Viruses on canola and Brassica juncea: Survey results in New South Wales and screening for resistance.

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Canola viruses reported in Australia

- *Beet western yellows virus* (BWYV) / *Turnip yellows virus* (TuYV)
  - Persistently transmitted. Green peach aphid most important vector.
  - Wide host range (> 150 species), including Brassicas and Leguminosa.
  - Early infection can cause significant yield loss
  - Frequently reported, but (**up to 2014**) generally low levels
- *Turnip mosaic virus* (TuMV)
  - Non-persistently transmitted. Transmitted by all aphids probing on canola
  - Very wide host range, particularly important in horticultural crops.
  - Severe losses on canola reported in Europe.
  - In Australia high levels reported in juncea, up to 2013 rarely in canola
- *Cauliflower mosaic virus* (CaMV)
  - Non-persistently transmitted
  - Limited host range
  - Only low levels reported

Turnip mosaic virus (TuMV)

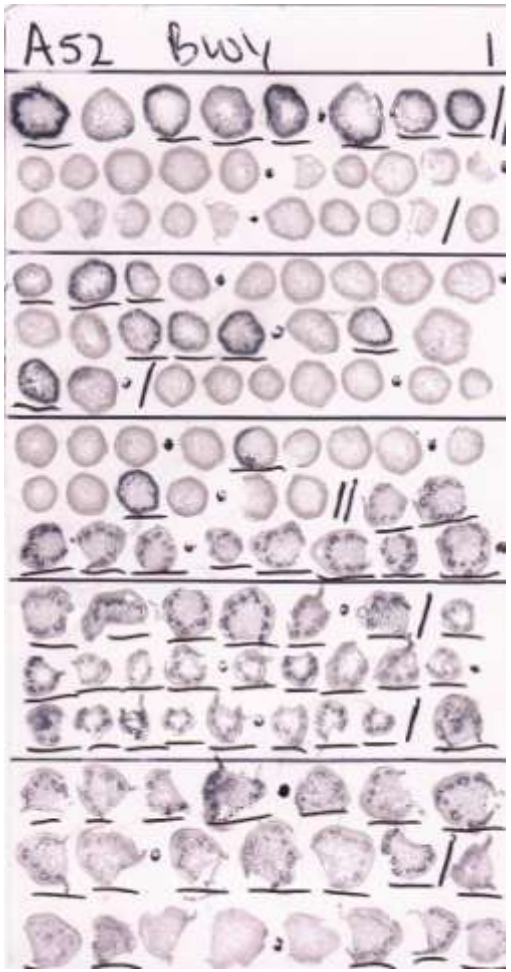
Clear mosaic symptoms, severe stunting after early infection.

Beet western yellows virus (BWYV, syn: *Turnip yellows virus*, TuYV)

Symptoms can be similar to nutrient disorders

Tissue blot immuno-assays (TBIA) combines relatively simple operation procedures and low costs with reliability.

Tissue-blot immuno assay of canola plants for *Beet western yellows virus*

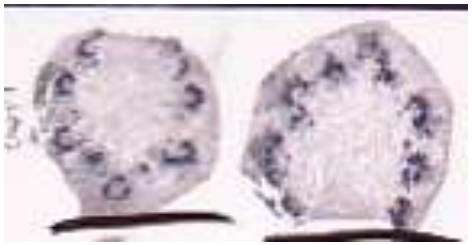


Flower stem blots

BWYV positive

BWYV negative

Leaf blots



BWYV positive

BWYV negative

Table 1. Survey for canola viruses in the New South Wales, 2013

Survey period Region[1]	Canola					cruciferous weeds[2]					
	Sites	BWYV		TuMV		Sites	BWYV		TuMV		CaMV	
		Ave	Range	Ave	Range		Ave	Range	Ave	Range	Ave	Range
July												
North	19	0.1	0 – 2	0.0		10	0.0		9.1	0 – 83	0.0	
Liverpool Plains	1	0.0		0.0								
South	5	2.2	0 – 9	0.0								
August – mid September												
Liverpool Plains	11	0.7	0 – 6	3.6	0 – 28	8	0.0		27	0 – 67	3.3	0 – 17
South	5	1.6	0 – 4	0.0		4	0.8	0 – 3	4.3	0 – 10	2.0	0 – 8
mid September – October												
North	3	40	23 – 55	0.7	0 – 2	1	0		96		0	
Liverpool Plains	3	21	2 – 38	44	0 – 100	2	4.0	0 – 8	44	31 – 55	11	0 – 22
South	15	63	6 – 100	0.0		8	17	0 – 50	33	3 – 100	5.8	0 – 22

[1] North; Moree, Narrabri, Gwydir shires. Liverpool Plains; Liverpool Plains and Gunnedah shires. South; Warrumbungle, Gilgandra, Wellington shires and further south.

