

SPRAYING OILS

ARE THEY AN UNDER UTILISED RESOURCE

in NEW ZEALAND?



A KELLOGGS PROJECT

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Introduction

One of the main problems we face orcharding in the Whangarei district is the encroachment of lifestyle residential properties and people buying orchards as lifestyle (residential) blocks. Traditional spraying of organophosphates and other toxic chemicals is at best tolerated and in some cases an unacceptable risk. Spraying oils may be part of the solution to this problem as they have been in use for 100s of years as matricides, fungicides, and insecticides and are non toxic to mammals. In recent times new chemistry has overtaken them to the point where I believe they are an under utilised resource in New Zealand with significant I.P.M advantages being non-fatal to beneficial insects giving low cost pest and disease control.

Objective

Get the knowledge and experience gained with spray oils into a form where our kiwi-fruit clients and neighbouring avocado growers gain the confidence and knowledge to use spray oils.

The final outcome will be to improve our living environments by reducing the dependency on toxic chemicals to produce export quality fruit.



Summary

Kiwifruit

Spray Oils are currently playing a small but significant role within kiwifruit growing in NZ to control scale. While its use is well researched the leading organic growers have led the way with safe effective use with the main points being get very good control between 2-3 weeks after bud-burst (new shoots 100mm or longer) and before flowering by handgunning leaders and trunks to saturation with 2% oil. With Gold do not spray after 10 days post flowering. With Green don't spray from 10 days post flowering until the end of February and then use 1% and only spray if necessary. Spray Oils may also have a role to play as a bud-burst Premotant with some very encouraging grower trials happening around the country.

Avocados

Spray Oils will control six spotted mite, thrips and scale in avocados. It requires a new mind set. Results are not instantaneous. There are a growing number of orchards using solely oil plus a form of leaf roller control and getting excellent packouts and pest control. It is very dependent on good coverage. Spray oils are used extensively around the world as fungicides. They may have a role to play in the avocado industry in the control of anthracnose.

Often the simplest things are the best. Spray oils may be an example of that. Billions of dollars is spent on developing, testing and then promoting and selling new chemistry. It doesn't necessarily mean that is best or necessary. Spray Oil is a tool that has been around for a long time. In my opinion it is an underutilised resource. There are some risks that comes with using it and a very good understanding of when not to use it is necessary. It offers low cost pest and disease control and an enhanced orchard living environment

What is Spraying Oil?

Spraying oils are made up of oils derived from petroleum, fish and plant respectively that are mixed with an emulsifier to make them water soluble. Botanical and Fish oils have been used for cosmetics, lubricants and energy sources for 1000s of years. In the 1920s they were shown to kill aphids and scale insects. The use of them has been largely taken over by petroleum oils as they have a more uniform formulation. In recent times botanical and fish oils are making a come back as they are seen to be more environmentally acceptable being a Renewable resource and having been more uniformly produced in recent years.

AVOCADO TREE SHOWING LEAF DROP DAMAGE FROM MITES



NORMAL AVOCADO TREE



Fish Oil

Fish oil is derived from fish and is produced in commercial quantities in New Zealand by Sealord. With the addition of an emulsifier it readily mixes with water. Sealord produce their product to a consistent refinement which has traditionally been hard to do with fish oils due to differing fish species and areas they are caught. The product has been in use for 5 years and is being trialled by Hort Research and many growers around the country for use for scale, mite, sooty mould, black spot, powdery mildew; botrytis control and bud break enhancer for kiwifruit. It is readily available and relatively cheap and has very exciting possibilities. It is a lovely pink colour and has quite a distinct fishy smell.

Plant Oils

Includes soya bean, canola, eucalyptus and T-tree, garlic, maize, sunflower, peanut, cottonseed, olive and coconut oil. There are some exciting possibilities with a t-tree eucalyptus blend and Eco-oil® both coming out of Australia and being promoted in New Zealand

Petroleum Oil

This is the most commonly used oil in New Zealand. It is petroleum based and a highly refined oil. Over the last 10 years it has developed greatly in its refinement process becoming finer with products such as DC Tron Plus having registration in fruit growing.

