



**AUSTRALIAN
TECHNOLOGIES**
COMPETITION
Food & Agritech Winner 2015

BOOSTER-MagTM

Productivity, Simplicity,
Safety, Sustainability



Calix

The Evaluation of BOOSTER-MagTM in Field Processing Tomato Production

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Product:

- concentrated (50% w/w) magnesium hydroxide suspension
- magnesium carbonate ore and advanced mineral processing technology
- diluted and sprayed using conventional equipment (0.5 - 2 % a.i v/v)

Active:

- micron scale active particles – 90% passing 20 micron
- nano-characteristics; high porosity and high energy surfaces
- bio-active; pathogen and insect pest inhibition ¹

Function:

- foliar fertiliser; augment magnesium where deficient
- crop protection; provide control of plant pests and pathogens ²
- grower productivity, safety and sustainability

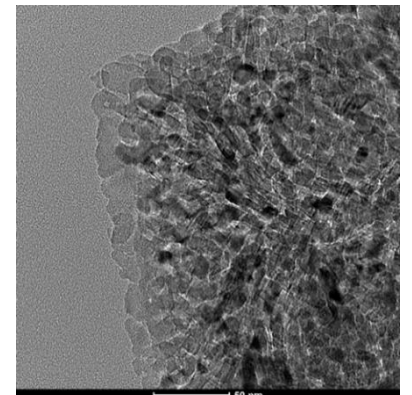
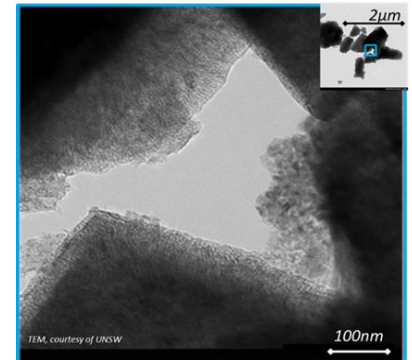
Safety, environment and residues:

- low human and aquatic toxicity ³, no phytotoxicity ¹
- non-hazardous and non-dangerous (Safe Work Australia), MRL exempt ²

¹ Published studies of nano-MgO and Independent BOOSTER-Mag in-vitro and field evaluations

² Subject to APVMA registration (underway)

³ Public domain Mg(OH)₂ toxicology data. To be confirmed by acute toxicity (6 pack) study of BOOSTER-Mag (underway)



Trial #	Location	Client	Crop	Target	Observations
1	Australia	UNSW	-	T.S Mite	2015 Complete; Equiv. control c.f pyrethrum, no mite mortality
2	France	Staphyt	Grape	Downy & Powdery Mildew	2015 Complete;
3	Philippines	FPA*	Corn	Yield	2016 Complete; 32% ↑ in yield c.f .control
4	Philippines	Grower	Rice	Yield & Rice Borer	2016 Complete; Borer damage limited to 40% c.f. control (>90% loss).
5	Philippines	PhilRice*	Rice	Yield & Rice Borer	2016 Complete; Borer damage limited to 40% c.f. control (>90% loss).
6	France	Vivescia*	Corn	Corn Borer	2016 Complete; Inconclusive; insufficient pest incidence / pressure
7	France	Compas*	Grape	Powdery M	
8	Australia	Peracto*	Egg Plant	Silver Leaf	
9	Australia	Peracto*	Roses	Two spott	
10	Australia	Peracto*	Cucurbits	Powdery &	
11	Australia	Peracto*	Cucurbits	Hemiptera & Mosaic Vir.	Equiv. statistically significant control of Thrips. 25% ↑ in yield
12	Australia	Peracto*	Grape	Powdery Mildew	Complete; 40% (av) ↓ in disease c.f. control
13	Australia	Peracto*	Grape	Downy Mildew	Complete; Limited efficacy
14	Australia	Peracto*	Grape	Botrytis	2017 Complete; Equiv. control of botrytis c.f. in-market fungicides
15	Australia	APTRC*	Tomato	Yield & Pests - 3 farms	2016 Complete; 6% (av) ↑ in yield, 67% (av) ↓ in insect damage c.f control
16	Australia	APTRC	Tomato	Yield & Pests - 2 farms	2017 Complete; 50% ↓ in conventional pesticide and equivalent yield
17	Australia	Webb	Grape	Downy & Powdery Mildew	2017 Complete; Complete substitution (Cu & S) without compromising yield
18	Australia	Peracto*	In-vitro	Pseudomonas & Botrytis	2017 Complete; 100% bac. control, inhibition of spore germination & growth
	Australia	Elanora	Turf- Golf	BF1 pathogen	Underway; Commenced May 2017
	France	Compas*	Grape	Powdery & Downy Mildew	Underway; Commenced May 2017
	France	Vivescia*	Corn	Corn Borer – 3 x 1 ha trials	Underway; Commenced June 2017
	Australia	Peracto*	Tomato	Hemiptera, Lepidoptera	Commencing Q4 2017
	Australia	Peracto*	Cucurbits	Powdery Mildew	Commencing Q4 2017
	Australia	Peracto*	Grape	Botrytis	Commencing Q4 2017
	Australia	Peracto*	Grape	Powdery Mildew	Commencing Q4 2017

