Getting the most out of your tomato crop.
Proven management practices and varieties for North Queensland growers.
Managing Tomato Yellow Leaf Curl Virus

Tomato Yellow Leaf Curl Virus (TYLCV) is a serious disease that has affected tomato production in most parts of the world. The virus has been known in Israel for over 40 years and in Australia (Queensland) since 2006. In Australia, there have been significant crop losses due to TYLCV and it is now considered the most serious disease affecting the future viability of the tomato industry.

Ecology of TYLCV

TYLCV is transmitted in a persistent manner by adult silver leaf whiteflies (Bemisia tabaci). It has a large host range with more than 30 species in over 12 plant families, including common weeds such as blackberry nightshade (Solanum nigrum), bindweed (Convolvulus arvensis) and thorn apple (Datura stramonium). Other hosts include cultivated plants such as capsicum (Capsicum annuum) and green beans (Phaseolus vulgaris) - however the tomato plant (Lycopersicon esclentum) is the preferred host.

TYLCV cannot survive outside a living host plant or its insect vector. The virus survives adverse conditions and intervals between crop cycles in alternative weed hosts, volunteer crop plants, abandoned crops or within in the insect vector.

It is not transmitted through seed or by mechanical transmission, eg. pruning.
Common symptoms of TYLCV

- Plants may exhibit stunted small leaves showing upward leaf cupping or curling and crumpling with strong yellowing at the edges and in between the veins.
- If plants are infected at an early stage they will not fruit and plant growth will be severely stunted.
- Later growth stage infections may result in stunting of growth laterals, abnormal erect or upright growth and a bushy appearance.
Silver Leaf Whitefly (SLWF), the only vector of TYLCV, has a very wide host range and is difficult to manage with insecticides. SLWF is a serious pest in many vegetables including cucurbits, capsicums, tomato, eggplant, brassicas, lettuce, sweet potato and beans.

Whiteflies are soft-bodied, yellow to clear (wingless juveniles) or white (winged adult) sap sucking insects. The insect has a high reproduction rate and a short generation time.

Temperatures of between 25°C and 30°C are ideal for SLWF development. Whitefly eggs are attached to the underside of the leaf surface, usually on younger leaves. Eggs hatch in 8 to 10 days. There are four immature or nymphal stages.

Crawlers or first instar nymphs crawl a short distance before settling to feed on plant tissue. Second and third instar nymphs are stationary and remain attached to the leaf surface where they feed until developing into the fourth and final nymphal stage. These fourth instar nymphs stop feeding, pupate and emerge from the pupal case as fully developed adults.

The silver leaf whitefly lifecycle takes 18 to 28 days in warm weather and 30 to 48 days in winter.

SLWF acquires TYLCV while feeding and sucking sap from the phloem tissue of virus-infected plants. An adult SLWF needs to feed on an infected plant for at least 15–30 minutes to acquire the virus.

After SLWF acquires TYLCV, there is a period of 6 to 24 hours before the insect can transmit the virus. This is called a latent period, after which adults are generally able to transmit TYLCV for life. Whiteflies are efficient vectors of TYLCV, transmitting the virus following a single 15 to 30 minute feeding period.

While the immature nymphal stages of the silver leaf whitefly can acquire TYLCV from infected plants, it is the adult that is the primary cause of disease spread.
Management options for Tomato Yellow Leaf Curl Virus

Successful management of TYLCV depends on the ability of growers to reduce the virus inoculum to levels that do not cause economic loss. Management options for SLWF must provide effective control while not impacting on its natural enemies and other tomato pests.

1. **Use of resistant varieties**

Under normal production conditions, the use of TYLCV resistant tomato cultivars, such as Seminis varieties Lava and Red Luck, may result in reduced losses.

Some resistant hybrids may exhibit symptoms under early or severe infection pressure and require additional cultural and chemical control measures to reduce whitefly populations and protect the plants from infection.

Chemical control may still be required to reduce other impacts of SLWF such as sooty mould.

2. **Production and use of virus-free transplants**

The production season should begin with the use of virus-free transplants. Young tomato plants are very attractive to whiteflies and are highly susceptible to TYLCV.

Therefore the use of a protective dose of neonicotinoid insecticide (Confidor®) either as a seedling drench or at transplanting may reduce the impact of whiteflies and lessen their ability to transmit TYLCV.

3. **Scouting and Insecticides**

The use of registered insecticides to control whiteflies is an important tool in reducing the spread of TYLCV. However, this should not be the sole basis of TYLCV control as whiteflies have the ability to quickly develop resistance to insecticides.