[2] Mainly turnip weed (*Rapistrum rugosum*), some wild radish (*Raphanus raphanistrum*) and unidentified species.

Table 2. BWYV incidence in NSW canola samples submitted for virus testing, July – August 2014

NSW Region[1]	Number[2]	Number of samples / Infection class[3]						Average % Infection
		0%	>0 ≤10%	>10 ≤25%	>25 ≤50%	>50 <100%	100%	
South	86	3	6	4	15	35	23	68
Central	31	4	3	7	4	12	1	43
North	17	8	4	1	1	2	1	17

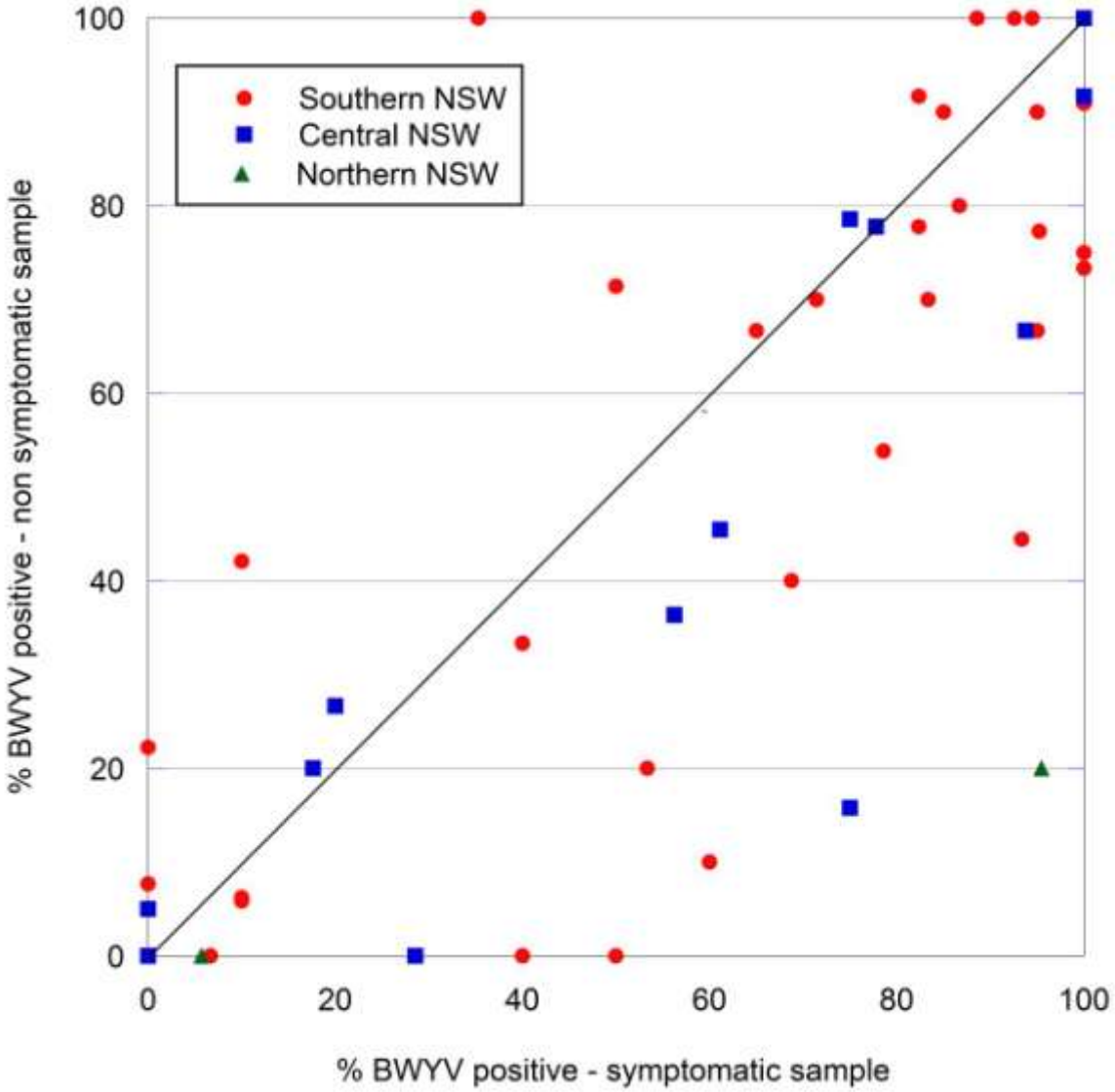
[1] South; sampling sites south of West Wyalong, North; sampling sites north of Dubbo

[2] Paired samples (symptomatic and non-symptomatic plants from the same paddock) were combined.