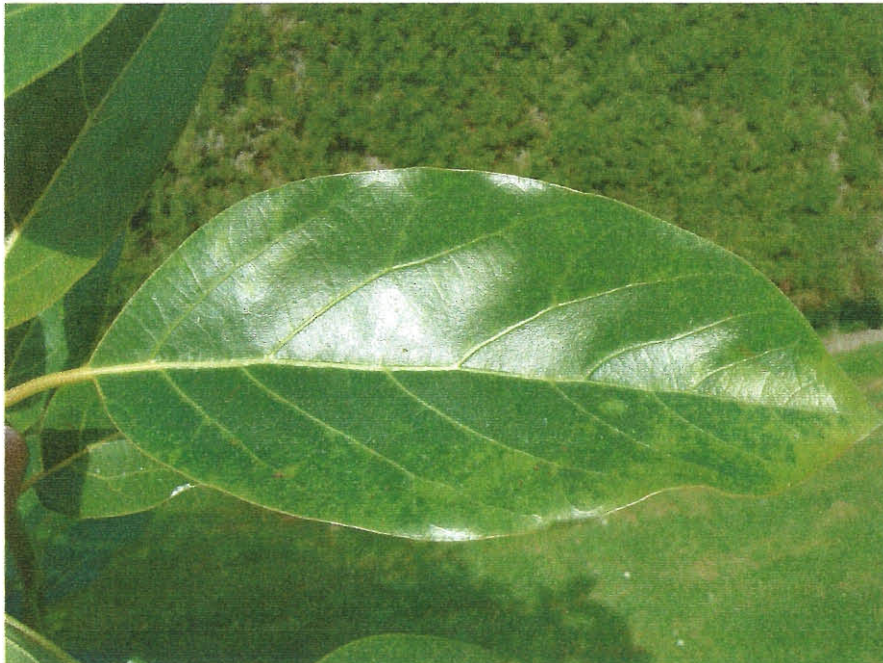
Mode of Action

Traditionally spray oils have worked by blocking the respiration of insects by clogging their pores. As they have become more refined they are being absorbed by the insects and breaking down the fat tissues. The highly volatile components of oil can also act as narcotic fumigants. Oil may also have a role in triggering plants defence mechanisms against pests and diseases.

Risks

Oil that is very good at blocking the respiration of insects also blocks the respiration of plants. Under hot dry conditions and differing times of the growing season this can be a problem causing fruit drop or speckling in kiwifruit and leaf blotching in avocados. As the oils have got more refined and rely less on blocking the pores on the insects they are less risk to the plant's respiration.

LEAF BLOTCHING CAUSED BY OIL



Uses around the World

Insecticides	Miticides	Fungicides
Scale <i>Kiwifruit</i>	Six Spotted Mite <i>Avocados</i>	Black Spot <i>Apples</i>
Thrip <i>Avocados, Oranges, mangos</i>	Citrus Rust Mite <i>Citrus</i>	Powdery Mildew <i>Grapes, tomatoes, cucumbers, cherries</i>
Spiraea Aphid <i>Apples</i>	Hawthorne Spider Mite <i>Apples</i>	Celery Mosaic Potvirus <i>Celery</i>
Purple Scale & White Louse Scale <i>Oranges</i>	Two Spotted Mite <i>Strawberries</i>	Tospovirus <i>Tomatoes</i>
Helicoverpa Spp <i>Cotton</i>	Varoa Mite <i>Bees</i>	
Codling Moth		
Lepidopteran Pests		
Pink Wax Scale <i>Citrus</i>		
Red Scale <i>Citrus</i>		

Bud Break Enhancer

Kiwifruit

Pears

Blueberries

Used in combination, oils can improve the effectiveness of some new generation low-toxicity chemicals which are pest-specific.

E.g. Success, Mitemec, Avid, Mimic.

Kiwifruit Industry

Zespri Innovation has contracted Hort Research to investigate the life cycles of scale and the effect of the number and timing of oil application on scale population control.

Studies have shown that 1% mineral oil can be phytotoxic to Hayward crops during certain periods of the growing season causing a speckling to the fruit if applied between 14 and 45 days after fruit set and fruit drop if applied after late March.

Studies also show 1% mineral oil is effective in controlling scale with the best results being obtained when one or two were used against the first generation of scale in November and early December plus two or more against the second generation in February / March.