Repetitive and frequent use of insecticides to control whiteflies may result in outbreaks of secondary pests such as two spotted mite and leaf miner.

A number of insecticides are effective against SLWF but it is important to understand the mode of action for each chemical so that it can be applied correctly. In general, the most important aspects of spraying are as follows:

- Check crops for whitefly regularly using a scouting method. Walking through a crop and inspecting it for any unusual outbreaks is very important.
- Don’t continue to spray an insecticide if it is obviously not working as this leads to resistance.
- Rotation of chemical mode of action groups is very important to prevent resistance from developing.
Scouting today involves initiating monitoring as early as possible, determining the presence and or the status of the target organism as quickly as possible. Encountering adult stage insects at first contact in a crop situation radically shifts the type of crop management decisions that are available to the grower. Monitoring, pest stage identification and knowledge of the variables set the framework required for management of pests and diseases in current cropping systems.

Today management options are triggered at the "micro" level which corresponds to egg deposition and instar stage.

Leaf inspection and the use of sticky traps are two useful methods for monitoring whiteflies. The most practical method for outdoor crops is probably leaf inspection or scouting.

Nymphs are flat, elliptical in shape and clear or creamy yellowish in colour. Adults are easy to spot as they normally congregate on the underside of the leaf and are tiny, white moth-like insects.

When scouting, take into account the relative density and distribution of pests as well as the stage of growth of the plant. Because whitefly populations tend to be more clumped than other pests, it is best to divide the area of each tomato field into 10m x 10m grids. A sample is then taken from 10 adjacent plants in each grid to ensure that every area of the field is sampled.

See below for sampling guidelines, according to the plant growth stage. Please refer to your consultant for the most appropriate scouting method for your farming system.

<table>
<thead>
<tr>
<th>Pest</th>
<th>Location on plant</th>
<th>Area to inspect</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiteflies</td>
<td>0–3 true leaves</td>
<td>Whole plant inspection</td>
<td>1 adult/plant*</td>
</tr>
<tr>
<td></td>
<td>&gt;3 true leaves</td>
<td>Terminal leaflet of 3rd (adults) or 7th (nymphs or pupae) leaf from the top</td>
<td>1 adult/leaflet* 5 nymphs/10 leaflets</td>
</tr>
</tbody>
</table>

*In areas with high TYLCV pressures the threshold would be lower
(Source: Schuster, David J UFL IFAS extension. Scouting for Insects, Use of thresholds and Conservation of beneficial insects on Tomatoes 2009)

**Common sprays for treating whitefly at different stages**

Please refer to your consultant or local chemical area sales manager for further information.

I. Neo-nicotinoids, eg. imidacloprid (Condifor®) and thiamethoxam (Actara®), are systemic and are effectively taken up by the plants’ roots. Soil application of these types of products at the time of transplant is effective. They affect adult and nymph stages but do not control the eggs. It is important to note that pests can develop high resistance to neo-nicotinoids so it is important not to overuse them.

II. Insect Growth Regulators (IGRs), eg. pyriproxyfen (Admiral®) and buprofezin (Applaud®). Admiral® stops eggs from hatching and prevents the development of nymphs into adults but it does not kill the adult itself. Applaud® affects the exo-skeleton of the nymphs but again does not kill the adult flies. While these chemicals do not produce an instant kill, it does not mean they are not working.

III. Pymetrozine (Chess®) is an insecticide with translaminar and systemic activity within the plant. Within hours of coming into direct contact with or ingesting pymetrozine, adult whitefly cease to feed. Although they may still be present on the leaves a few days later, the whitefly is not causing any damage. They starve within 2–5 days. Please check for registration in your area.

IV. Synthetic pyrethroids, eg. bifenthrin (Talstar® and other products), affect the insect’s nervous system. They mainly control adult flies but also have some effect on nymphs. Resistance to synthetic pyrethroids can also occur so they need to be rotated with other chemical groups.
V. Spirotetramats, eg. Movento®, have a unique 2-way systemic action (they translocate both up and down the plant and can reach new shoots where pests are likely to be feeding). Spirotetramats are also highly effective in pest populations that have developed resistance to existing registered products. They work by inhibiting the fatty acid biosynthesis, controlling the nymph stage and also reducing the viability of eggs laid from female adults exposed to the chemical.

VI. Oils and soaps can work by smothering the insects. However oils can cause burn under periods of high plant stress and therefore it is recommended that a trial area be sprayed first. Oils and soaps also require full leaf coverage when spraying in order to be effective.

