

**IMPROVING PREDICTIONS OF PEST
MORTALITY PRIOR TO PEST
ERADICATION OPERATIONS: PART II**

M. K. Kay

Client Report No. 39472

Improving predictions of pest mortality prior to pest eradication operations: Part II

The influence of a phagostimulant on the efficacy
of *Bacillus thuringiensis* var. *kurstaki*

M. K. Kay

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Client: **FBRC**
Contract No:

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EXECUTIVE SUMMARY

Objective

The objective of this work was to determine if there was any effect of adding the commercially available feeding stimulant Mobait[®] to the standard Btk preparation used to determine the efficacy of Btk on different host plants in a previous study.

Key Results

All Btk treatments reduced larval growth on both host plants. The decline in larval growth was positively correlated to the rate of Btk application, with the high rate of 5 l/ha reducing growth by about 50% (Figs. 1 & 2). However the addition of Mobait[®] had little effect on larval growth.

Application of Results

The addition of Mobait[®] to the standard Btk preparation did not provide any improved larval mortality. However, the use of Mobait[®] may well be of value as an adjuvant for dry Btk formulations such as Dipel[®].

Further Work

Mobait[®] will be used as a sticker for the application of Virrtus, a nucleopolyhedral virus (NPV) in Part III of this research project.



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Information for Ensis abstracting:

Contract number	
Client Report No.	39472
Products investigated	
Wood species worked on	Pinus radiata
Other materials used	Nectria fuckeliana
Location	Berwick Forest, Otago

INTRODUCTION

Part I of this study showed that the growth rate of painted apple moth larvae on different host plants was a strong predictor for the efficacy of Btk. On poor plant hosts, natural larval mortality was compounded, even at very low doses, by Btk. For poor host plants, such as *Sophora* and Douglas fir, a response threshold could be measured at doses of 0.1l/ha, well below the 5l/ha recommended application rate. This level of dose ensuring larval mortality on these hosts negates the need for a phagostimulant to encourage the consumption of Btk.

However on good host plants, such as *Acacia* species there is a demonstrable dose effect and the growth rate and the subsequent final pupal weights of surviving larvae are lowered in proportion to the dose applied. Although feeding was not prevented by the presence of Btk, there was a decrease in frass production at higher dose rates. This may have been due to the insect having to cease feeding to continually repair the midgut wall damaged by Btk, or it may also be due to some rejection of Btk if it was distasteful to the larva. The trials described here evaluated the effect of adding the commercially available feeding stimulant Mobait® to the standard Btk preparation used in Part I.

MATERIALS AND METHODS

Foray 48B Btk formulation was sourced from stocks used for the painted apple moth eradication programme. The Btk was applied to cut plant samples passing under an applicator on a moving belt 'track sprayer'. Belt speed and both Btk dilution and pump delivery rate were regulated to deliver nominal doses by way of the CDA ULV8 applicator delivering droplets of 120µ vdu. The equipment is designed to mimic that used in operational spray programmes and dose rates are given as litre/hectare equivalents. Dose was measured by the colourmetric analysis of the Btk deposition on mylar sheets that were run consecutively with the plant samples.

The phagostimulant was kindly supplied from Australia by Nufarm. It was cleared for use in New Zealand after a class determination from New Zealand Food Safety Authority.

Treatments applied to the foliage of *Acacia mearnsii* and *A. decurrens*, sourced from the Ensis Rotorua campus, consisted of:

- Control - no Mobait®, no Btk
- No Mobait® + Btk at 2.5 l/ha
- No Mobait® + Btk at 5 l/ha
- 2.5% Mobait® + Btk at 2.5 l/ha
- 5% Mobait® + Btk at 5 l/ha

Fifth instar larvae for the bioassays, were provided from the painted apple moth colony maintained on artificial diet within the Ensis quarantine facility. Bioassays were run at 22°±1C and 16 hour photoperiod within the same facility. Ten replicates were run of

each host plant treatment in bioassays which utilised 1 fifth instar larva per replicate. For each bioassay, control and treated plant samples were secured individually, each in a two-pot system (Matsuki *et al.* 2001), which maintained plant turgor, while providing a dry test arena around the plant for the insects. For each bioassay the control and sprayed replicates were arranged as randomised blocks within the quarantine facility.

Larvae were placed within the test arenas and mortality, the live weight of surviving larvae and the frass produced by surviving larvae, was recorded six days after treatment.

RESULTS

All Btk treatments reduced larval growth on both host plants. The decline in larval growth was positively correlated to the rate of Btk application, with the high rate of 5 l/ha reducing growth by about 50% (Figs. 1 & 2). However the addition of the phagostimulant Mobait[®] had little effect on larval growth.

