

Integrated pest management of tomato potato psyllid (*Bactericera cockerelli* Sulc.)

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Tomato potato psyllid (*Bactericera cockerelli* Sulc.) (TPP)

- Native to Central & North America
- Introduced into NZ in 2008
- Main host: Solanaceous crops
- Psyllid yellows disease
- Major vector of bacterium, *Candidatus Liberibacter solanacearum* (CL_{so})
- **Zebra chip** - first reported in US in 2004
- Induced extra cost of \$28 millions for potato industry in NZ (Kale, 2011)



Extension Led Research Objectives

- Understand TPP life cycle
- Understand damage and injury caused by TPP
- Develop phenological model of TPP based on thermal time accumulation
- Reduce cost of control by implementing IPM



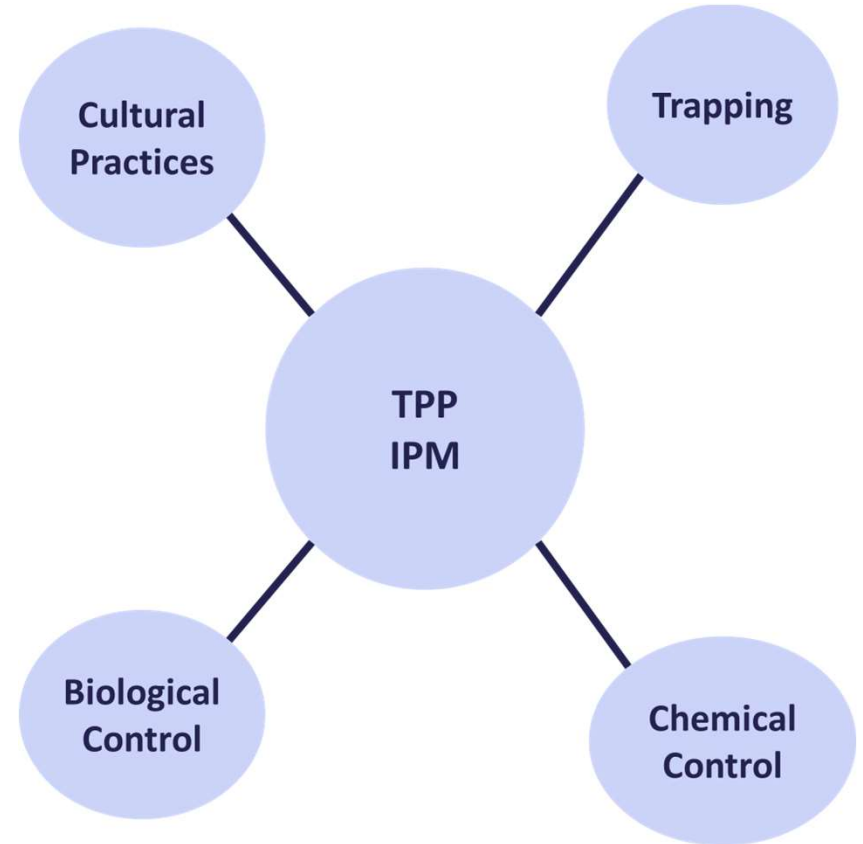
Research Methods

- **Build Phenological Model**

- Model based on Cumulative Degree Days
- Collect Canterbury Data
- Model TPP Life Cycle in Canterbury

- **Integrated Pest Management (IPM)**

- Cultural Practices
- Trapping of TPP
- Biological Controls
- Chemical Controls



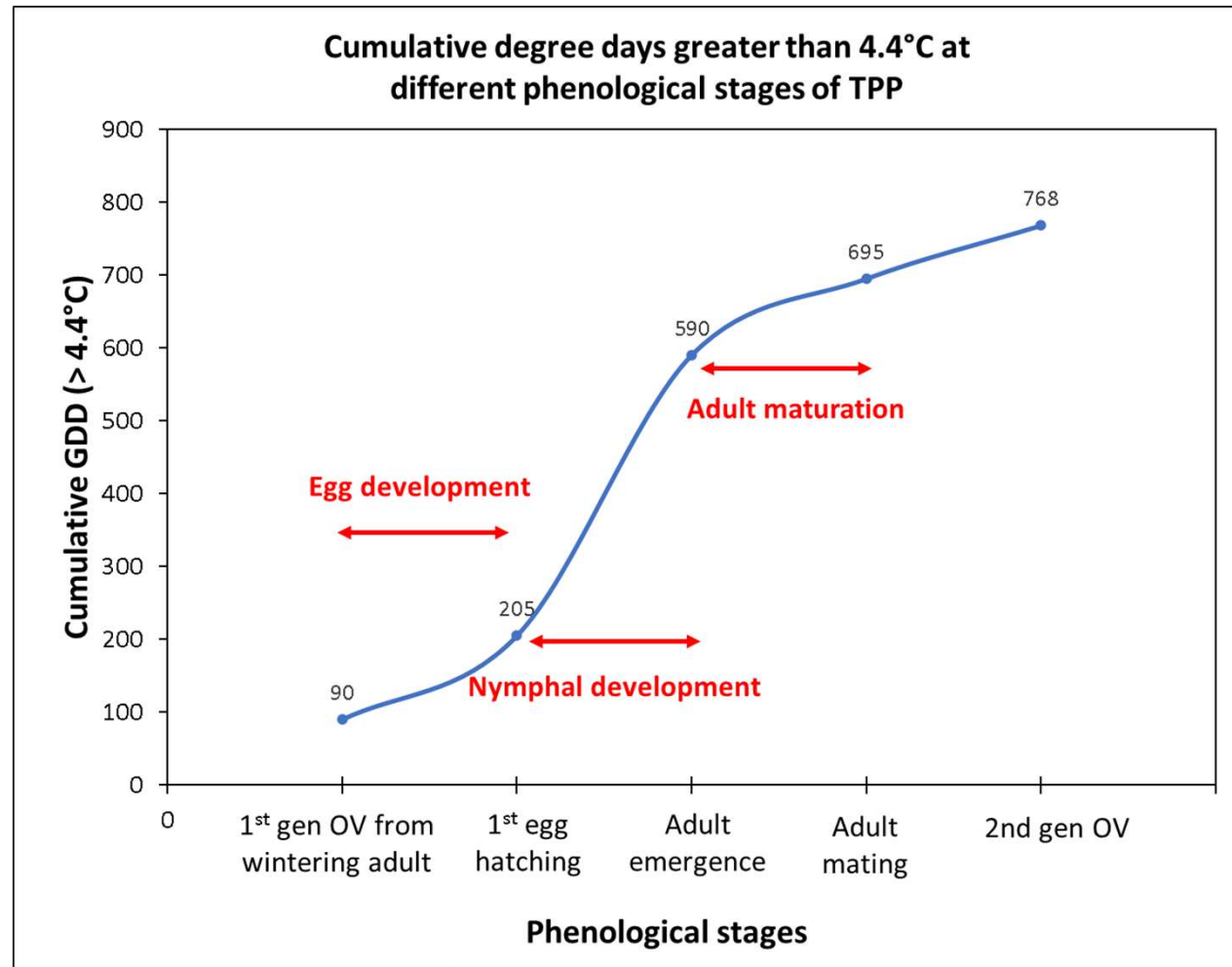
$T_{base}: 4.4^{\circ}\text{C}$; $T_{max}: 30.0^{\circ}\text{C}$