Leading growers have shown you can use 2% oil up to flowering on Gold and Green and hand-gunned onto the trunk and leaders is the key to scale control with oil on kiwifruit. This can be followed up with 1% oil from February to 20th March if scale monitoring shows it is necessary on green only.

Scale Control at WAJIM Properties - 2004/2005

Green Kiwifruit

Feb 2004 % Live Scale on Leaves	Spray Programme	Feb 2005 % Live Scale On Leaves
31.8%		2%
39.3%		7.2%
50.5%	28/10/04 Actara	2.8%
35.7%	13/10/04 DC Tron Oil @ 2%	1.8%
27.3%	1/12/04 DC Tron Oil @1%	7.9%
27%	Mimic	4.5%
	Rovral	

Gold Kiwifruit

Feb 2004 % Live Scale on Leaves	Spray Programme	Feb 2005 % Live Scale On Leaves
15.7%		1.8%
9.9%		.9%
9.1%	29/9/04 DC Tron Oil @ 1%	
8.2%	13/10/05 DC Tron Oil @ 2%	2.1%
5.4%	28/10/05 DC Tron Oil @ 2%	
9.1%	Mimic	0%
4.3%	Rovral Gold	
6%		4.2%
11.3%		

Promoting Floral Bud Burst in Kiwifruit

The green kiwifruit industry in Northland is currently dependant on the bud-burst Premotant hydrogen cyanamide in order to produce yields of sufficient quantity as to be economic.

The use of this product is under threat due to its toxicity and thus much interest is being shown in finding a replacement. The idea originated that fish oil could have an effect when some blueberries in Nelson were sprayed in late dormancy for scale control which resulted in a much improved bud burst.

It has since been used in pears to avoid bi-annual bearing and is being trialled in kiwifruit by organic growers. Currently fish oil is being applied approximately six days before natural bud burst at 6% in 2000lts per ha.

Of interest is some work done by R.H. Blank and colleagues on diazanon and mineral oils in the winter and spring of 1994 for the control of scale. They found there was an interesting trend for a 21% increase in the fruit/winter bud ratio for all oil/diazanon treatments up to 2%oil.



Bud Burst at McKenzie Orchard – Keri Keri
No Hicane – 6% Fish Oil – 2000 lts / ha – applied 23.09.05

Case Study – Promoting Floral Bud Burst

BOP Organic Blocks (2003)

	Number Flowers per winter Bud		
	Control	Fish Oil	% Increase
Trial 1	2.11	2.4	13.7%
Trial 2	1.3	1.71	31%
Trial 3	2.33	1.86	36%
Trial 4	1.47	1.8	22%

McKenzie Orchard applied 23rd September 2005 Fish Oil @ 6%, 2000 lts per ha.

Vine	Total Buds	Fruitful Budburst	Total Flowers	Flowers? Winter Bud
1	456	47%	540	1.18
2	378	48%	450	1.19
3	468	52%	697	1.48
4	582	48%	708	1.21
5	595	53%	897	1.5
6	676	48%	1154	1.7

Kerimeri Orchard applied 21st September 2005 @ 6% 2000lts ha.

<u>Vine</u>	<u>Total Buds</u>	<u>Fruitful Budburst</u>	<u>Total Flowers</u>	<u>Flowers/Winter Bud</u>
<u>1</u>	<u>537</u>	<u>42%</u>	<u>632</u>	<u>1.17</u>
<u>2</u>	<u>456</u>	<u>42%</u>	<u>473</u>	<u>1.03</u>
<u>3</u>	<u>328</u>	<u>35%</u>	<u>409</u>	<u>1.24</u>
<u>4</u>	<u>330</u>	<u>42%</u>	<u>392</u>	<u>1.18</u>



MCKENZIE ORCHARD – KERIKERI

NO HICANE – FISH OIL @ 6% - APPLIED 23.09.05

Avocado Industry

We live on an avocado orchard on Whatitiri Mountain amongst lovely mature trees – a very peaceful, awesome place. We moved here in 2002 and our lifestyle was shattered somewhat by the necessity every few weeks to spray for six-spotted mite which if left would defoliate the trees. The chemicals currently being used were organophosphates not only on our orchard but on the other 1000 or so acres of neighbour's orchards. Having had experience with navel oranges previously where organophosphate use led to an outbreak of citrus rust mite and then proceeding with an oil based programme for successful pest control we took that route with avocados. The mites reduced to low levels within six months and our spraying has been minimal ever since with good pest control.