[3] Incidence based on Tissue blot immunoassay.

Over 4,000 plants tested

Comparison of paired (virus symptomatic v non-symptomatic) samples from 58 canola paddocks in three NSW Regions for BWYV incidence, 2014



High BWYV incidences in non-symptomatic ('healthy looking') canola plants

- Latent infections; symptoms will appear later?
- Later infections will not cause clear symptoms?
- Different BWYV strains?
- Other (non BWYV) viruses?
- Symptoms result of an interaction of BWYV with other factors?

Canola virus surveys New South Wales 2013 & 2014
Preliminary conclusions

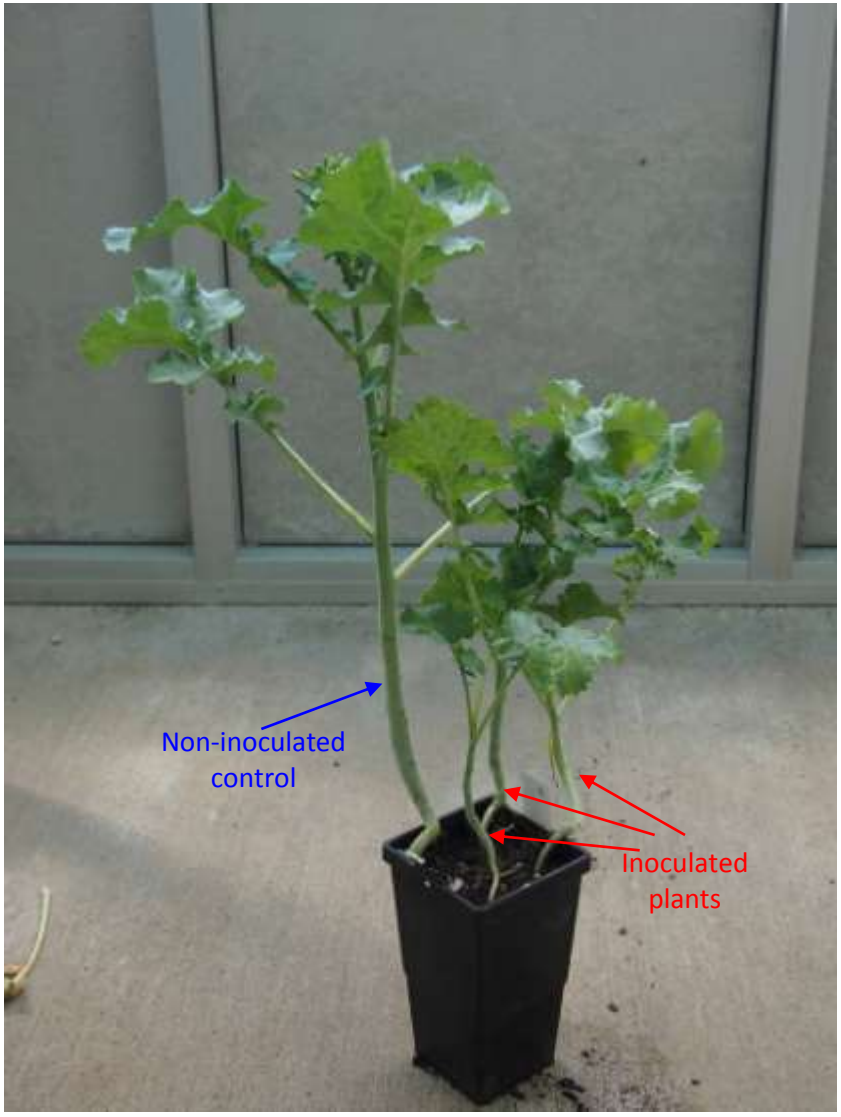
- Highest BWYV incidences in southern NSW, both in 2013 and 2014.
  - More aphid activity?
  - Specific alternative hosts?
  - More canola grown?
- Symptoms not a good indicator for BWYV presence
  - Industry needs fast access to diagnostic tests.
- Canola virulent TuMV strains present on Liverpool Plains and limited number of locations in central NSW.
  - Severe impact on plant growth
  - Insecticide seed treatments have limited effect.
  - Will spread to other canola growing regions