Fig. 1. Larval mortality with respect to Btk dose rate over all treatments of *A. mearnsii*.

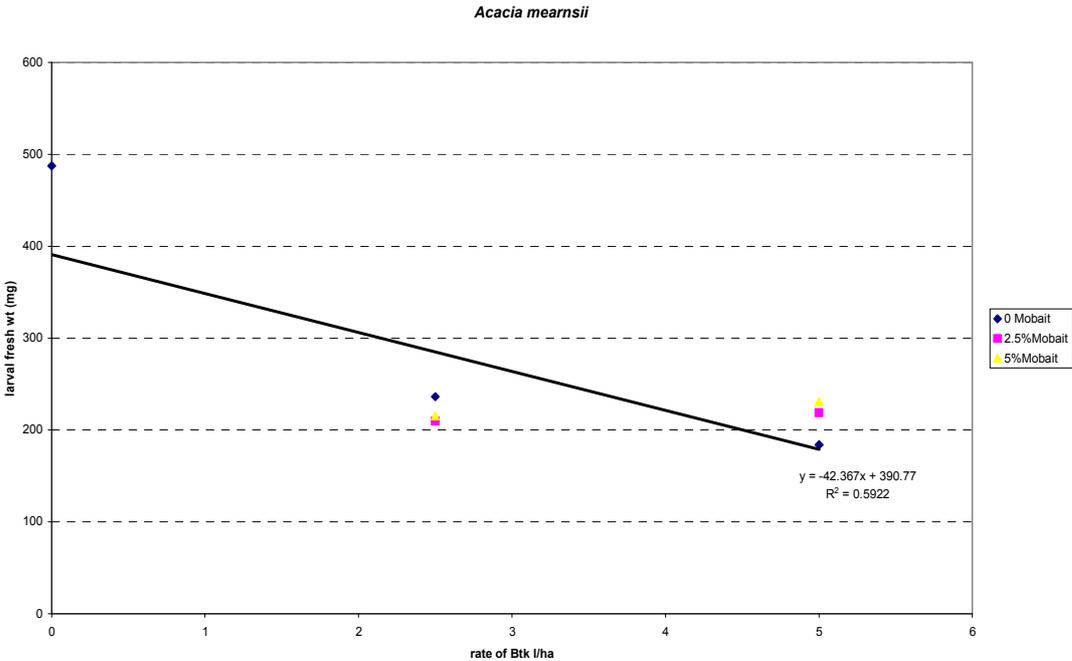
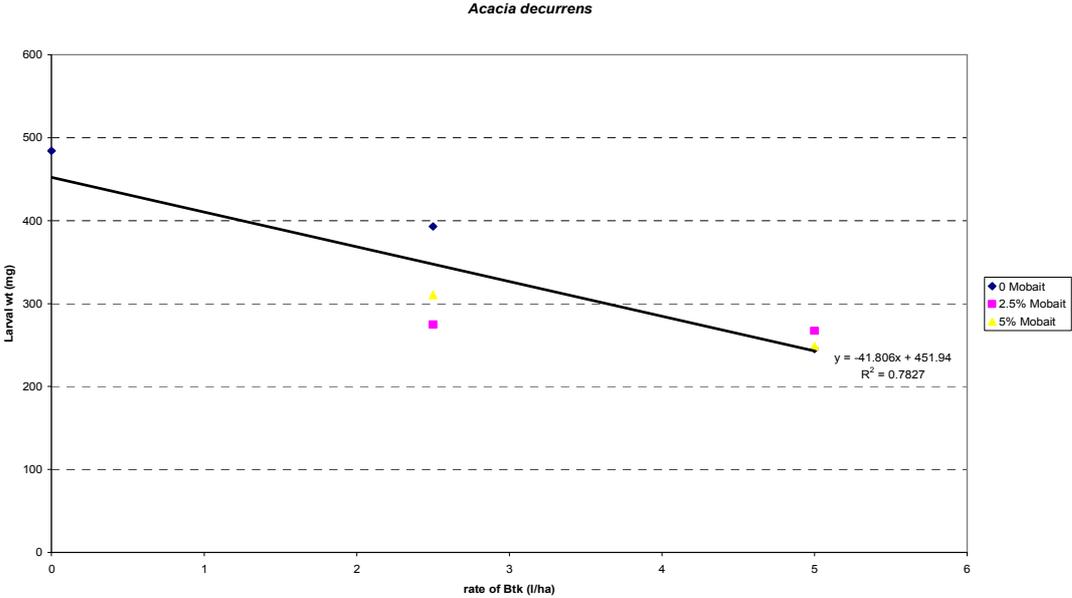


Fig. 2. Larval mortality with respect to Btk dose rate over all treatments of *A. decurrens*



Larval mortality tended to increase with the application rate of Btk, but the phagostimulant Mobait[®] had virtually the opposite effect on larval mortality across the two plant hosts, *A. mearnsii* and *A. decurrens* (Figs. 3 & 4).