We are currently achieving excellent pest control with very little spraying with mite numbers staying low. .

There is research by private companies which shows oils control mites. I suspect for it to be effective there needs to be no use of broad spectrum sprays to maintain a predator population and possibly no use of copper sprays to maintain a lady bird population which may be a predator of six spotted mite.

Good coverage is absolutely essential. Getting to the tops of 10 metre trees is difficult. We spray the trees twice. Once with 3 bottom nozzles and 3 top nozzles in the volute of 400psi and then the second time with just the 3 top nozzles at 600psi.

Spray oil will also control thrips. We solely used oil in 2003/2004 and 2004/2005...

In some work from the Centre for Horticulture and Plant Science, University of Western Australia they showed by coating Valencia oranges with DC Tron Plus Oil and then exposing the fruitlets to greenhouse thrip the damage on the control was **38.11%** of the area, 0.5% oil was **0.95%** of area, 1% oil was **.16%** of area and 1.5% oil was **.01%** of area.

The oil stopped the feeding by larva and adults and oviposition by adult females. It reduced the numbers of the adult thrips and the number of larvae but did not eliminate them.



Mode of Action on Six Spotted Mite

When spraying oil for mite control you do not see any evidence of mites being killed or their numbers being drastically reduced quickly. Rather over a period of weeks/months the population declines. It seems to me that rather than killing six spotted mites, it is creating an environment where they can't live. Maybe it is destroying the eggs. Maybe the eggs can not attach to the leaf due to the oil or maybe they can not effectively feed due to the oil. I do not know the answer but it definitely is not the quick fix we have got used to with other chemicals

When to Spray

The other issue with mites is when to spray. I think a nil population is unrealistic and they are a pest we can tolerate in low numbers and their population does go up and down naturally. My experience is the same spots get affected first and get the highest degree of infestation. On our home orchard these are a tree that has fallen over and is still growing, against the shelter on the Southern boundary and where 2 trees are touching. Shade and stress seem to be the key hot spots.

We were spraying every time the population started rising initially. Now we spray if over 25% of leaves have mites with numbers greater than 3 per leaf.

In September 2005 we experienced leaf drop after a sustained period of relatively high mite levels and mite levels were above the preset threshold. We sprayed with mitemec plus .5% oil. I believe Mitemec and Avid fit well with an oil spray programme as they are both very selective and do not kill beneficial insects.

We also trailed Mitemec and .5% oil in June 2005 on one block. It was more effective than just oil but took four weeks for a reduction in mite numbers.

Concentration

We have used 0.5% concentration with mineral oil and predominantly used DC Tron Plus. We have had no sign or symptoms of photo toxicity. With fish oil we use 1% and use Sealord's product

New Chemistry

There is a new generation of chemicals coming on stream now that have the advantage of being very pest specific with nil toxicity and often have a systematic residual effect. Examples of this being Calypso and Actara in Kiwifruit and Mimic, Success, Calypso, Mitemec and Avid in Avocados.

Alternative Fungicide

There is a dilemma in the avocado industry at the moment with the need for an alternative fungicide to copper to control anthracnose. Spray Oils are used in numerous other industries as fungicides. They may have a role to play in avocados.