Weather station: Chertsey EWS

$$T = \frac{T_{max} + T_{min}}{2} - T_{base}$$

$\text{GDD} = 0$; if $T \leq T_{base}$ or $T \geq T_{max}$

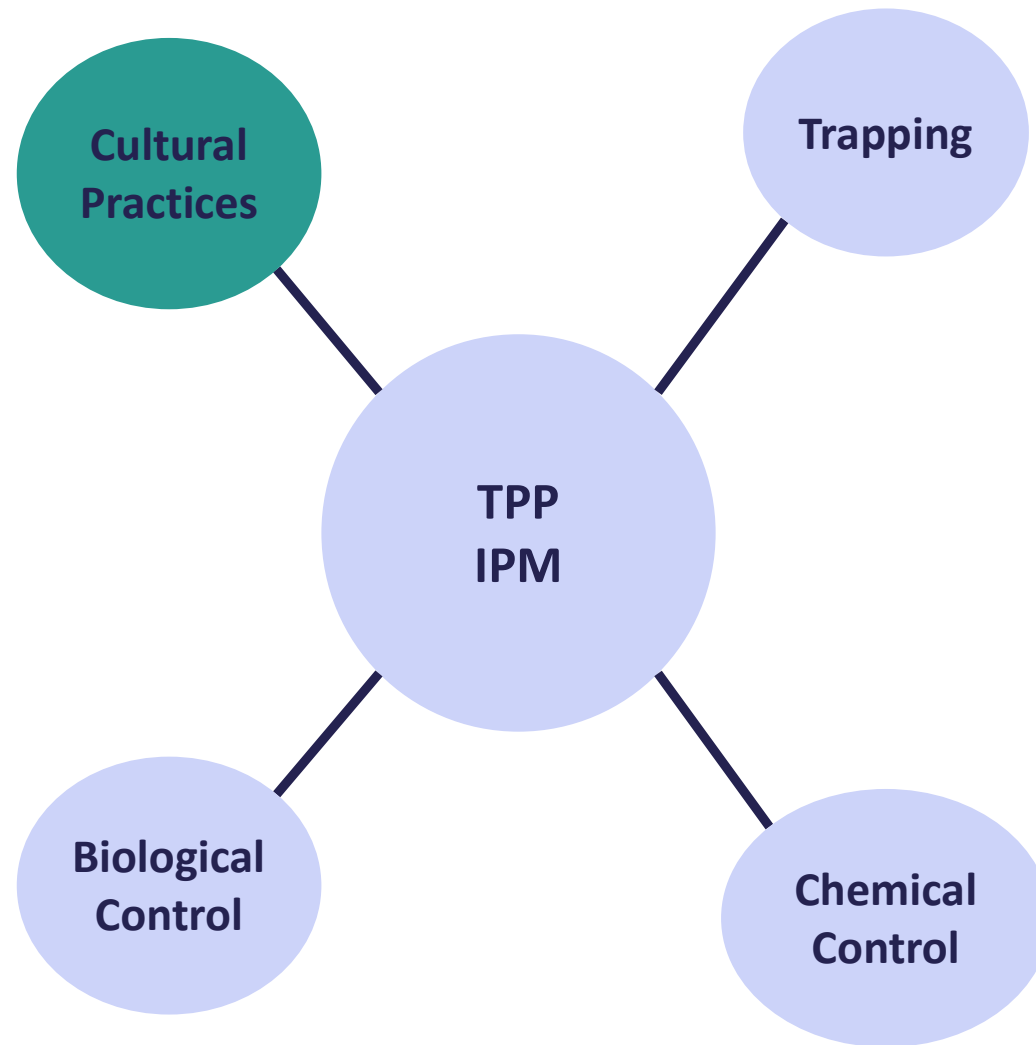
Phenological stages	GDD ($^{\circ}\text{Cd}$)	Cumulative GDD ($^{\circ}\text{Cd}$)
First OV of wintering adult	90	90
Egg development	115	205
Nymphal development	385	590
Adult Pre-OV	105	695
Peak OV period	73	768