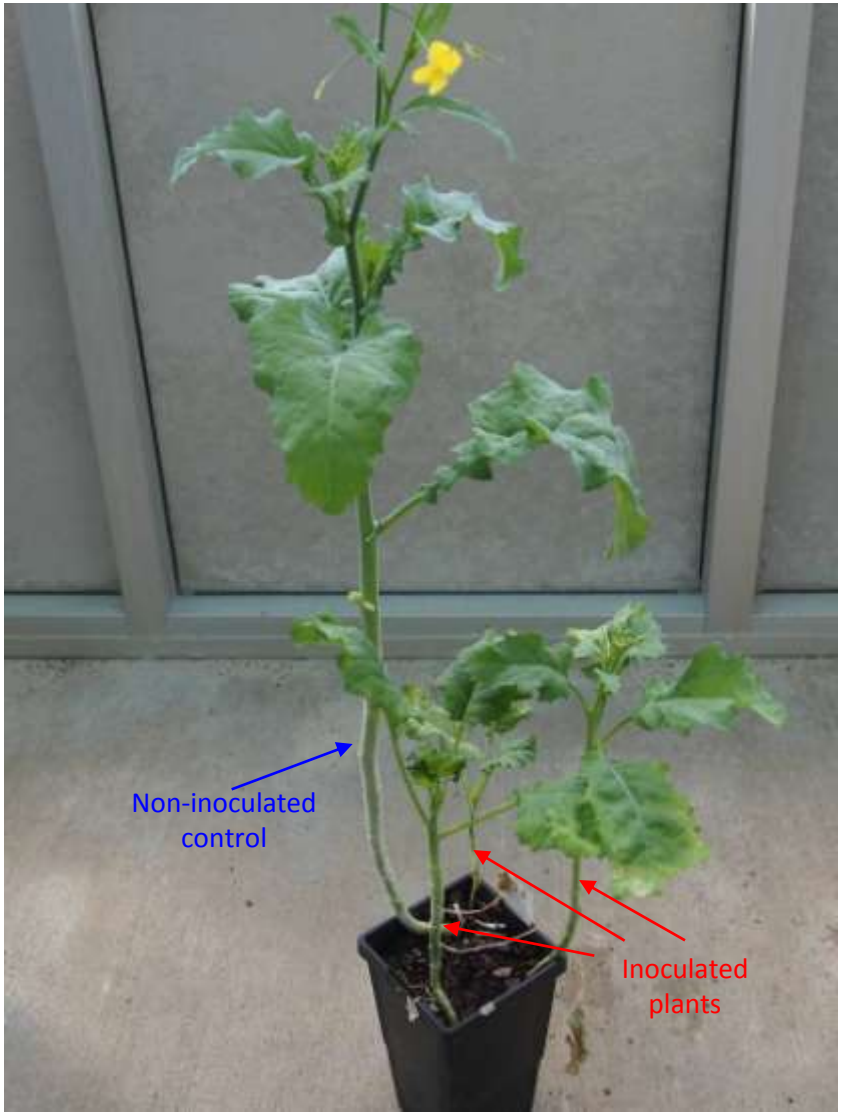
Screening canola for virus resistance 2013 and 2014 seasons

- BWYV resistance screening in field trials exposed to natural infection.
  - Low BWYV pressure in 2013, no differentiation among varieties tested.
  - In 2014 evaluation of NVT trials in two locations with moderately high BWYV did not show clear indication of differences in varietal resistance.