Sunlight, nature's fungicide

Orchard Performance

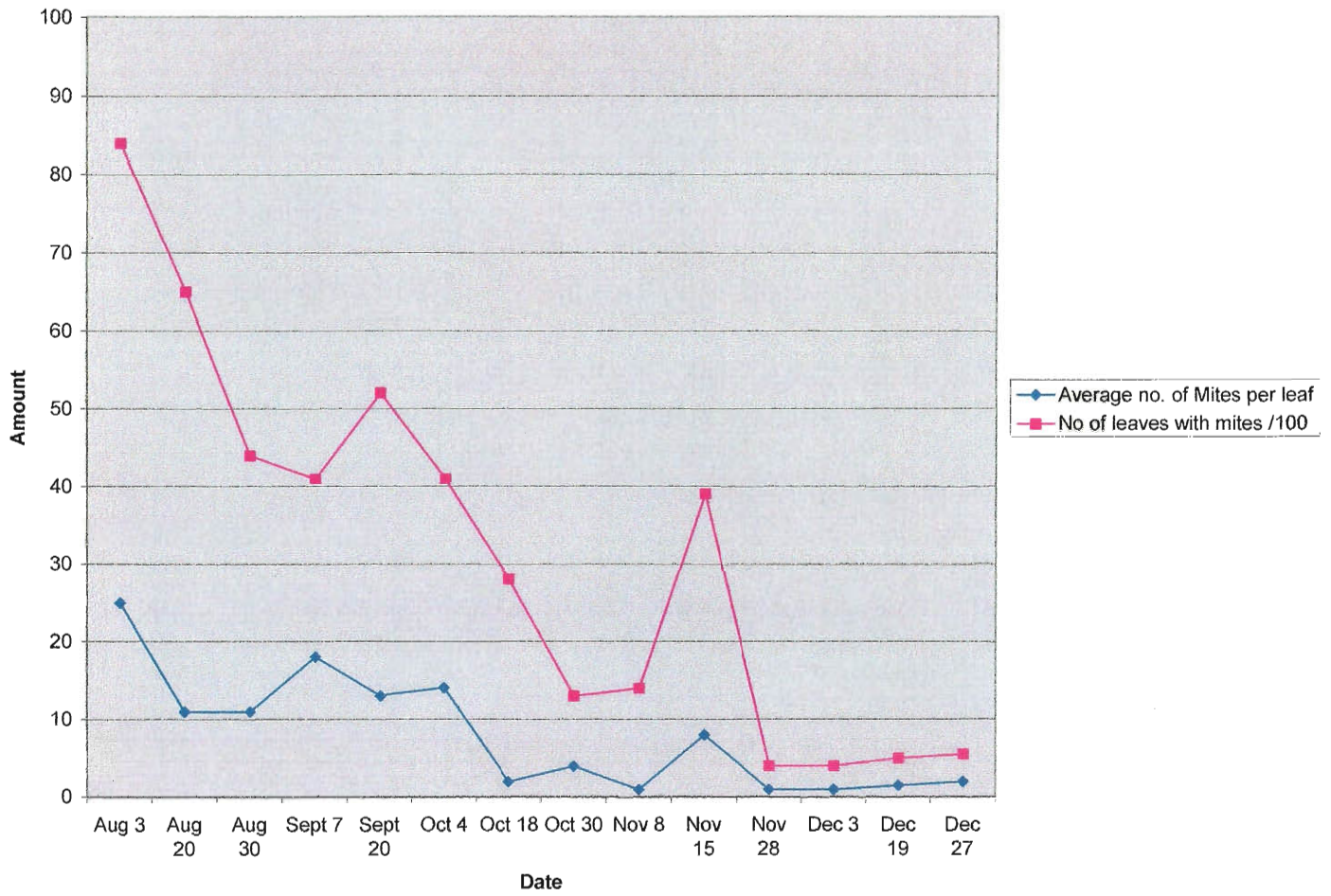
We have two avocado orchards that we use an oil based programme on. The mature orchard is well located on the North East of Whatitiri Mountain and is a high performance orchard with production above average on its on years and better than most in the district on the off years. It is in a bi-annual bearing pattern as is most of Whangarei which is a concern. The 9 year old orchard is located on Otaika Valley Rd and is increasing in production this year doing 2500 trays strip picked in July off 280 trees with 92% going Tag 1. The spray programme at Otaika Valley consisted of two sprays, one oil/mimic/mitemec at flowering and a mimic/oil one month later.

