs.

The early main trials harvested in late February had generally satisfactory yields and often high dry matter levels but there were differences between the levels of zebra stripe in raw tubers from moderately severe to complete absence. Fry tests showed a level of zebra chip generally higher than expected from the symptoms in the raw tuber.

	Total yield t/ha		Marketable yield t/ha		Average dry matter %		Tuber size 1 (tiny) – 9 (huge)		General impression 1 (v bad) – 9 (v good)		Fry colour 40 acceptable	
Cultivar	2007	**2008**	2007	**2008**	2007	**2008**	2007	**2008**	2007	**2008**	2007	**2008**
Moonlight	52.1	**20.8**	49.1	**16.9**	16.7	**11.6**	6	**4**	6	**3**	42	**40**
Rua	42.9	**17.0**	38.5	**10.4**	17.6	**12.8**	5	**3**	5	**2**	46	**32**
Agria	50.7	**30.0**	42.8	**26.2**	18.3	**13.6**	5	**4**	6	**4**	48	**40**
Allura	58.5	**20.7**	51.2	**10.9**	17.3	**10.7**	5	**3**	6	**2**	40	**32**
Bondi	57.2	**26.9**	52.5	**21.6**	18.3	**12.8**	6	**4**	8	**4**	40	**34**
Fianna	37.2	**27.4**	30.2	**18.7**	20.0	**16.0**	5	**3**	5	**4**	48	**44**
Golden Miracle	52.2	**19.8**	44.4	**14.6**	18.8	**13.6**	4	**3**	5	**2**	50	**40**
I Hardy	59.2	**25.2**	47.0	**15.9**	13.5	**9.0**	5	**4**	3	**1**	30	**25**
Nadine	38.0	**24.4**	30.7	**17.4**	16.6	**14.5**	3	**3**	6	**4**	30	**28**
R Burbank	38.9	**26.5**	33.2	**21.4**	18.9	**14.5**	4	**3**	4	**3**	50	**38**
Crop20	43.9	**19.3**	40.6	**10.5**	18.1	**13.5**	5	**2**	6	**2**	42	**34**

Table 1: Liberibacter and psyllid effects on potato crops.

Conclusion

PTP and the associated liberibacter conditions have had a large detrimental effect on the Plant & Food Research potato breeding trials at Pukekohe since the first identification of the PTP on the Pukekohe Research Centre in February 2007.

They are major concern for the New Zealand potato industry. Within a year of my starting as a potato researcher in 1971 the discovery of potato cyst nematode caused major concern and disruption to the New Zealand potato industry for many years. Because of its ability to spread rapidly, cause drastic reductions in yield and massive quality problems even when yields are acceptable, I consider the PTP to be a far bigger crisis than PCN[5] ever was.

One of the consistent messages of the World Potato Congress was the potential increasing importance of the potato in adequately feeding the world as population levels head to a peak of nine billion people. Based on the potential devastation the PTP has been shown to cause, this hope could be severely compromised if it became more widely established throughout the world.

References

Liefting L W, Perez-Egusquiza Z C, Clover G R C, Anderson J A D 2008. A new 'Candidatus liberibacter' species in Solanum tuberosum in New Zealand. Plant Disease 92 (10): 1474

Walker, M, Berry N 2009. Insecticides have potential for tomato/potato psyllid control. Grower (April) 64 (3): 27-28.

www.panhandle.unl.edu/potato/html/potato psyllid.htm Potato Psyllid. Potato Education Guide.

5 Potato cyst nematode