

Mango budmite and Fusarium malformation in mango.

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Mango malformation

Mango malformation prominent in most mango orchards

Continuous presence and/or increase in incidences and/or severity

Initially mango spray programmes included a single bromopropylate application

Mango bud mite infestations proved negligible (isolated occurrences and/or low pest pressure)

Initial registration trials conducted on nursery plants only (2015/16 & 2016/17)

Systematical increase in mango malformation despite bromopropylate applications

Causal agent and/or relationship between bud mite and *Fusarium* questioned

Mostly attributed to *Fusarium* infections (bud mite only aiding in spread / establishing infections if present)

Mango bud mite control generally ceased

LIMA (Potassium phosphate (phosphorous acid equivalent: 400 g/ℓ)) registration trials commenced 2014/15

Apparent reduction in efficacy over time

Irregularities in infection patterns (incidences / distribution) reported

LIMA 560 SL product properties = negligible break-down PLUS internal distribution

For this reason application to coincide with flushing period

MRL's restricting export

None / negligible *Fusarium* control (until resolved) resulting in increase in infection severity & spread

None / negligible bud mite control resulting in excessive population build-up & spread

Irregular manifestation - infection and/or infestation



Mango flower malformation vs. bud mite

Most often simultaneous (*Fusarium* malformation enhanced by mites)

Mites **transport** fungus (spores) to apical buds

Conidia of pathogen do not cling to any specific body part

Feeding wound act as penetration site for disease

Adult bud mites are microscopic (0.2mm in length)

Cylindrical in shape, whitish in colour

Live year round in **closed adventitious buds** on tree trunks & branches

Move onto terminal bud(s) during periods of population increase

Do not prefer axillary buds

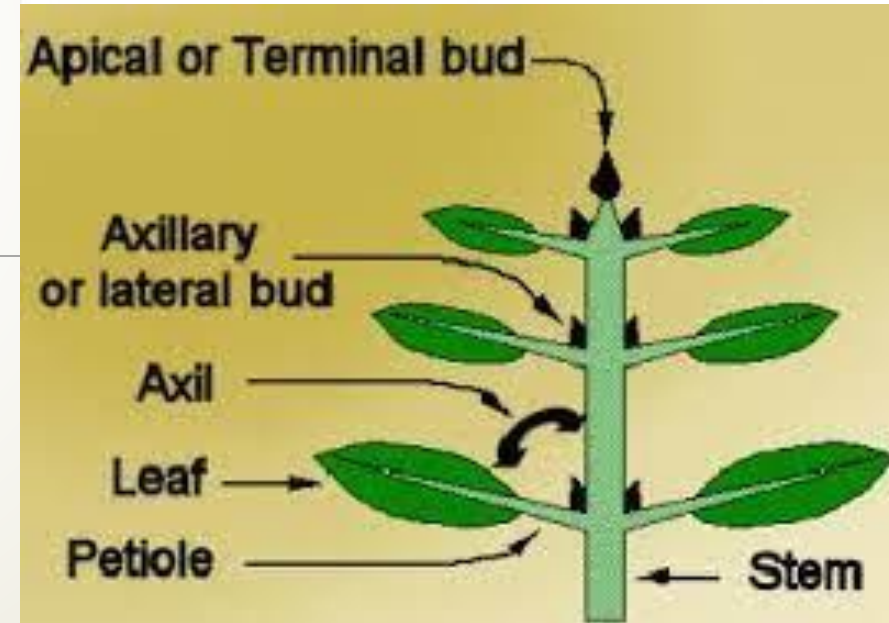
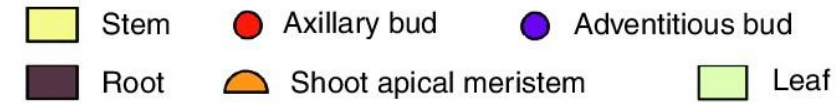
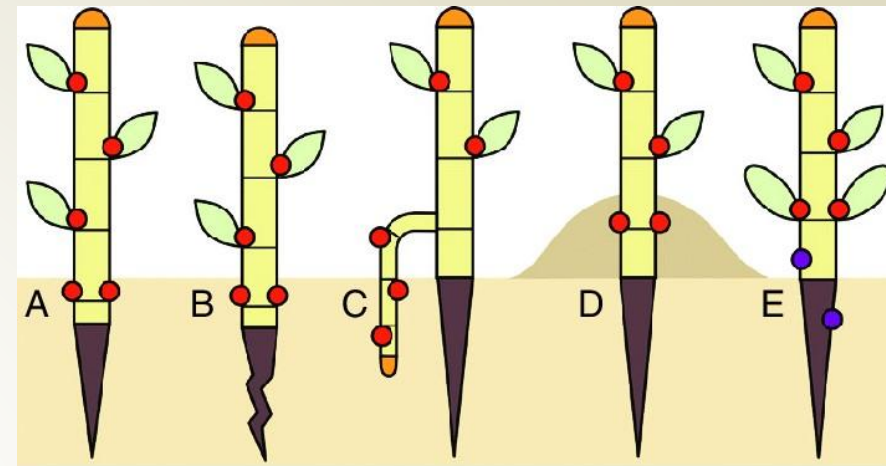
Approx. 8 generations / year, distinctive peaks in Spring & Autumn

Adventitious bud: The bud occurring elsewhere on the plant (such as on trunks, roots, or leaves) except from the leaf axils, stem tips and plant apices

Terminal bud: The bud located at the tip of a stem

Apical bud: The bud located at the top of the plant

Axillary bud: The axillary bud (or lateral bud) is a shoot located in the axil of a leaf



Fusarium (mangiferae)

E. Gamliel-Atinsky, *et al.*, **2009** . Infection Dynamics of *Fusarium mangiferae*, Causal Agent of Mango Malformation Disease. PHYTOPATHOLOGY, Vol. 99, No. 6

Conidial (asexual spores) germination and colony growth requires at least >5°C (Peak at 25°C and 28°C respectively)

Minimum 2h wetness period required for conidial germination (Peak after 8h of wetness)

High incidences of fungal colonization in **apical (terminal) buds**

Significantly less in lateral (axillary) buds

Higher in node sections (containing lateral buds) than internode sections (between lateral buds)

(Systemic) colonization behind (infected) apical parts minimal (Reduction as plant grow past initial infections)

Colonization negligible in branches & leaves

Infected soil = infected roots, but no manifestation in above-ground plant parts (**no systemic movement**)

Not typically soil borne (rapid decline in viability of conidia)

Wind borne (general presence on all plant parts but targeted landing sites (apical buds) needed for infection)

Inflorescence malformation

Short, thick, branched axes of the inflorescence, larger flowers, increased number of male flowers.