Mature Orchard

Season	Total Production (Trays)	Total Tons/ Ha
2005/2006	20,000 (estimate)	22
2004/2005	5,000	5.5
2003/2004	10,000	11
2002/2003	21,000	23.1
2001/2002	13,000	14.3
2000/2001	21,000	23.1

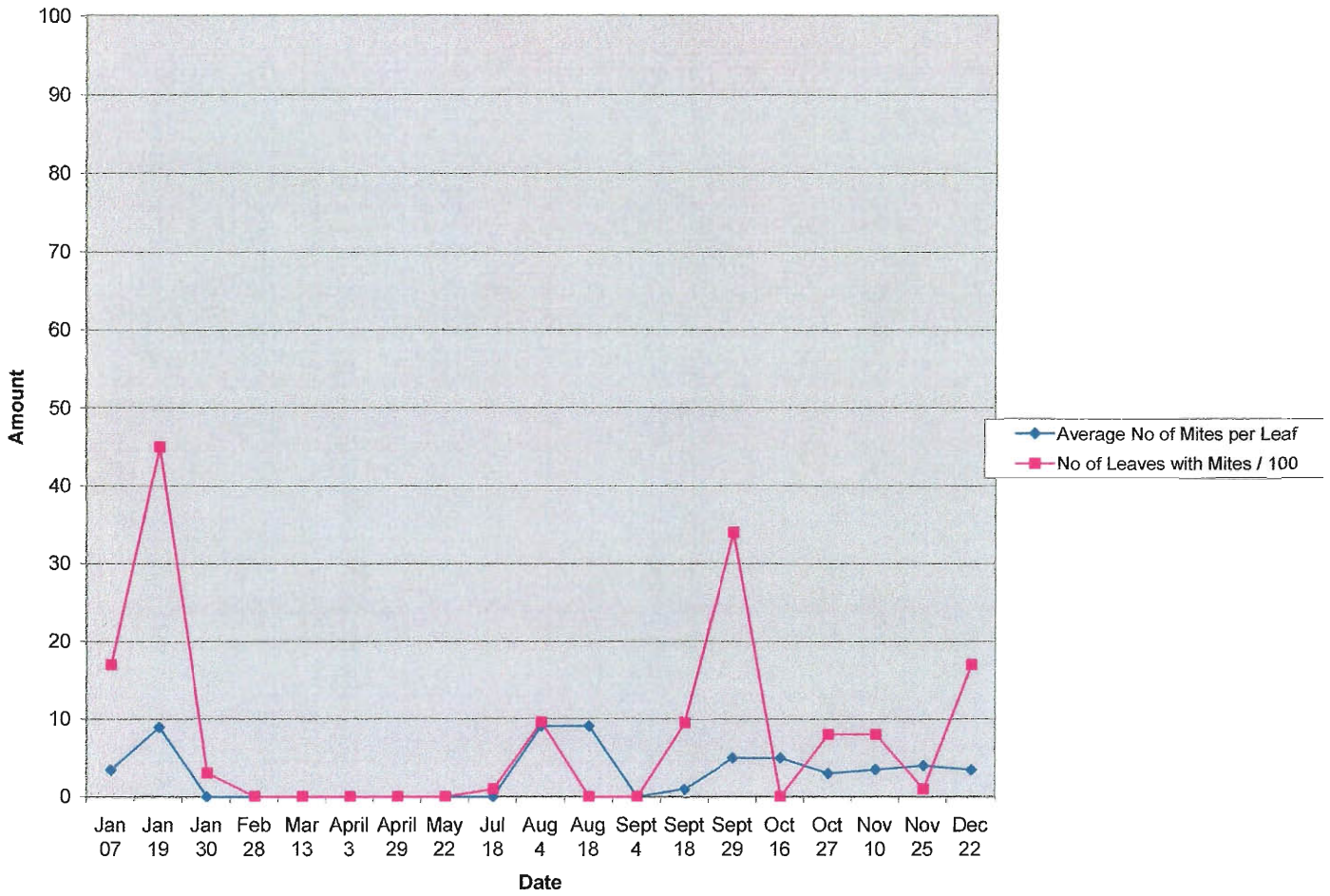
Oil has been used from 2002/2003 onward. I do not believe it has affected orchard performance. The packout has varied between 50% to 97% Tag 1 with the major reject factors being ridging and opossum chewing.