Note: This information is a guide only. All users should check the details and conditions of the label before using the product. For more information on which chemicals are registered for use in Australia, visit http://services.apvma.gov.au/PubcrisWebClient/welcome.do

4. Cultural Practises

I. Sanitation – The most prominent source of TYLCV and whiteflies is tomatoes nearing, or at the end of, the production cycle. The virus can spread rapidly in older or abandoned blocks were whitefly control has ceased. As the crop nears the end of its production cycle, virus laden whiteflies within these plants are likely to migrate to neighbouring younger blocks.

II. Weed management – Weeds within the production area and the immediate surrounds should be kept at a minimum as they harbour whitefly populations.

III. Avoidance – Planting dates or locations that avoid high whitefly populations may reduce the incidence of TYLCV infection. Where possible, new plantings should not be located near old plantings, particularly if the old crop is known to have infections of TYLCV.

Summary

- Tomato Yellow Leaf Curl Virus is a serious disease effecting tomato production in Australia.
- Growing susceptible varieties in areas with a high incidence of TYLCV will require vigilance and careful monitoring of the crop and pest levels.
- An understanding of the months in which the threat is highest is key to making sound variety choices.
- Choosing resistant hybrids (such as Seminis varieties Red Luck and Lava) is an effective management option in reducing the impact of TYLCV, where the likelihood of TYLCV infection is high.
- A combination of a rotation of insecticides to control silver leaf whitefly in addition to cultural practices to reduce virus reservoirs and whitefly populations is an effective management option where the likelihood of infection of TYLCV is low.

References:
Persley D, Cooke T, House S (Eds) (2010). Diseases of vegetable crops in Australia. CSIRO.
Polston JE (2012). Tomato Yellow Leaf Curl disease management. IFAS http://ipm.ifas.ufl.edu
Schuster DJ. J UFL IFAS extension. (June 2009). Scouting for insects, use of thresholds and conservation of beneficial insects on tomatoes.
While North Queensland tomato growers certainly face challenges at the moment, Seminis has a range of proven performers available, along with two new varieties in the pipeline.

Pinnacle is still the benchmark for quality and weather tolerance. Red Luck and Lava offer good TYLCV resistance with consistent, firm fruit, providing good options in areas where TYLCV management practices are still being established.

To help ease the pressures on North Queensland growers, we are also developing new varieties that will make it easier to manage TYLCV while delivering excellent fruit.

Doug Heath, our chief Australia and New Zealand tomato breeder reports that:

“We have two new TYLCV-resistant tomato varieties to move forward with now. The first is 11-A8-FIR-0215, which has already been advanced to pre-commercial. In addition to TYLCV resistance, it is resistant to tomato spot wilt virus (TSWV) and has a long shelf life.

After just reviewing the trials, we will also advance a new hybrid, 12-A8-FIR-0240. This variety is extremely similar in overall appearance and quality to Pinnacle. Both 11-A8-FIR-0215 and 12-A8-FIR-0240 also resist weather marking, which many competitor hybrids do not.”

Red Luck – leaves nothing to chance.

**Variety:** Red Luck

**Crop:** Open field tomato

**Type:** Deep red fruit with oblate shape

**Time slot:** Late winter/spring

Red Luck is a highly productive variety with intermediate TYLCV resistance and excellent weather tolerance.

It produces medium-large, firm, deep red fruit that is resistant to weather marking. The taste is excellent, and better than you would normally expect from an open field variety.

Red Luck crops tend to be high yielding, even in difficult growing conditions.

- 180–220g glossy red uniform fruit, with a traditional gourmet shape (similar to Pinnacle)
- Very strong plant vigour
- Intermediate TYLCV resistance
- Adaptable to a range of growing conditions
- May–July transplant in North Queensland
**Lava – a hot performer in the cold.**

**Variety:** Lava  
**Crop:** Open field tomato  
**Type:** Deep oblate, red fruit  
**Time slot:** Early autumn / winter / early spring

*Lava is an indeterminate F3 variety suitable for northern Australian production.*

With good resistance to TYLCV, Lava is early maturing and it produces consistent, gourmet shaped, firm fruit that is strong against weather marking.

With a growing season extending from early autumn to early spring, Lava is a consistent performer.