No fruit = yield losses

Vegetative malformation

(Cell) enlargement of young shoots, shorter internodes, dwarfed malformed leaves

Overall tightly bunched appearance of infected shoots

Mango bud mite (*Aceria (Eriophyes) mangiferae*)

Badawi A. ABOU-A WA, [1981](#). Ecological and Biological studies on the Mango Bud Mite, *Eriophyes mangiferae* (SA YED), with description of immature stages (Eriophyoidea: Eriophyidae), *Acarologia*, t. XXII, fasc. 2

Egg

Oval, 30-35µm long & 18-25µm wide, whitish translucent

As incubation proceed the egg enlarge and became more translucent before hatching (4 – 7 days)

Larva

105-125µm long & 32-36µm wide, translucent white (4 – 5 days)

First instar nymph

Elongated worm-like appearance, 125-145µm long & 37-42µm wide, whitish in colour (3 – 4 days)

More active than larva

Females develop from fertilized eggs, males from unfertilized eggs

Male slightly smaller than female

Approx. 2 days activity before settling in terminal buds

Egg laying on day 3 (laid in groups under budleaf scales)

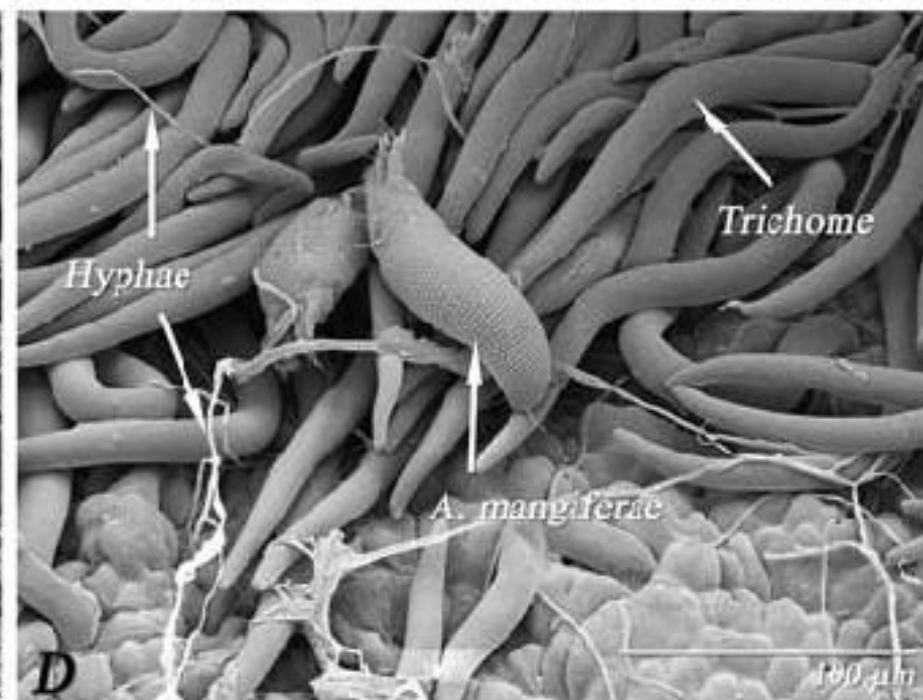
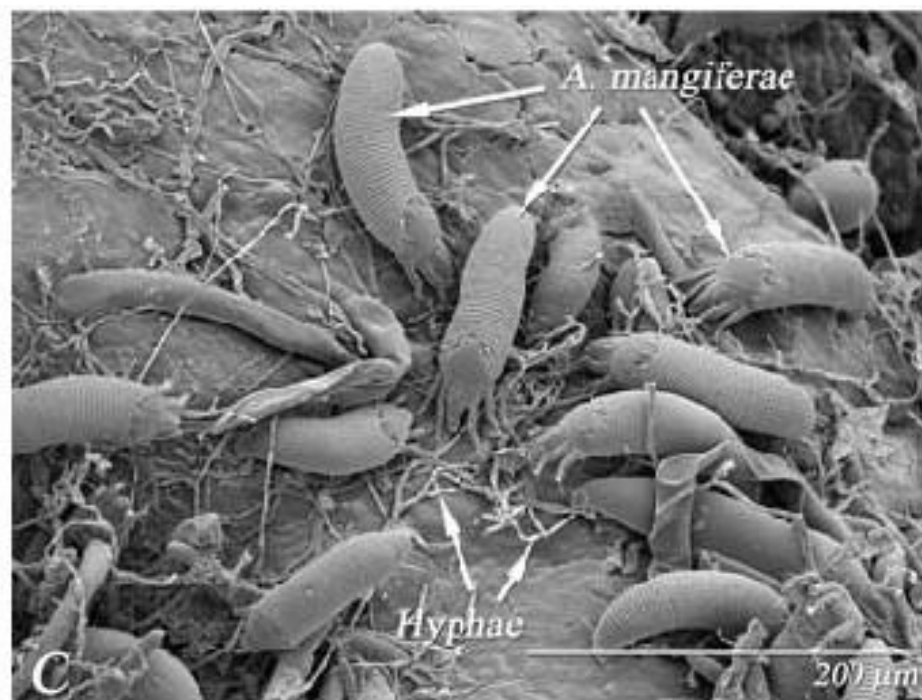
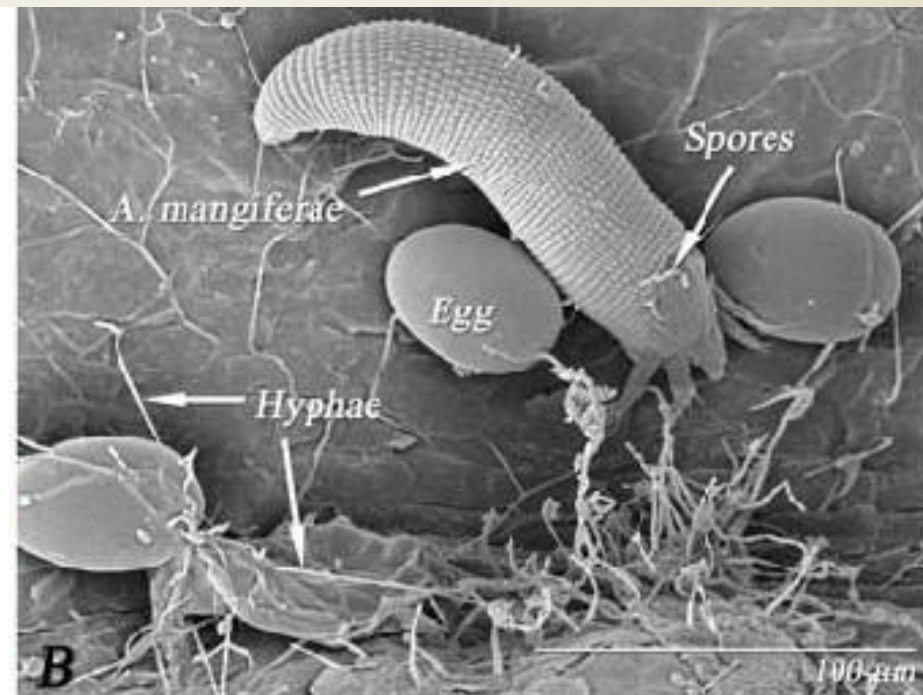
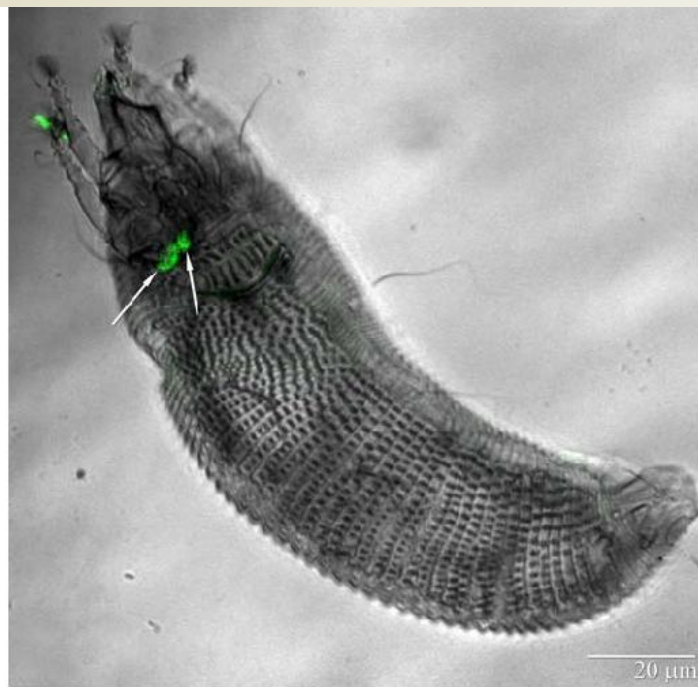
Generation period (egg to egg): [2 – 3 weeks](#)