Case Studies - consecutive years field testing

* Denotes randomised split plot with multiple replicate trial protocol.

Year 1. Controlled field evaluation, designed and managed by APTRC and participating growers.

Objective; Quantify the effect of BOOSTER-Mag™ foliar applications, in addition to conventional treatment.

Design; Randomised Split Plot (four replicates).

Agronomic Management:

- Control; farmed conventionally (grower standard IPM)
- Trial; as per Control but with 3 x 1%v/v sprays B-Mag applications (1.5 kg /ha)

Spray Records.

Farm 2			
Booster-Mag	Fungicide	Insecticide	
		maldison, alpha-cypermethrin	22/12/2015
	cuprous oxide		22/12/2015
BOOSTER-Mag			8/01/2016
		maldison, alpha-cypermethrin	8/01/2016
	cuprous oxide		8/01/2016
BOOSTER-Mag			18/01/2016
		abamectin	21/01/2016
	cuprous oxide		21/01/2016
	azoxystrobin		7/02/2016
		methomyl, acephate	7/02/2016
	mancozeb		19/02/2016
		alpha-cypermethrin, dimethoate	19/02/2016
BOOSTER-Mag			20/02/2016

Farm 3			
Booster-Mag	Fungicide	Insecticide	
		chlorpyrifos, maldison, bifenthrin	17/11/2015
		chlorpyrifos, bifenthrin	21/11/2015
		chlorpyrifos, bifenthrin	24/11/2015
		alpha-cypermethrin	2/12/2015
	phosphorous acid		2/12/2015
		maldison, alpha-cypermethrin	3/12/2015
	phosphorous acid		3/12/2015
		spirotetramat	11/12/2015
	cuprous oxide		22/12/2015
		spirotetramat, methomyl	24/12/2015
		maldison	8/01/2016
		alpha-cypermethrin, methomyl	9/01/2016
BOOSTER-Mag			9/01/2016
	phosphorous acid		21/11/2015
	phosphorous acid		24/11/2015
	phosphorous acid		2/01/2016
	cuprous oxide		8/01/2016
	sulphur		9/01/2016
	sulphur		16/01/2016
		methomyl, lambda-cyhalothrin	16/01/2016
BOOSTER-Mag			20/01/2016
		abamectin	21/01/2016
	phosphorous acid		24/01/2016
	sulphur		26/01/2016
		methomyl, alpha-cypermethrin	26/01/2016
	azoxystrobin		7/02/2016
		abamectin	7/02/2016
	dithane, iprodione, sulphur		15/02/2016
		acephate	20/02/2016
BOOSTER-Mag			22/02/2016
	iprodione		26/02/2016
		indoxacarb, methomyl	26/02/2016
		bifenthrin, sulfoxaflor	3/03/2016
	triadimenol		3/03/2016
		bifenthrin, methomyl	14/03/2016
	dithane, sulphur		14/02/2016