TPP Phenological Model

Year	Start date	Date of each phenological stage at Chertsey						
		1st OV on alternate host	1st egg hatching	Adult emergence	Adult mating	1st OV on potato	2nd OV on potato	3rd OV on potato
2016	1-Jul-16	18-Aug-16	12-Sep-16	9-Nov-16	22-Nov-16	28-Nov-16	1-Feb-17	5-Apr-17
2017	1-Jul-17	12-Aug-17	6-Sep-17	31-Oct-17	10-Nov-17	20-Nov-17	15-Jan-18	3-Mar-18
2018	1-Jul-18	29-Jul-18	29-Aug-18	4-Nov-18	15-Nov-18	24-Nov-18	22-Jan-19	15-Mar-19
2019	1-Jul-19	23-Jul-19	26-Aug-19	2-Nov-19	10-Nov-19	18-Nov-19	19-Jan-20	10-Mar-20
2020	1-Jul-20	1-Aug-20	27-Aug-20	24-Oct-20	3-Nov-20	13-Nov-20	15-Jan-21	11-Mar-21
2021	1-Jul-21	3-Aug-21	30-Aug-21	1-Nov-21	13-Nov-21	20-Nov-21	20-Jan-22	22-Mar-22

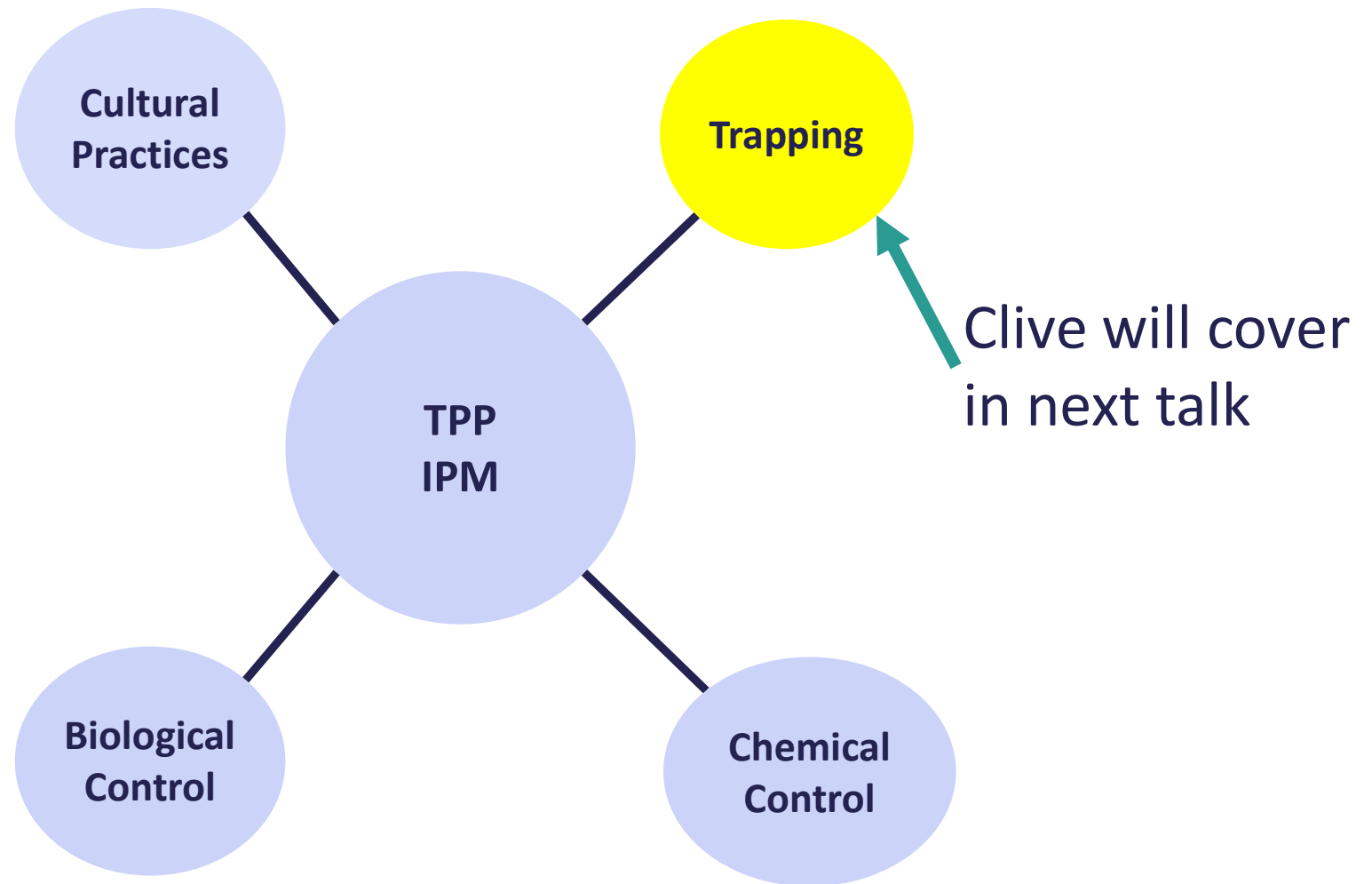