[Twice as long during winter months](#)

High (summer) T = adverse impact, no correlation with RH

Attack [terminal buds](#) of young and old trees

Causing bud malformation, [stunting of inflorescences](#), twiggy and/or stubby branches



Vegetative malformation



Remnant vegetative malformation – source of infestation / infection



Fusarium vs. bud mite malformation



Fusarium vs. bud mite malformation



Fusarium vs. bud mite malformation



Nursery trials 15/16

Investigate effect of miticides on terminal branching

2 applications @ 14-day interval (restricted application for resistance management)

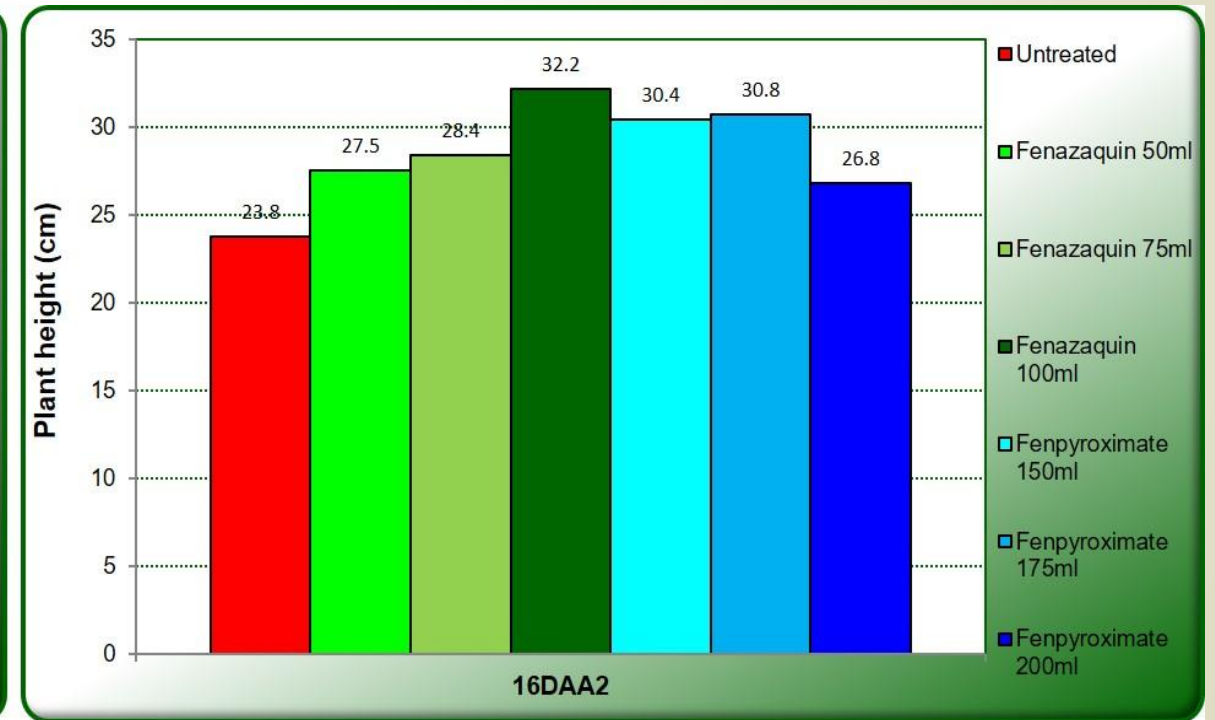
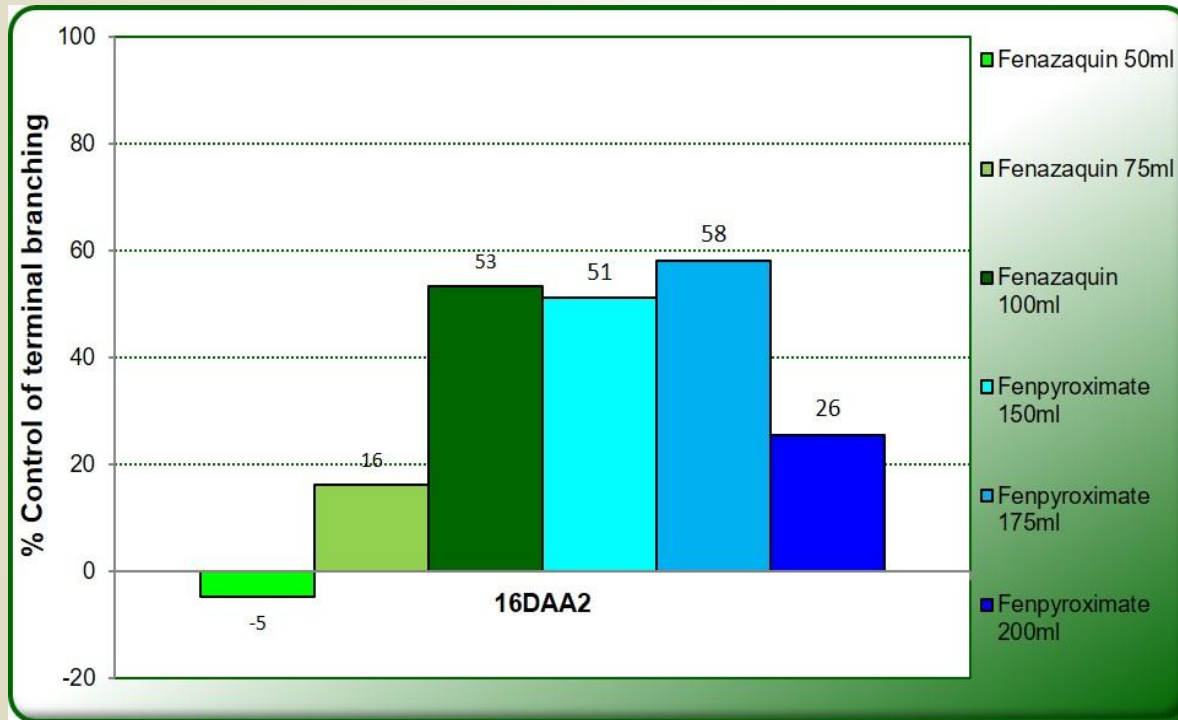
Determine % reduction in terminal branching & avg. plant height

Lower application rates of Fenazaquin ineffective

Some terminal branching present at time of initial application

Timing NB (initial bud break)

Prevent (earlier) feeding damage to manifest (later) during plant growth



Mango bud mite - nursery



Nursery trials 16/17

Investigate impact of adjuvant (spreader/sticker)