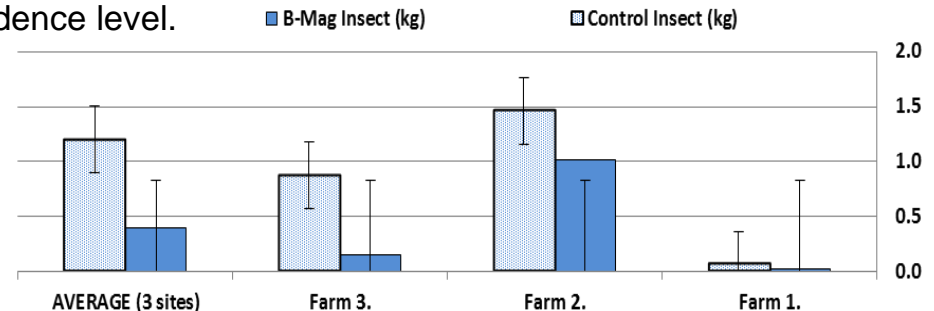
- **Chemical Pest Control in Integral**
- **Significant differences in pesticide usage patterns.**

Year 1; Three Farm Hand Harvest Results – all parameters.

Control	Red (kg)	Green (kg)	Insect (kg)	BER (kg)	Total Yield (kg)	Brix (°Bx)
Farm 1.	40.74	3.18	0.06	0.34	44.31	5.00
Farm 2.	38.84	1.15	1.46	0.46	41.91	5.18
Farm 3.	47.65	6.73	0.88	3.55	58.80	5.05
AVERAGE (3 sites)	42.41	3.68	1.20	1.45	48.34	5.08
Standard Deviation	4.64	2.82	0.70	1.82	9.14	0.09
Trial (B-Mag)	Red (kg)	Green (kg)	Insect (kg)	BER (kg)	Total Yield (kg)	Brix (°Bx)
Farm 1.	42.61	2.31	0.03	0.59	45.54	5.20
Farm 2.	40.78	1.19	1.01	0.31	41.69	5.10
Farm 3.	51.78	6.60	0.15	0.73	59.25	4.60
AVERAGE (3 sites)	45.05	3.37	0.40	0.54	48.83	4.97
Standard Deviation	5.89	2.86	0.54	0.21	9.23	0.32
Statistical Significance	NSD	NSD	NSD	NSD	NSD	NSD
% Change c.f. Control	6%	-9%	-67%	-63%	1%	-2%

- no statistically significant differences at a 95% confidence level.

- numerical trends common to all three farms;
 - ripe and unblemished fruit higher in trial areas
 - insect damaged fruit lower in trial areas.



- soil chemistry or nutrient uptake results do not readily account for observed trends

Outcome; commercial grower commitment to further, expanded scale and scope evaluation.

Year 2. Comparative evaluation undertaken with support from APTRC (crop scouting & hand harvest).

Objective:

Quantify farm productivity (yield, yield quality and overall pesticide usage) when BOOSTER-Mag is used as a base treatment.