Fig. 3. An apparent positive effect of Mobait[®] on larval mortality when applied to *A. mearnsii*.

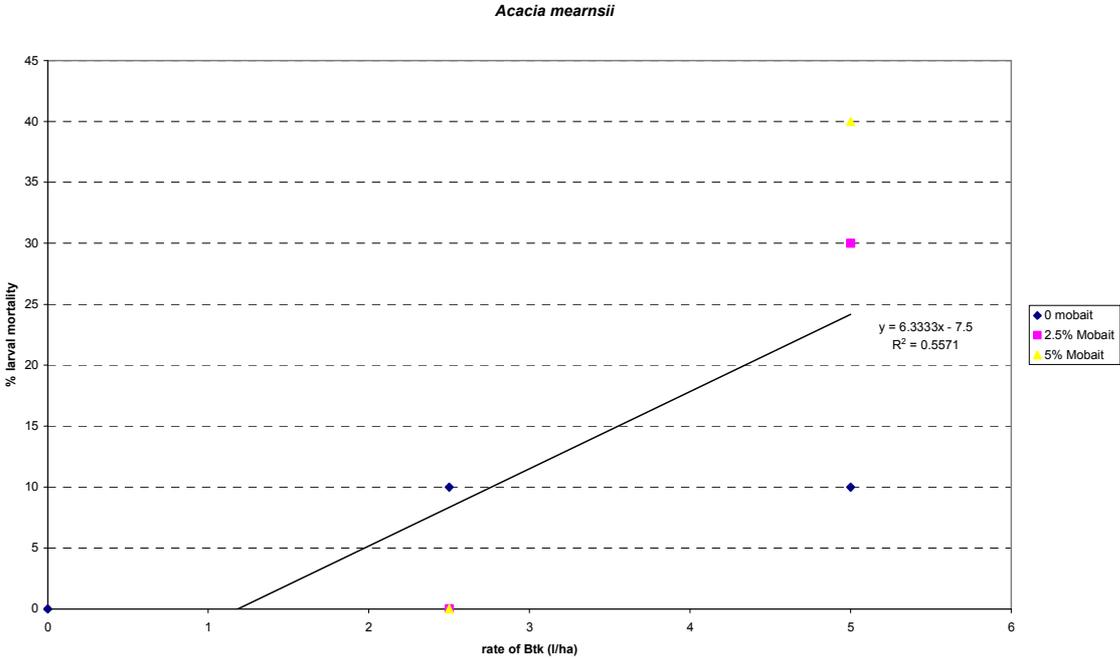
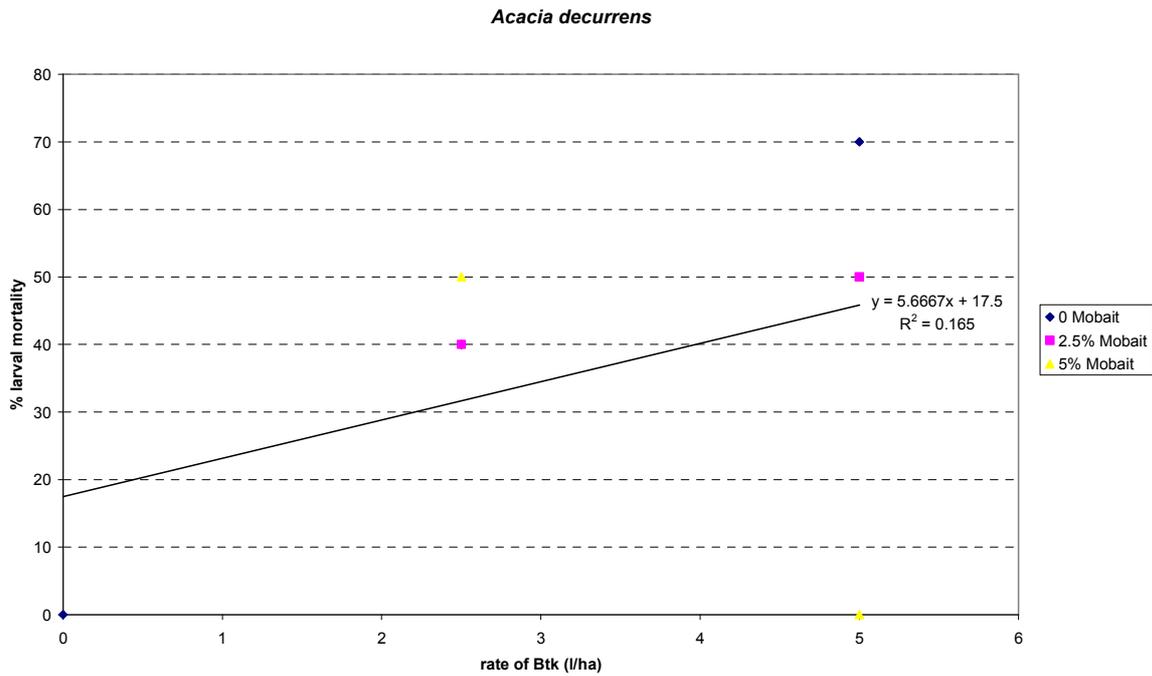