- 160–180g gourmet shaped fruit
- Strong plant vigour
- Good disease resistance
- Adaptable to a range of growing conditions
- Long growing season

**Pinnacle – at the top of its field.**

**Variety:** Pinnacle  
**Crop:** Open field tomato  
**Type:** Round, deep red, uniform fruit  
**Time slot:** Please contact your Regional Business Manager

*Pinnacle is the benchmark for quality and weather tolerance.*

It is a high-yielding variety that produces medium-to-large, uniform fruit with a brilliant red colour. The fruit is early maturing and of a consistently high quality. It is firm with good resistance to marking in Queensland conditions, given good management practices.

Pinnacle is highly adaptable with excellent weather tolerance.

- 150–200g deep red, uniform fruit with a small calyx and blossom end scar
- Smooth skin, nil micro-cracking
- Excellent weather tolerance
# Queensland Tomato growing guide

<table>
<thead>
<tr>
<th>Variety</th>
<th>Season</th>
<th>Maturity</th>
<th>Plant Vigour</th>
<th>Average Fruit Weight</th>
<th>Fruit Shape</th>
<th>Firmness</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RED LUCK</strong></td>
<td>Spring/summer</td>
<td>Late</td>
<td>Very Strong</td>
<td>180–220g</td>
<td>Deep Oblate</td>
<td>Very firm</td>
<td>HR ToMV, Aal, Fol:0-2, Vd, IR TYLCV</td>
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<tr>
<td></td>
<td><strong>LAVA</strong></td>
<td>Early autumn, winter, early spring</td>
<td>Early</td>
<td>Strong</td>
<td>160–180g</td>
<td>Deep Oblate</td>
<td>Very firm</td>
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<tr>
<td></td>
<td><strong>PINNACLE</strong></td>
<td>Very early</td>
<td>Strong</td>
<td>150–200g</td>
<td>Deep Oblate</td>
<td>Very firm</td>
<td>HR ToMV,Aal, Fol:0,1,2, Sbl, Vd</td>
</tr>
</tbody>
</table>

Deep red uniform fruit, very firm. Excellent weather tolerance. Highly suited to spring/summer production.

Lava is an indeterminate F3, TYLCV resistant tomato suitable for northern Australian production. It produces 160–180g gourmet shaped fruit. Fruit are firm and strong against weather marking.

Deep red uniform fruit, very firm, small calyx and blossom end scar. Highly adaptable variety.

<table>
<thead>
<tr>
<th>Code</th>
<th>Scientific Name</th>
<th>English Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aal</td>
<td>Alternaria alternate f.sp. lycopersici</td>
<td>Alternaria Stem Canker</td>
</tr>
<tr>
<td>Fol</td>
<td>Fusarium oxysporum f.sp. lycopersici</td>
<td>Fusarium Wilt</td>
</tr>
<tr>
<td>Ma</td>
<td>Meloidogyne arenaria</td>
<td>Root-Knot Nematode</td>
</tr>
<tr>
<td>Mi</td>
<td>Meloidogyne incognita</td>
<td>Root-Knot Nematode</td>
</tr>
<tr>
<td>Mj</td>
<td>Meloidogyne javanica</td>
<td>Root-Knot Nematode</td>
</tr>
<tr>
<td>Sbl</td>
<td>Stemphylium botryosum f.sp. lycopersici</td>
<td>Grey Gray Leaf Spot</td>
</tr>
<tr>
<td>ToMV</td>
<td>Tomato Mosaic Virus</td>
<td></td>
</tr>
<tr>
<td>TYLCV</td>
<td>Tomato Yellow Leaf Curl Virus</td>
<td></td>
</tr>
<tr>
<td>Va</td>
<td>Verticilliun albo-atrum</td>
<td>Verticillium Wilt</td>
</tr>
<tr>
<td>Vd</td>
<td>Verticillium dahliae</td>
<td>Verticillium Wilt</td>
</tr>
</tbody>
</table>
For more information, please contact:

Russell Parbery  
Regional Business Manager  
Tasmania, North Queensland & New Zealand South Island  
0407 283 304  
russell.john.parbery@monsanto.com

David Campbell  
Technology Development Specialist  
0400 304 766  
david.nicholas.campbell@monsanto.com

For all general enquires please contact Monsanto customer service:  
Ph: 1800 364 846  
Fax: 1800 892 066  
Email: vegetablesales.australia@monsanto.com

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Monsanto Australia Ltd ABN 86 006 725 560 Head Office: 12/600 St Kilda Rd, Melbourne VIC 3004. Post: PO Box 6051, St Kilda Rd Central, VIC 8008. www.monsanto.com.au