2 applications @ 14-day interval

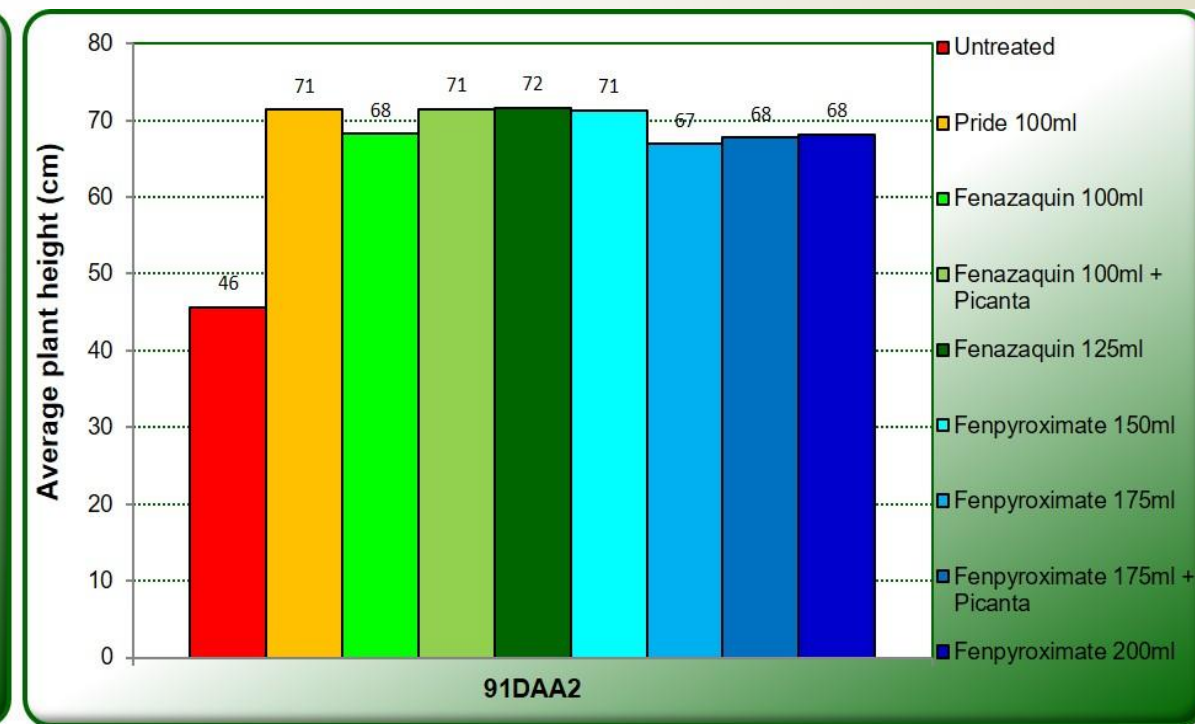
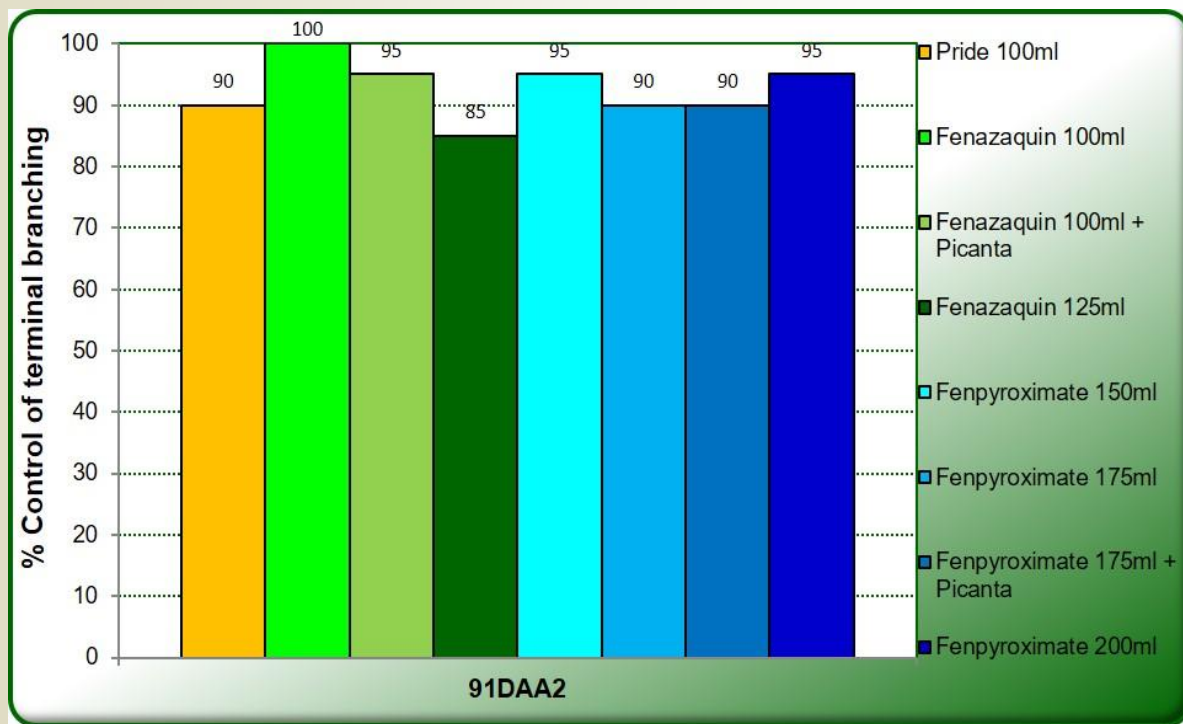
Determine % reduction in terminal branching & avg. plant height - allow sufficient growth time

All treatments with prominent reduction in terminal branching (malformation)

Earlier application (with bud break) preventing (later) manifestation of (earlier) feeding damage

Higher number of single stem seedlings with prominent increase in plant height

Spreader / sticker (Picanta) with no apparent increase in efficacy of control



Field trials 18/19

Orchard infestations wide spread & prominent within 2 year period (16/17 – 18/19)

2 applications @ 14-day interval + 2 additional applications for extended flowering period

Hoedspruit & Letsitele Valley, Cv. Keitt - Determine malformation as % of all flowers produced / tree