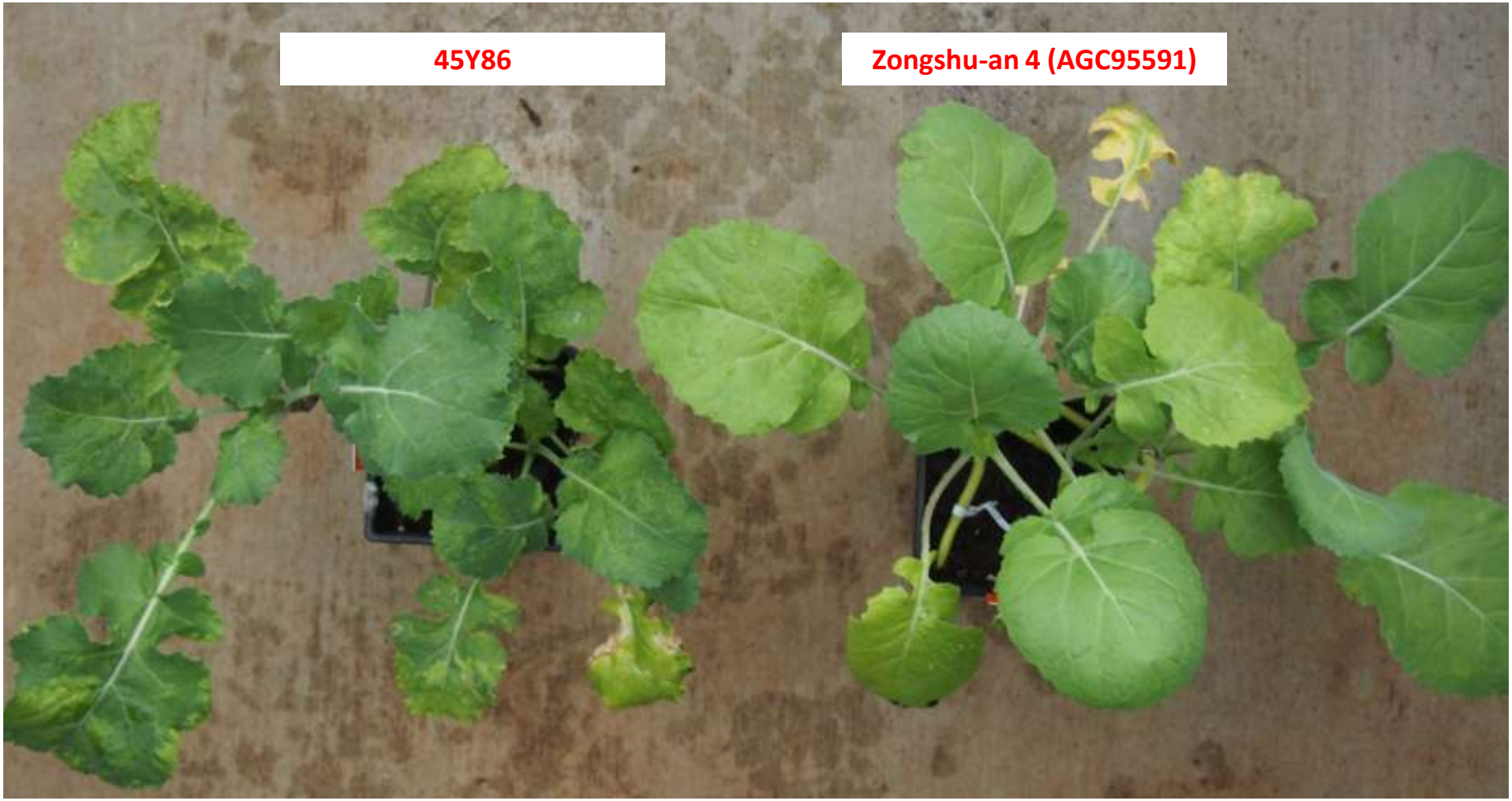
- TuMV resistance screening in inoculated field and greenhouse trials.
  - Trial results of 2013 and 2014 showed that all currently grown varieties are susceptible to the canola-virulent 'Liverpool Plains' strain.
  - Greenhouse screening of over 100 *B. napus* germplasm accessions with a wide range of origins, yielded few accessions with possible resistance. Results to be confirmed.

Greenhouse screening for TuMV resistance: Effect on plant growth of two canola varieties





Greenhouse screening for TuMV resistance: Resistance identified in Chinese germplasm accession (?)



GRDC funded collaborative pulse and oilseeds virus project
NSW DPI, DAFWA, DEPI Vic, DAFFQ/UQ, ICARDA
2015 – 2020
Canola Components

- Focus on identification and utilisation of resistance:
  - Screening for BWYV resistance in field trials (WA, NSW, confirmation at ICARDA).
  - Continuation of screening for TuMV resistance in field and greenhouse trials (NSW).
  - **Collaboration with NBGIP to utilise identified sources of resistance**.
- BWYV impact and management in canola
  - Evaluation of insecticide seed dressing (WA, NSW).
  - Effect of time of infection on yield (WA)
- BWYV strain differences
  - Molecular comparison of BWYV strains from canola v. pulse crops (QLD, Vic).
  - Vector transmission studies (Vic).

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