Tatton Rd Mite Levels 2002



Sprays Applied- 15/8/02-[.5% crop oil](#) 26/9/02--[.5% crop oil](#) 8/10/02 – [Oil@.5%](#) plus BT
 26/11/02--- [Oil@.5%](#) plus BT

Tatton RD Mite Levels 2003



13/2/03--- [Oil@.5%](#) plus Success

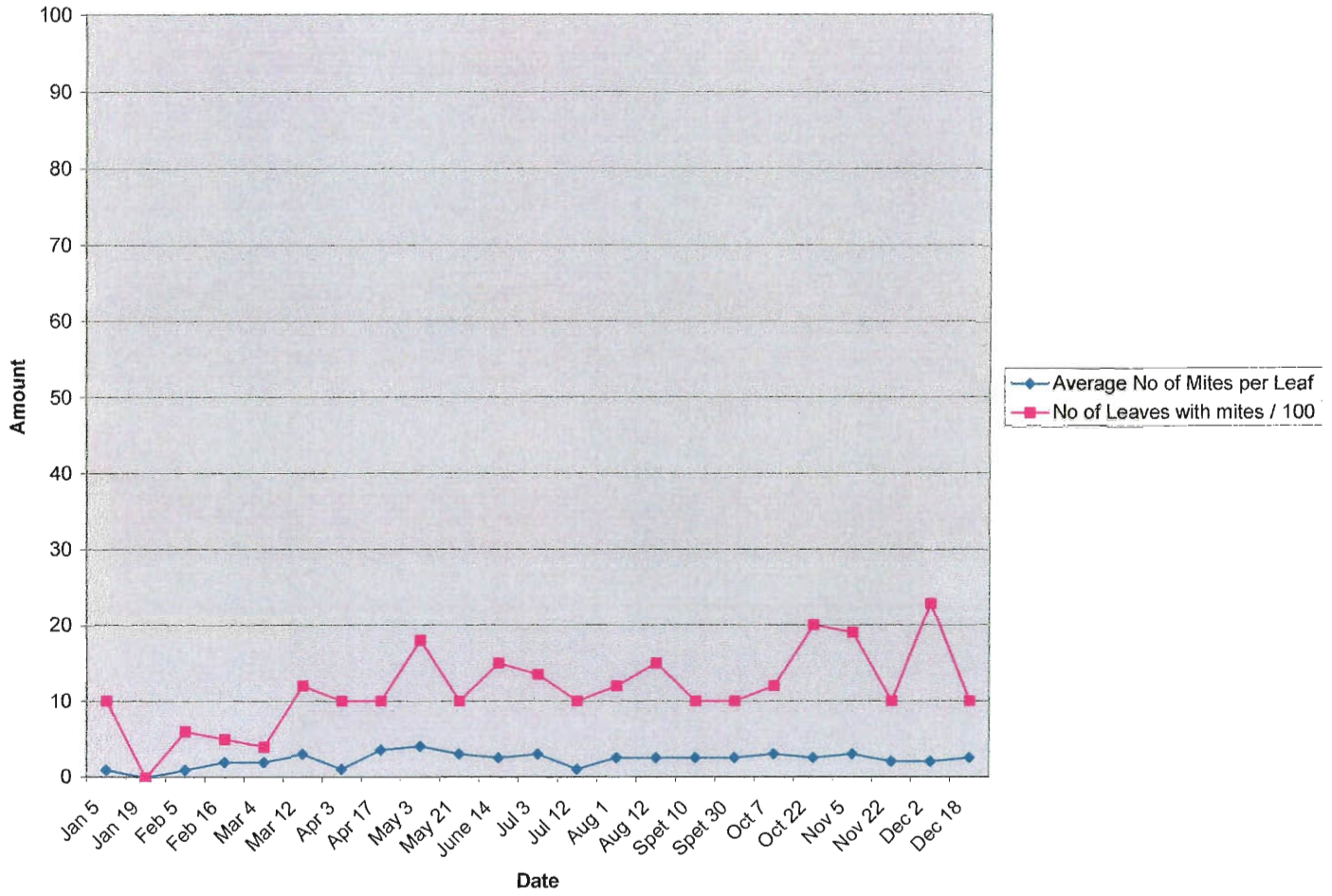
9/4/03---- [Oil@.5%](#) plus Success

3/8/03--- [Oil @.5%](#)

29/9/03 --- [Oil@.5%](#)