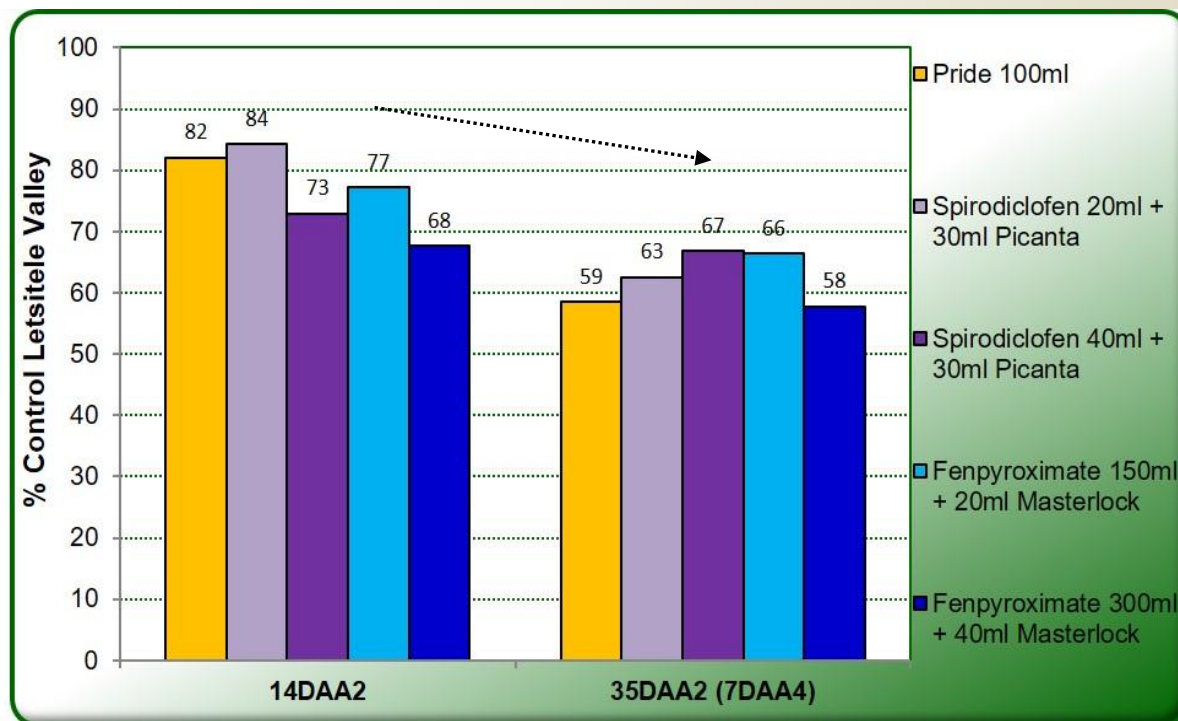
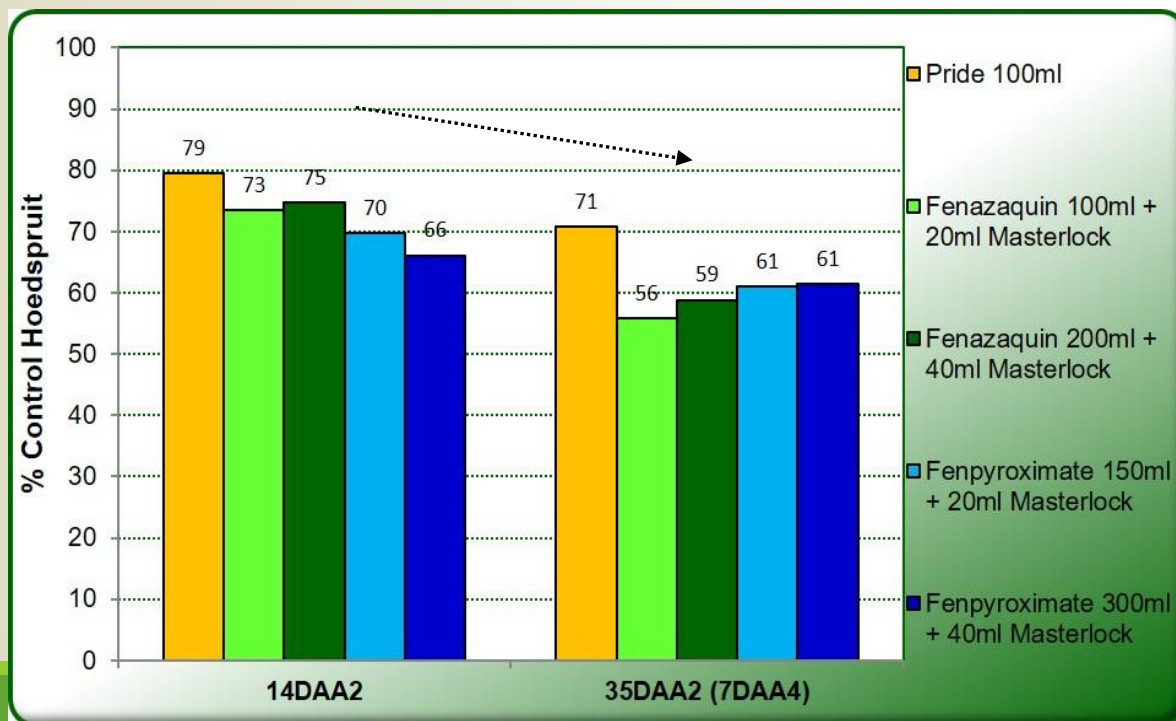
Prominent reduction in malformation but not absolute control - high initial populations vs. spray efficacy

Timing of application (bud break) difficult with uneven flower

- If commencing with 1st buds: high number of applications to cover whole of flowering period

Slight decline in efficacy over time - population increase > chemical control vs. *Fusarium* malformation

Assessments concluded at 7DAA4 (full flower) - difficult to distinguish between bud mite & *Fusarium*



Field trials 19/20

Same trial sites - **determine carry-over effect**

2 applications @ 14-day interval + 3 x winter LIMA 560 SL – resistance management + *Fusarium* control

Prominent reduction in malformation but not absolute control – extent of remnant colonies vs. spray efficacy

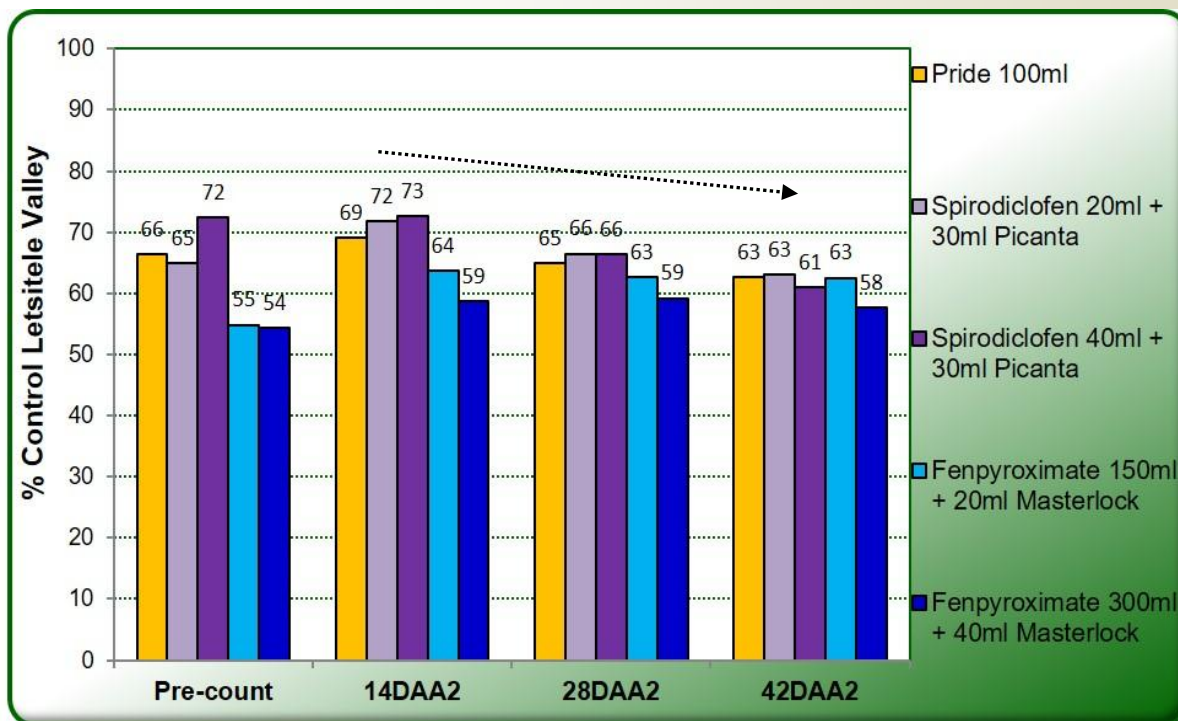
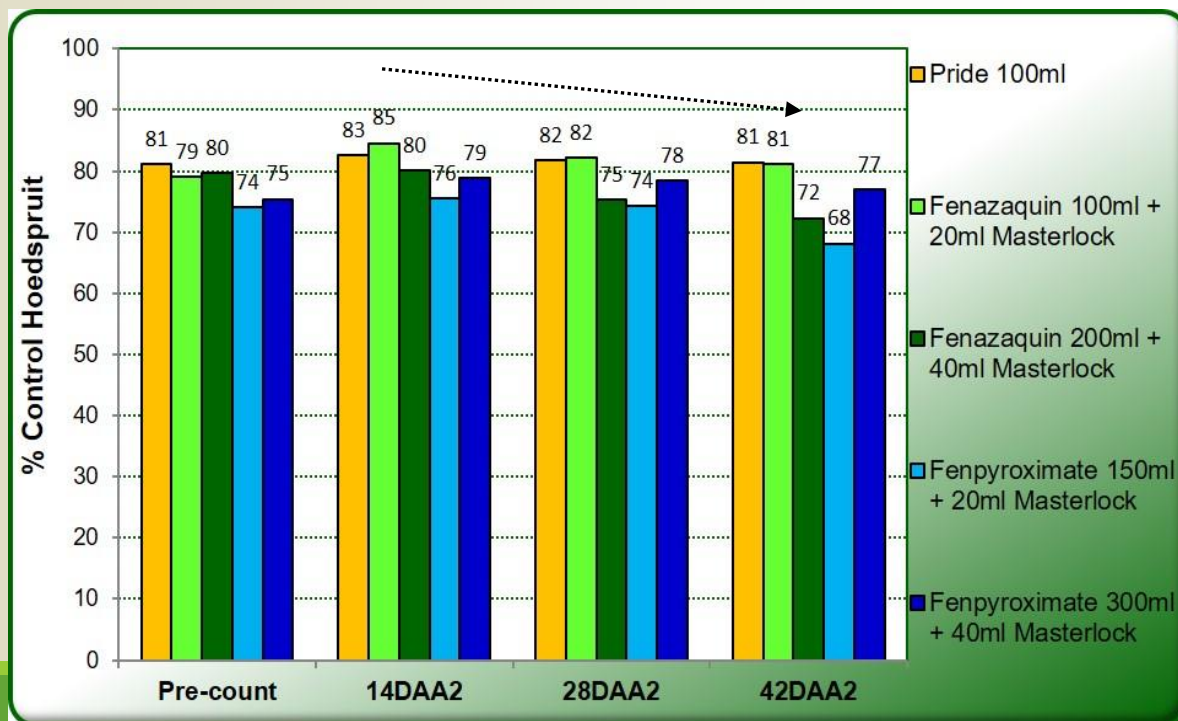
Prominent carry over effect – pre-count (4 applications in 18/19 season)