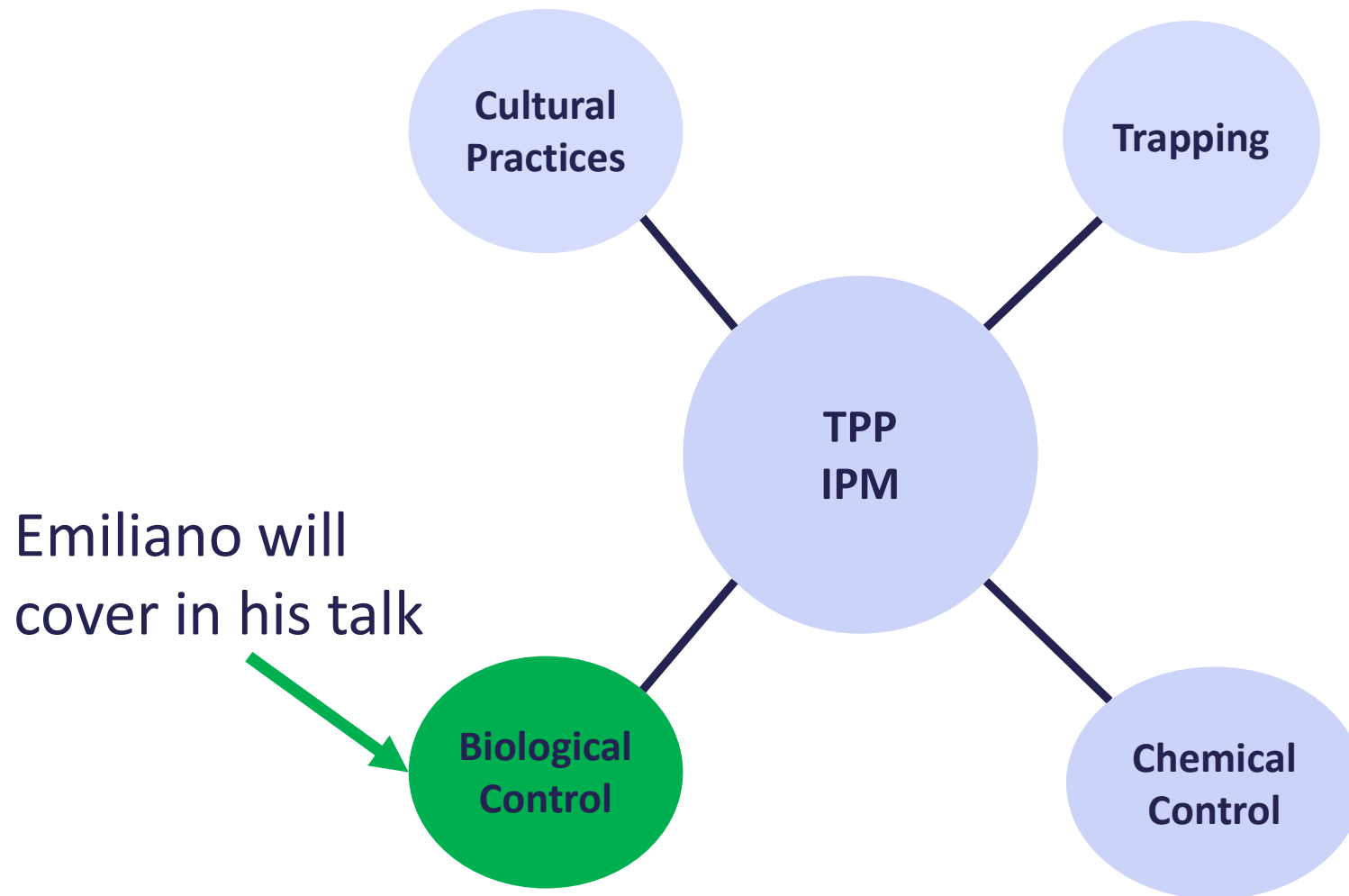


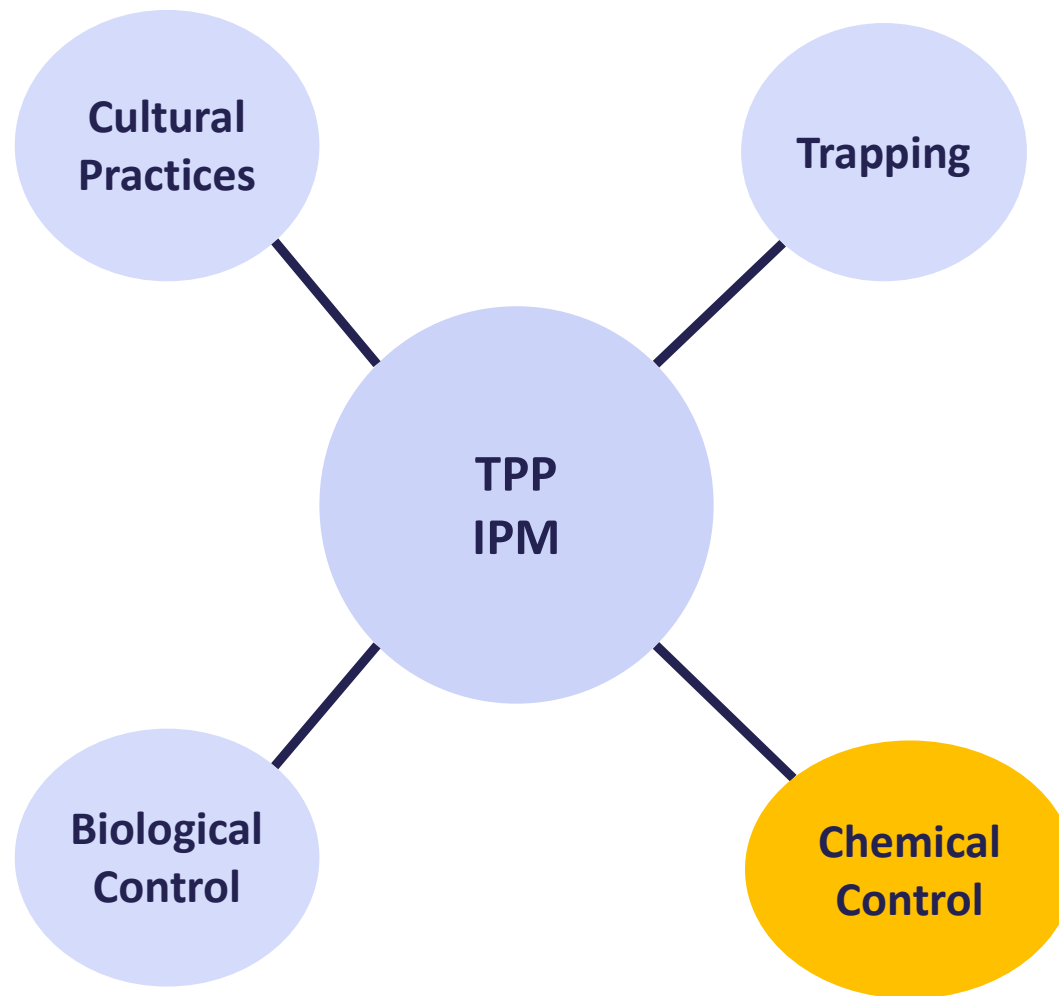
IPM – Cultural Control

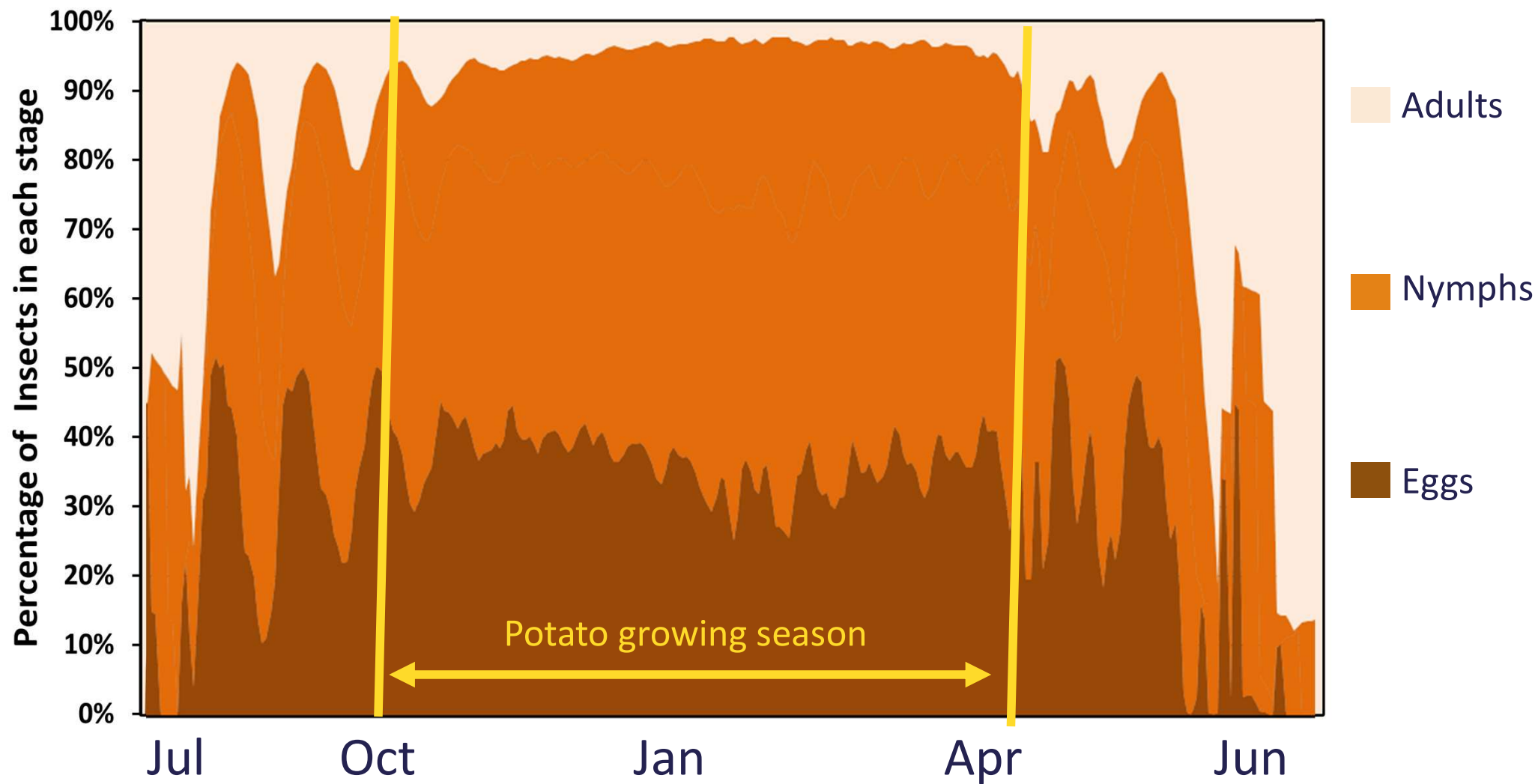
- Strict hygiene & sanitary practices
 - Remove Volunteers
 - Remove nightshade weeds
 - Remove & bury diseased plants
- Use of fine mesh cloth (organic)
- Selection of early-maturing cultivars
 - -‘Norland’, ‘Russet Norkotah’
- Optimize plant health