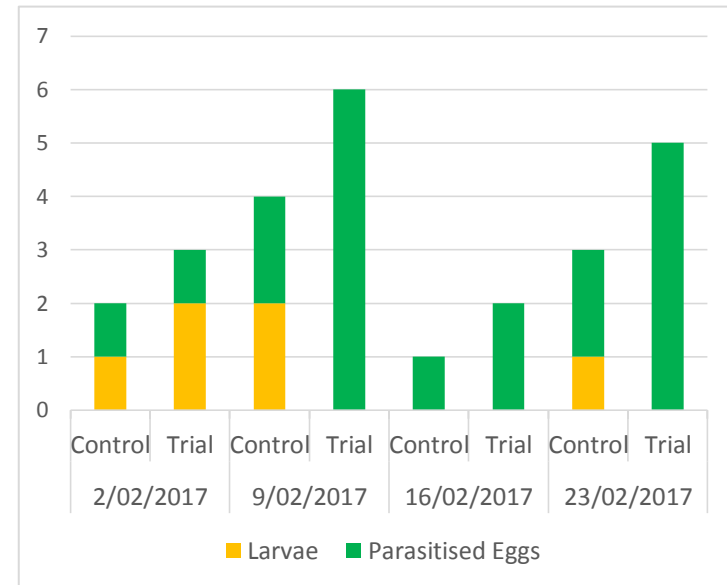
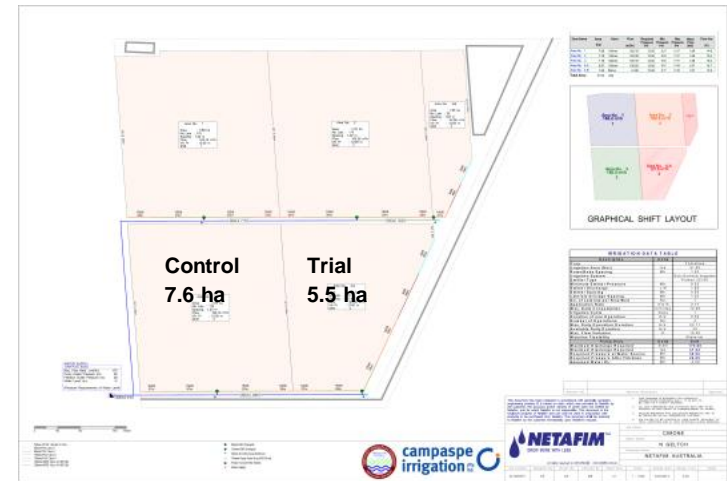
Design: 7 ha Control, 5 ha Trial.

Agronomic Management:

- Control; pesticide treatment according to pest / disease pressure and industry thresholds and agronomist advice.
- Trial; BOOSTER-Mag sprays every 2 weeks and additional intervention according to pest & pathogen pressure.

Beneficial Insects and Parasitism - crop scouting:

- widespread evidence of spiders in trial field (none in control)
- heliothis (moth) eggs collected and egg viability assessed
- no material difference in relative pest and pathogen pressure



Year 2. Productivity Assessment

	Sprays.	Pesticide Sprays.	Products Used.	Total Cost (\$ / ha)	Payable Fruit (Tne. / ha)
Control	9	8	cypermethrin, methomyl, maldison, abimectin phosphoric acid, cuprous ox. iprodione, mancozeb, triadimenol ethephon	\$ 509	89
Trial	10	4	BOOSTER-Mag, indoxcarb & methomyl, abimectin cuprous ox., mancozeb	\$ 315	89

- half as many pest & disease pressure threshold events
- \$194 / ha (38%) reduction in agronomic management costs
- equivalent payable yield
- enhanced safety and sustainability through reduced hard chemical usage

Outcome; commercial grower commitment to 40 ha / full farm evaluation - October 2017.

BOOSTER-Mag  **nano-active Mg(OH)₂:**

- Bio-activity; tendency for reduced agricultural insect pests and disease pressure
- Productivity; demonstrated ability to reduce agronomic management costs without compromising yield
- Simplicity, Safety and Sustainability; non-toxic, non-phytotoxic and likely to be MRL exempt
- **BOOSTER-Mag is highly complementary to IPM methodology**

Our Aims and Activity.

- Continue to develop BOOSTER-Mag:
 - efficacy trials (lab, controlled and grower direct) in grape, flowering veg and tomato
 - registration

Calix is very open to collaboration to help achieve this...