Cost effective control in Hoedspruit vs. no post-harvest pruning in Letsitele Valley stressed importance of pruning

Slight increase in efficacy after initial applications - chemical impact @ 14DAA2

Slight decline in efficacy over time – population increase > chemical control (*Fusarium* reduced with LIMA)

Uneven / long flowering necessitates more applications to cover whole of flowering period (2 appl. insufficient)



Field trials 20/21

Hoedspruit trial site only - determine carry-over effect (3^d year running)

Noticeable carry over effect: pre-count < 19/20

2 appl. insufficient to ensure seasonal control (population increase > che. control = population build-up)

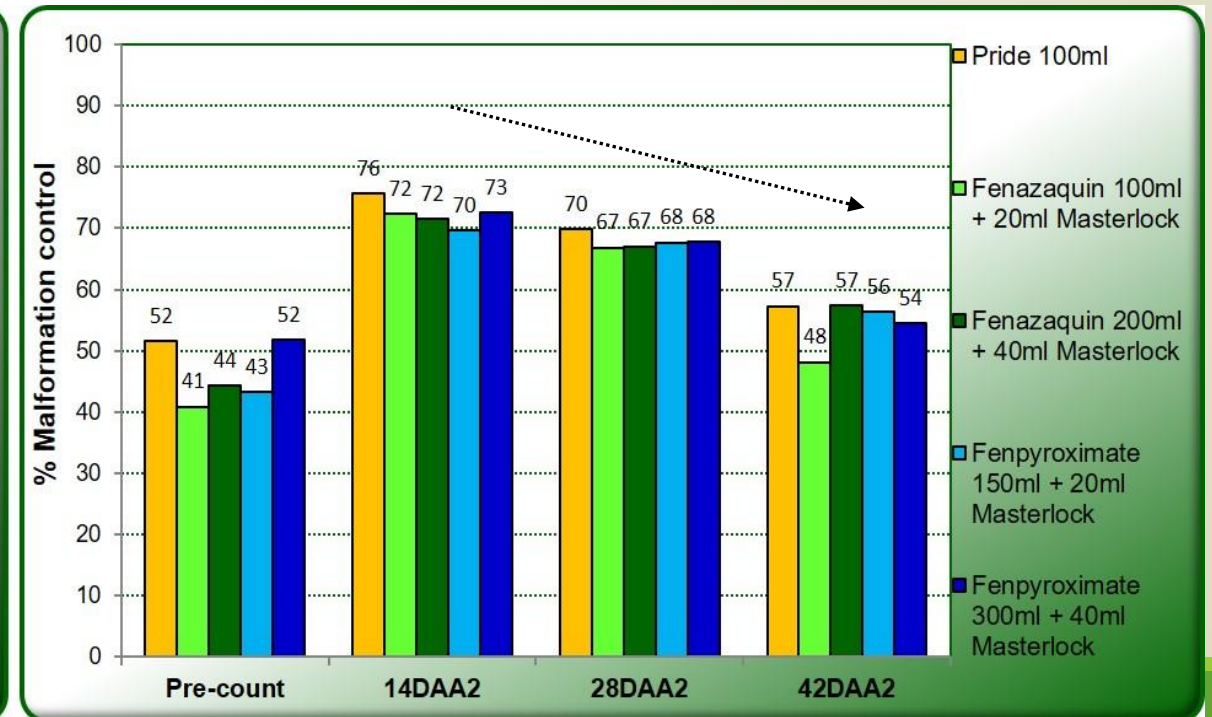
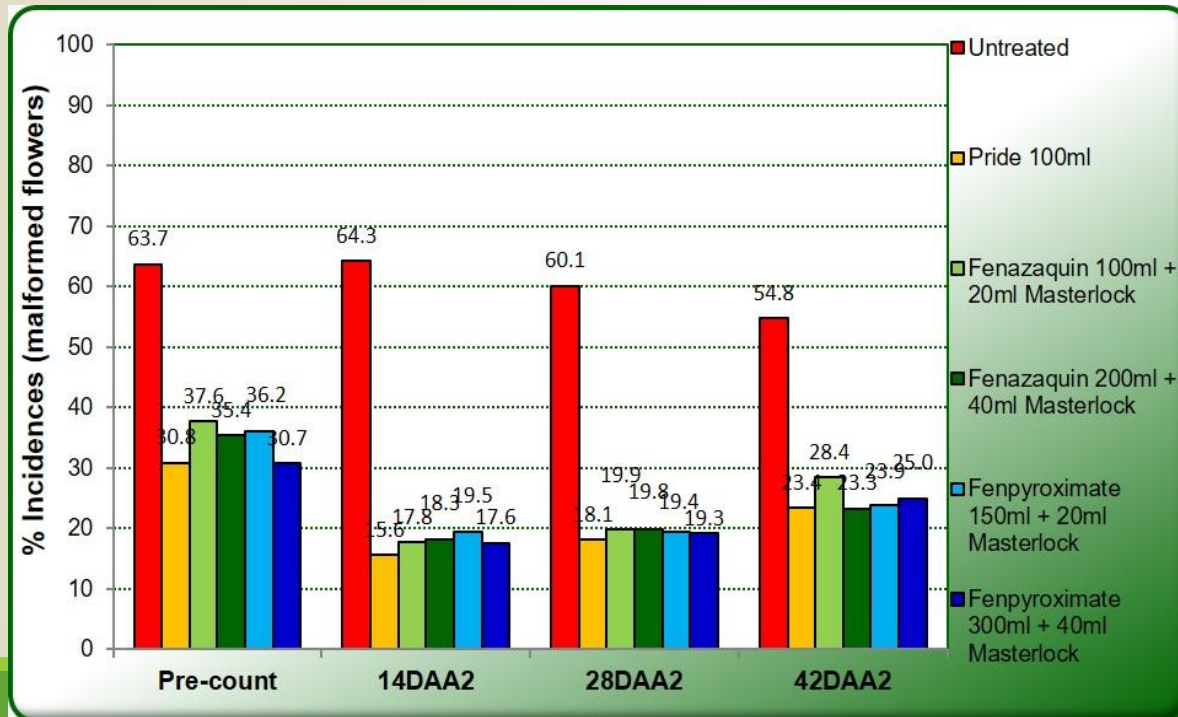
Confirmed by reduction in efficacy over time