[19/10/03---Oil@.5%](#)

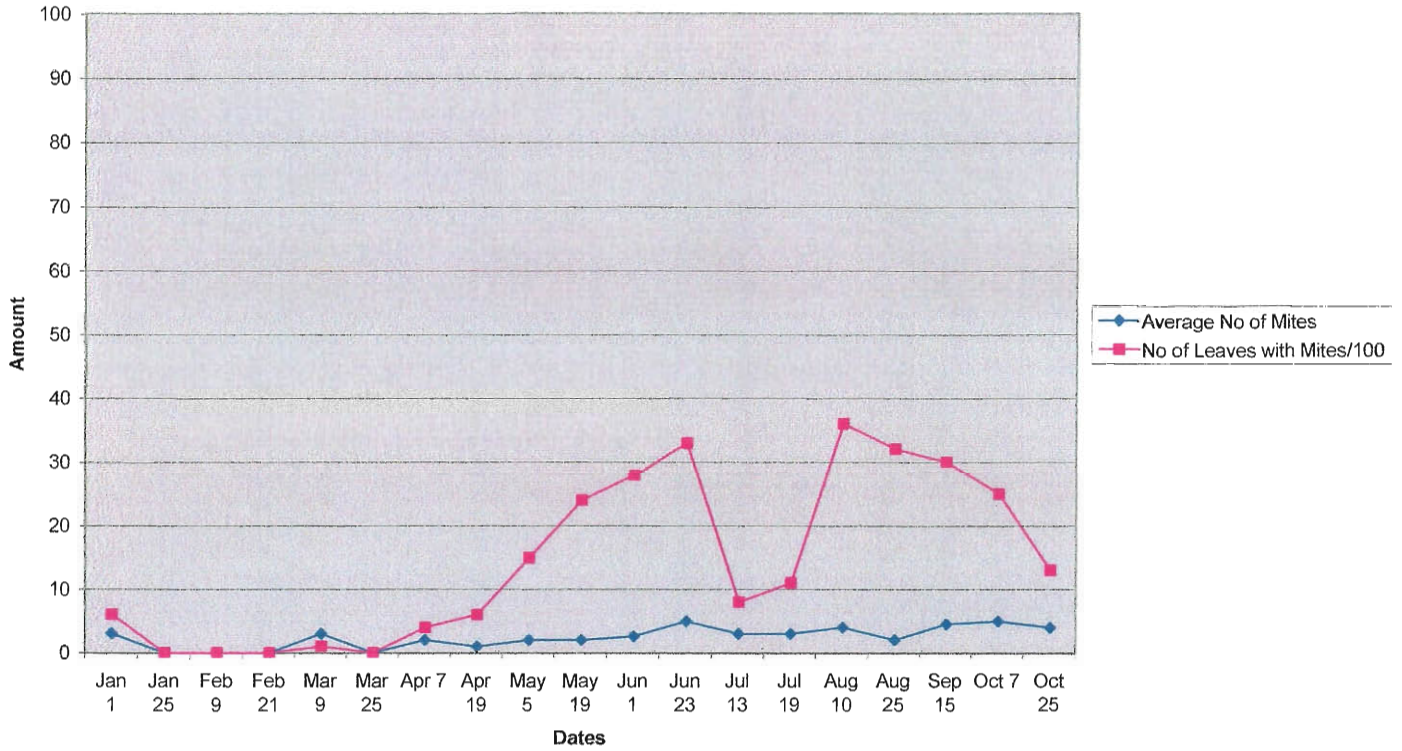
Tatton Rd Mite Levels 2004



18/3/04--- [Oil@.5%](#)

18/11/04--- [Oil @.5%](#)

Tatton Rd Mite Levels 2005



11/2/05 Success 15/3/05 Calypso 28/3/05 Success 9/6/05 Fish Oil Trial
 13/9/05 Mitemec/Oil @.5%

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Armoured Scale and Leaf roller Management on Kiwifruit – A Preliminary Analysis of Industry Data"

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Predicting Scale Insect Phenology on Kiwifruit – A Preliminary Analysis

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Spray Oil Beyond 2000 – Sustainable Pest and Disease Management

Leading Growers

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