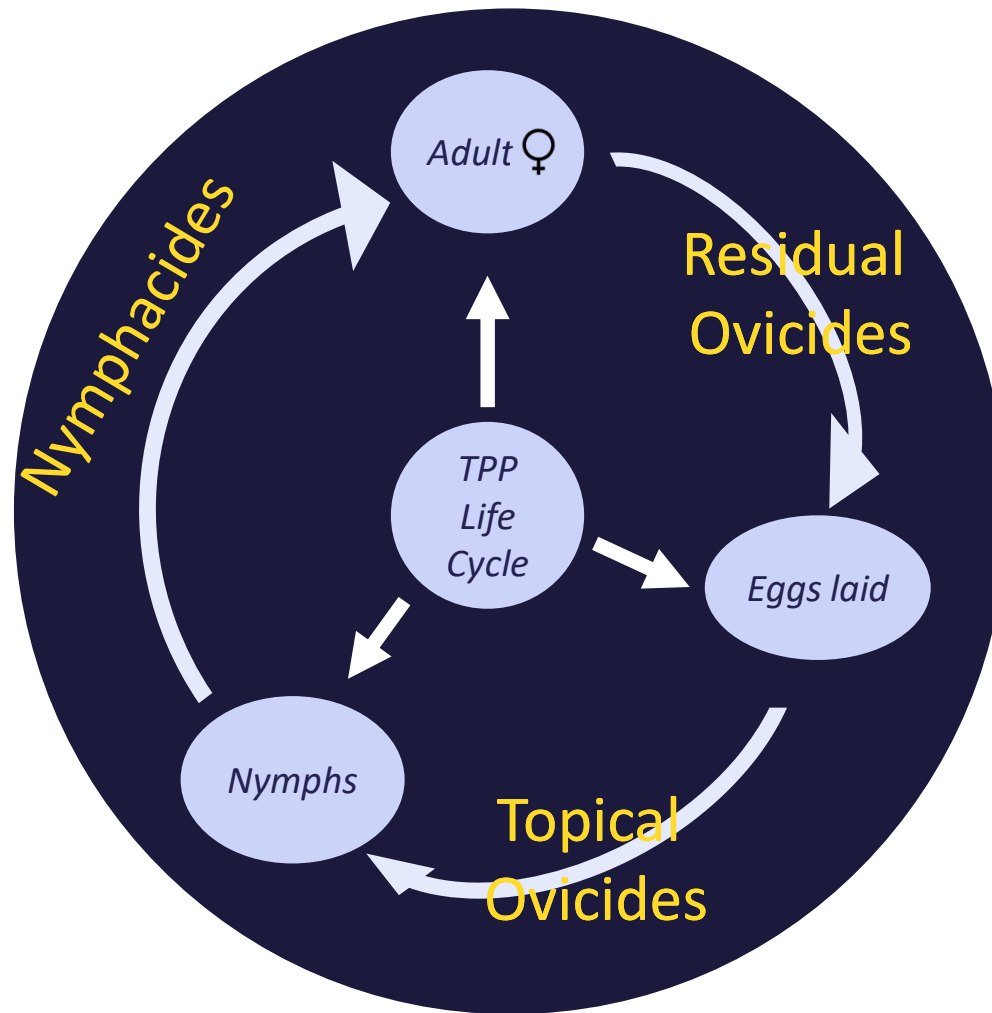




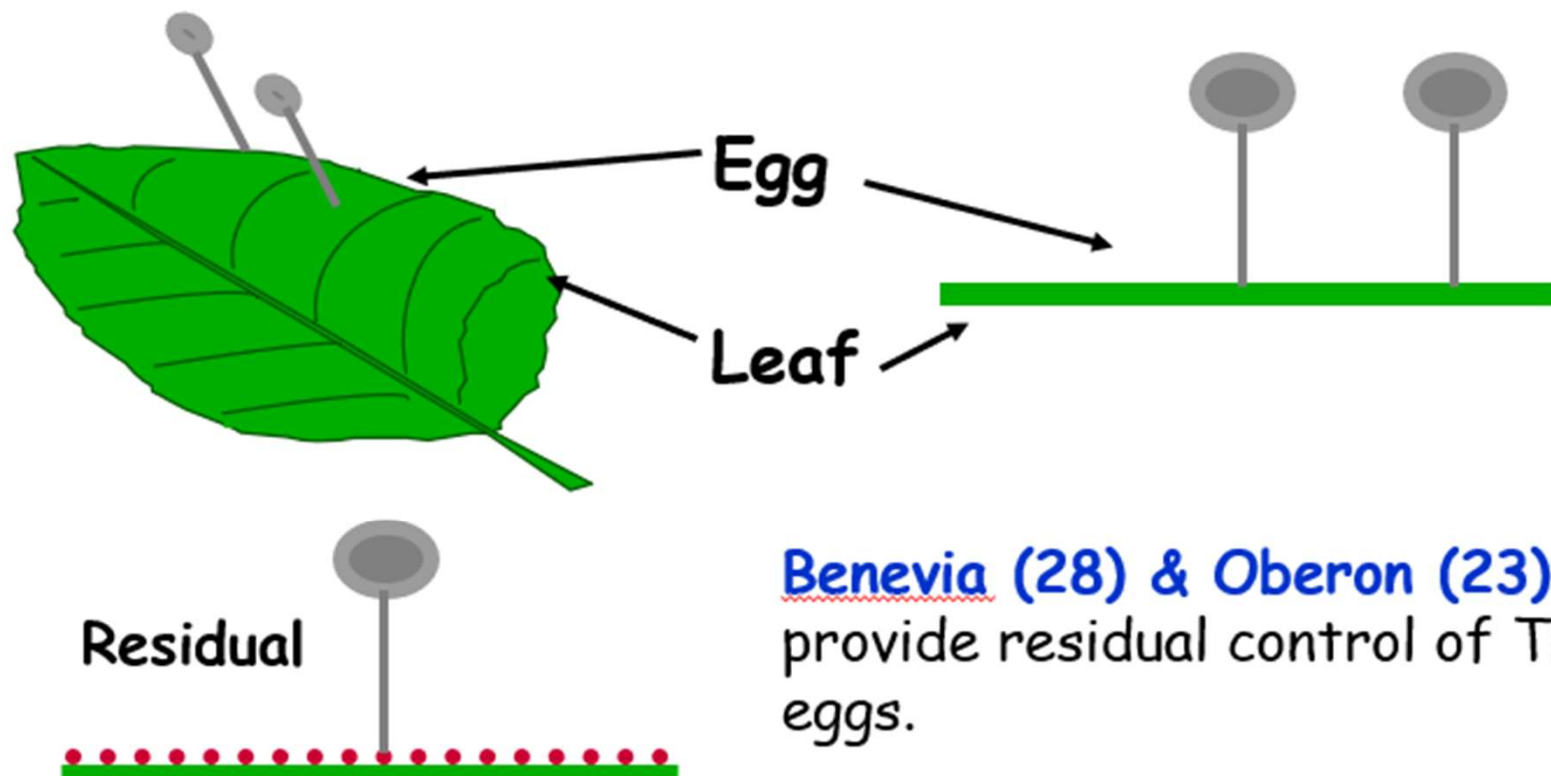




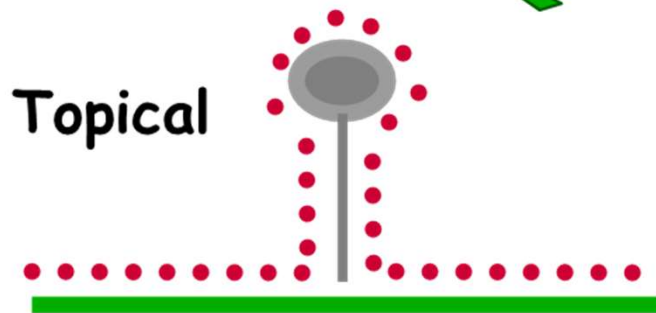
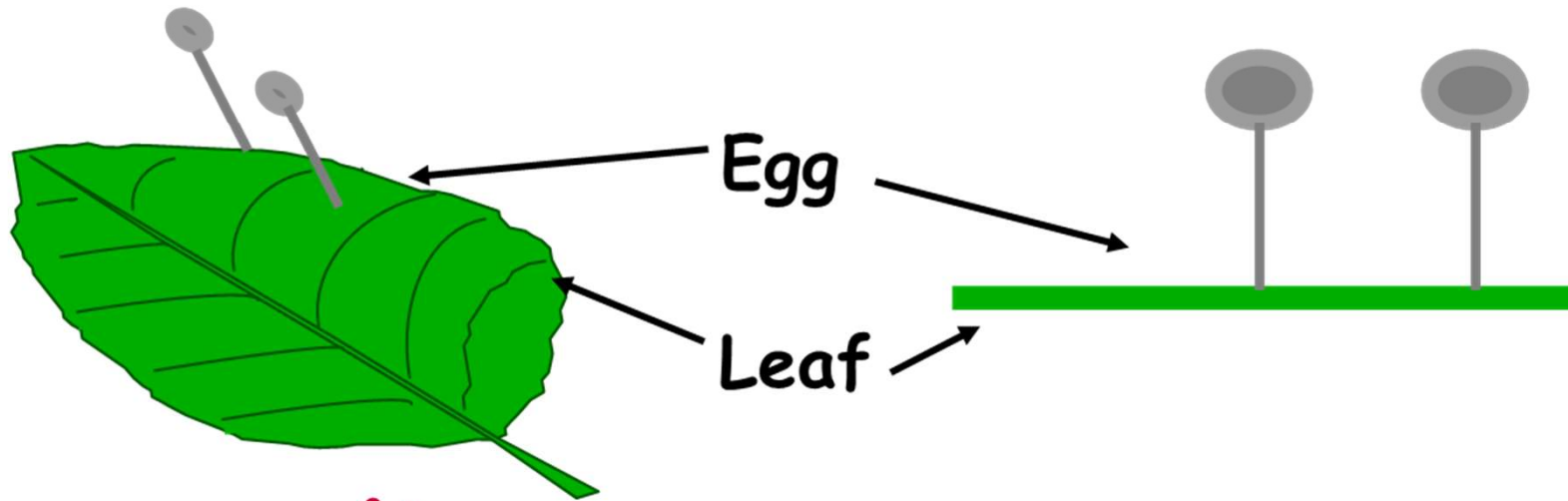




Ovicides for Tomato Potato Psyllid



Ovicides for Tomato Potato Psyllid



Ovicides demonstrated by
PFR can provide contact control of
TPP eggs

IPM – Chemical Control

	Active Ingredient	NZ Trade Name	IRAC Group	Registered on Potatoes	Registered in NZ on TPP	US Trade Name
Residual Ovicides	Novaluron	<i>*TEST</i>	15	NO	NO	Rimon
	Lufenuron	Nuron	15	YES	YES	
	Spiromesifen	Oberon	23	YES	YES	
	Cyantraniliprole	Benevia	28	YES	YES	Exirel
	Chloranthraniliprole	Coragen	28	YES	NO	Besiege