Prominent reduction in malformation but not absolute control

Post-harvest pruning not absolute (difficult to remove all infected material) = source of infestation / infection

Spray efficacy (difficult to ensure thorough coverage / run-down into (all) reproductive / vegetative buds

Ineffective *Fusarium* control with only 3 x LIMA (winter) applications



Pruning to reduce infections / infestations not absolute



Additional field trials 19/20

Hoedspruit – Hoogland, Cv. Keitt

Various miticides (+ Masterlock) + 3 x winter LIMA 560 SL – *Fusarium* control

Physical removal vs. 2 x (14-day) “winter” applications – with 1st post harvest flush

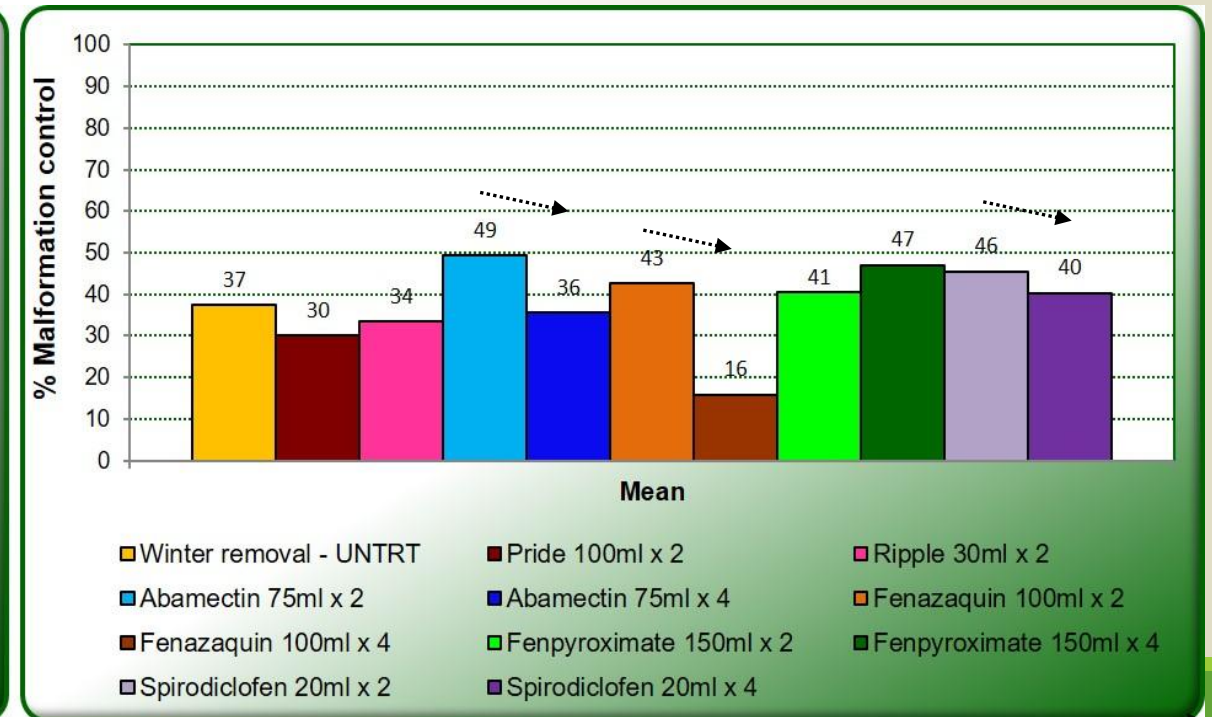
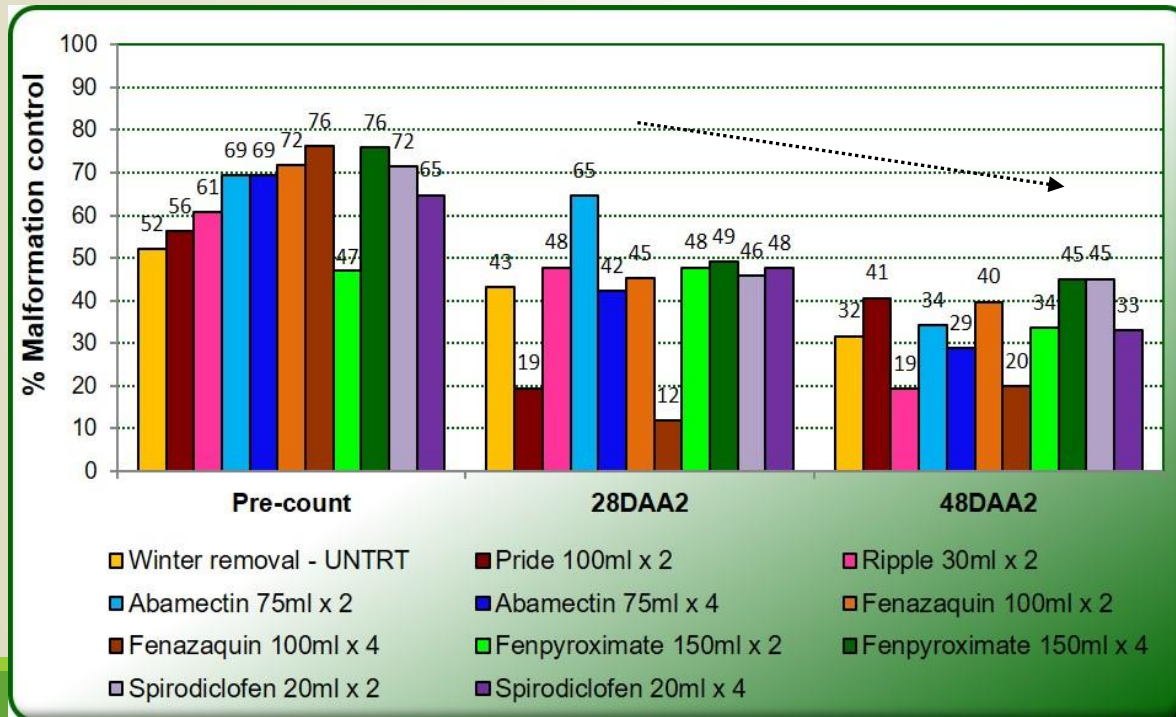
All treatments with 2 x (14-day) “in-season” applications – AFTER onset of flowering (pre-count)

Apparent inefficacy after in-season application – influenced by severity of initial infestation levels (remnants)

Severity (size) of remnant colonies impacted (variably) on efficacy of control (population growth >> che. control)

Physical removal (2x che. appl.) generally > winter appl. (4x che. appl.) – removal of whole remnant > spray efficacy

General slight decline in efficacy over time – continual population increase > chemical control



Severity of pre-existing infestations influences severity of subsequent infestations



Additional field trials 20/21

Carry over effect (3 x winter LIMA 560 SL = *Fusarium* control)

Physical removal of infested material in ALL treatment plots

Physical removal vs. Removal PLUS 2 x (14-day) “winter” applications – with 1st post harvest flush

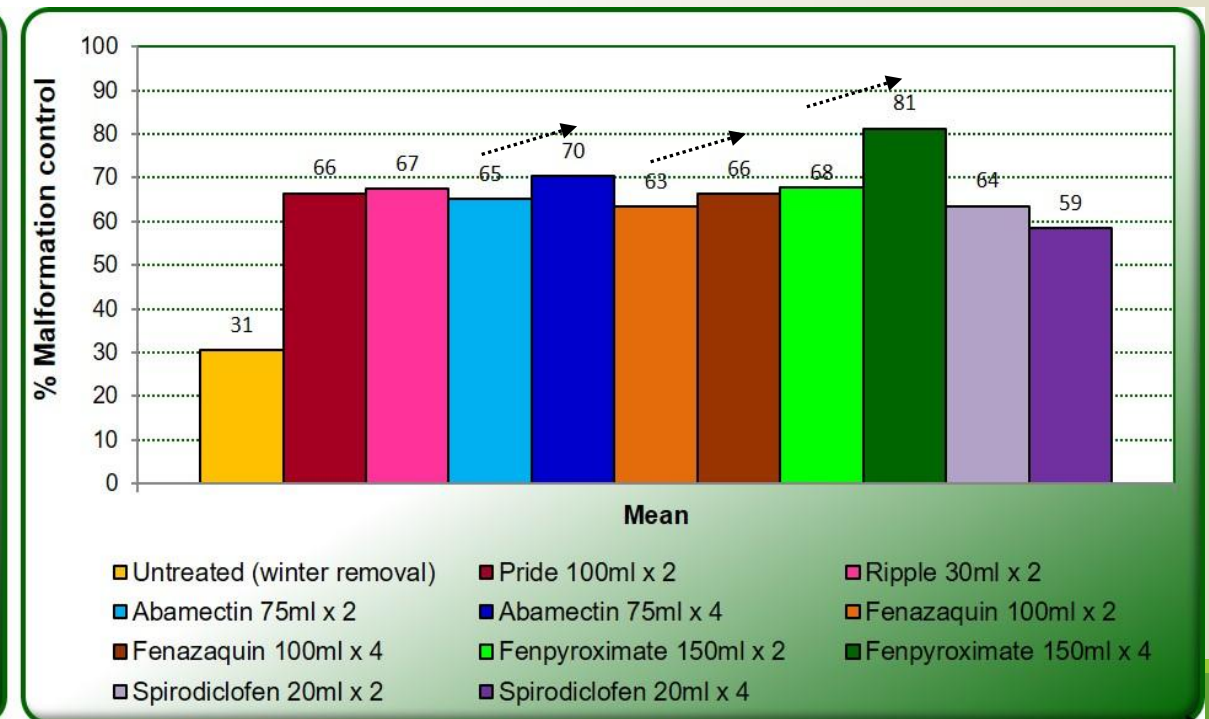
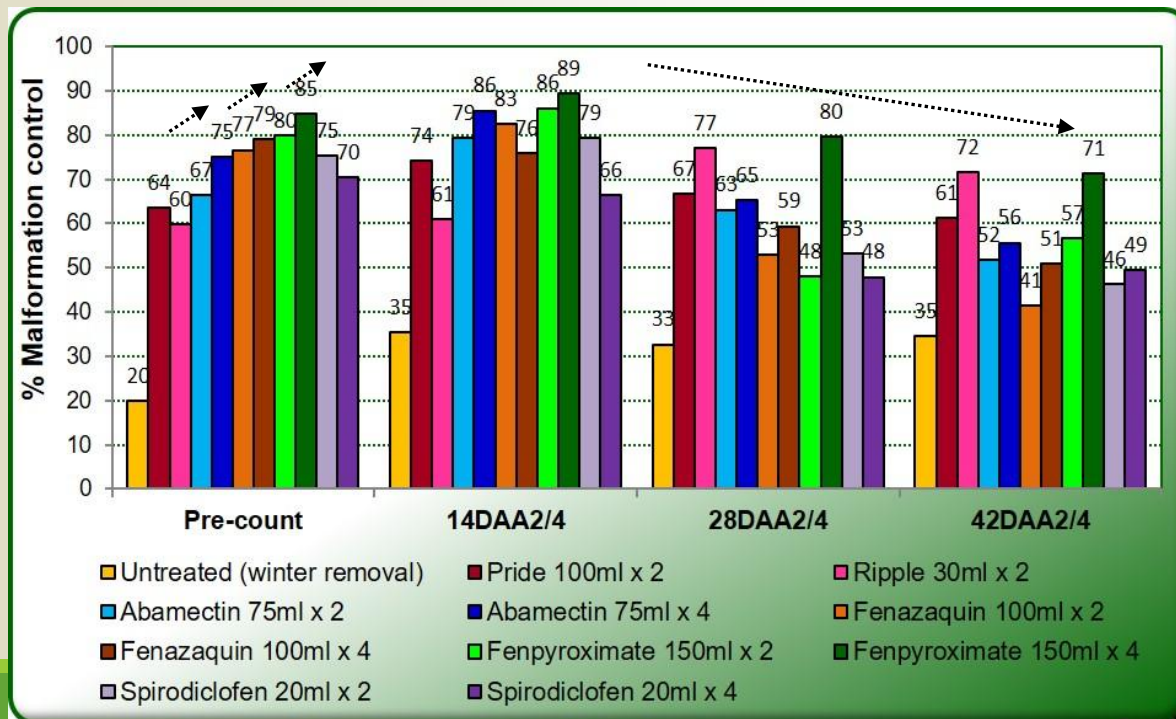
All treatments with 2 x (14-day) “in-season” applications – with onset of flowering

Slight carry over effect – pre-count 20/21 > pre-count 19/20

Physical removal (2x che. appl.) generally < Removal + winter appl. (4x che. appl.) – variability = efficacy of pruning

Suppression rather than control after 2 years – population increase > chemical control

General slight decline in efficacy over time – 2 applications insufficient to render seasonal control



Conclusion:

Mango bud mite – very difficult to control

Location (difficult to ensure effective chemical contact within (developing) buds)

Population growth for whole of season vs. chemical control during (early) flowering period only

Tree density (spray penetration) always NB

Timing imperative (with initial bud break)

Relationship between *Fusarium* malformation and mango bud mite = complex

NB to combine with LIMA (export MRL's still to be finalized)

LIMA applied with every new flushing stage (20%)

Minimum 5 applications (TA) to maximum 7 applications (Keitt), Last application 50DBH (MRL = 50ppm)

Removal of infested / infected plant material imperative

Physical removal of infested plant material from orchard to prevent (aerial) re-distribution of mites

Currently looking into (extended) chemical control throughout flowering period

6 in-season appl. + removal of infested material post-harvest + 2 x Abamectin applications post-harvest

14-day spray interval coinciding with new generations (2 – 3 wks)

Alternate products for resistance management

Abamectin end season with bud break to ALSO combat gall fly infestations

Bud mite localized (negligible external influxes and population increase generally limited to specific area)

If eradication can be achieved, orchard should remain pest free for the foreseeable future