IPM

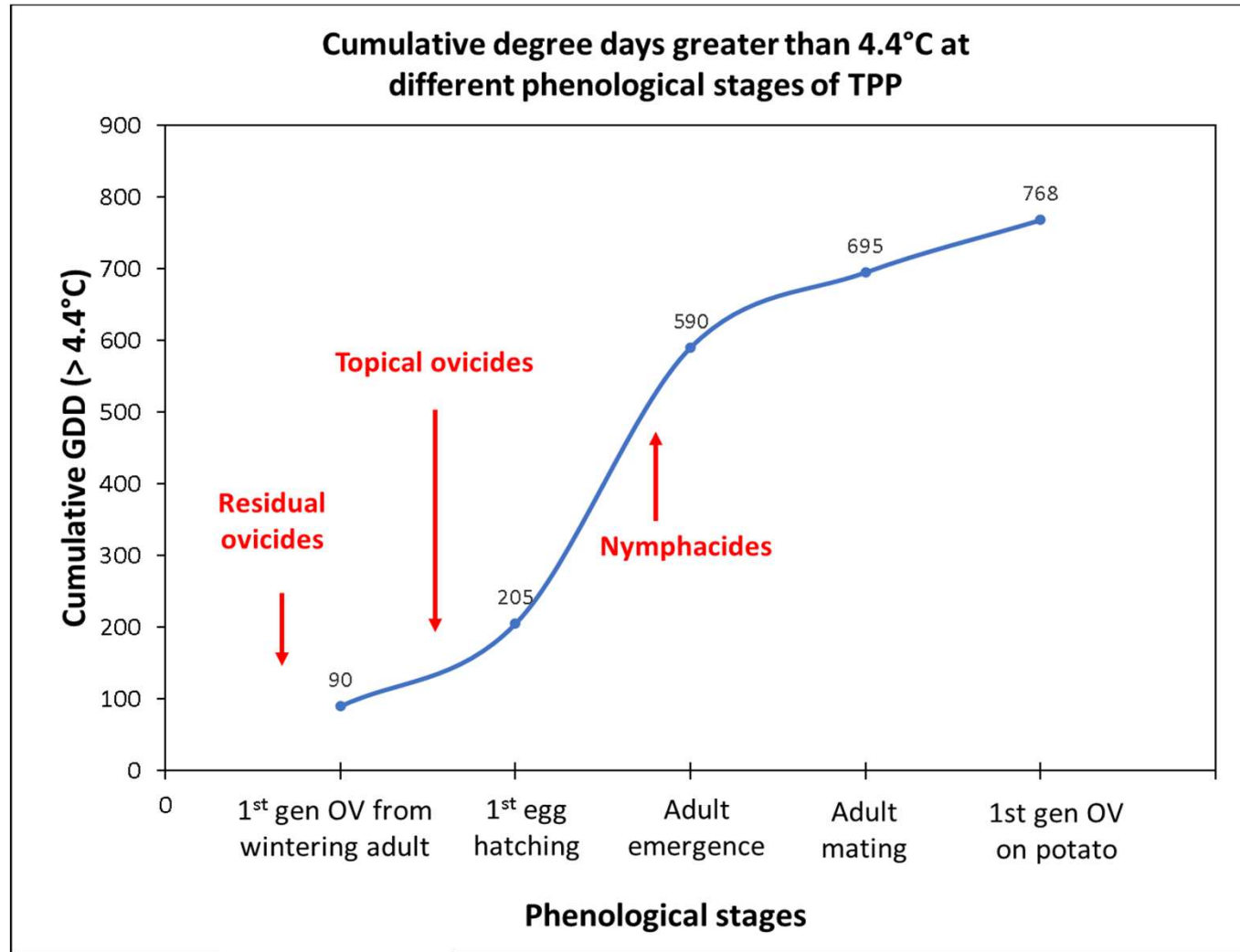
Chemical Control

Nymphacides/ Adulticides

Active Ingredient	NZ Trade Name	IRAC Group	Registered on Potatoes	Registered in NZ on TPP	US Trade Name
Methamidophos	Metafort 60SL, Methafos 600	1b	YES	YES	
Lambda-cyhalothrin	Kaiso , Lavron, Karate, Cyhella	3a	YES	YES	Warrior II
Tau-fluvalinate	Mavrik Aquaflo	3a	YES	YES	
Thiacloprid	Topstar	4a	YES	YES	
Thiamethoxam	Actara	4a	Yes	NO	
Thiacloprid, Deltamethrin	Proteus	3, 4	YES	YES	
Acrinathrin, Abamectin	Trisol	3, 6	YES	YES	
Spinosad	Entrust SC Naturalyte	5	YES	NO	Success
Spinetoram	Sparta, Uphold	5	YES	YES	Delegate, Radiant
Abamectin	ABBA, Apostle, Invert EW, Verdex	6	YES	YES	Agri-Mek SC
Pymetrozine	Endgame	9b	YES	NO	Fulfill
Lufenuron	Nuron	15	YES	YES	
Spiromesifen	Oberon, Optimite	23	YES	YES	Oberon
Spirotetramat	Movento, Supremis 100SC	23	YES	YES	Movento
Cyantraniliprole	Benevia	28	YES	YES	Exirel
Flonicamid	Mainman	29	YES	YES	Beleaf 50SG, Carbine 50WG



IPM Chemical Control



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IPM – Biological Controls

- Predatory insects
 - damsel bugs (*Nabis* spp.)
 - miniature pirate bugs (*Orius tricolour*),
 - pirate bug (*Buchananiella* spp)
 - brown lacewing (*Micromus tasmaniae*),
 - larvae of small hoverfly (*Melanostoma fasciatum*)
 - steely blue ladybird (*Halmus chalybeus*)
- Parasitoid wasps (*Tamarixia triozae*)
- Entomopathogenic fungi
 - Preferal (*Isaria fumosorosea*)
 - BotaniGard & Mycotrol (*Beauveria bassiana*)



IPM Recommendations

Activities	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Nightshade weed/ Volunteer removal												
Planting												
Crop monitoring												
Residual ovicides												
Topical ovicides												
Nymphacides/ Adulticides												
BCAs												



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