Fig. 4. An apparent negative effect of Mobait® on larval mortality when applied to *A. decurrens*.



Frass production was positively correlated to larval growth on both hosts (Figs. 5 & 6). However frass production by surviving larvae showed an ambivalent effect to the addition of Mobait® to Bt application (Figs. 7 & 8).

Fig. 5. The relationship between frass production and larval growth on *A. mearnsii*.

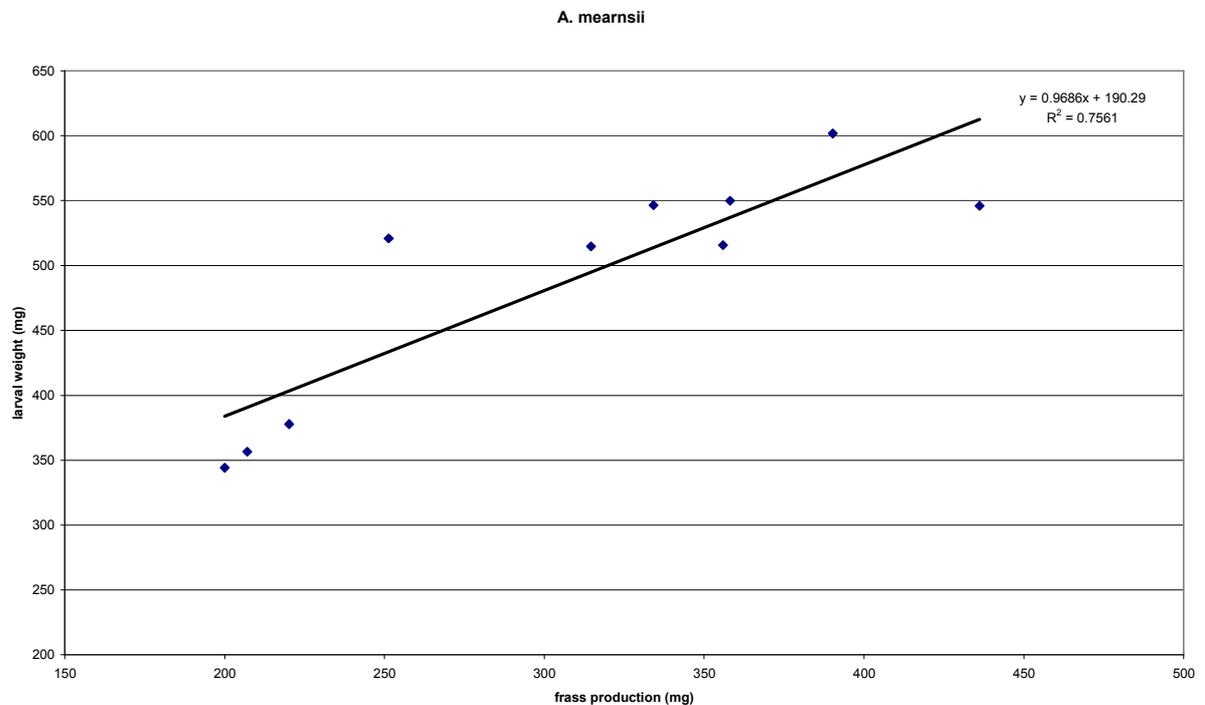


Fig. 6. The relationship between frass production and larval growth on *A. decurrens*.

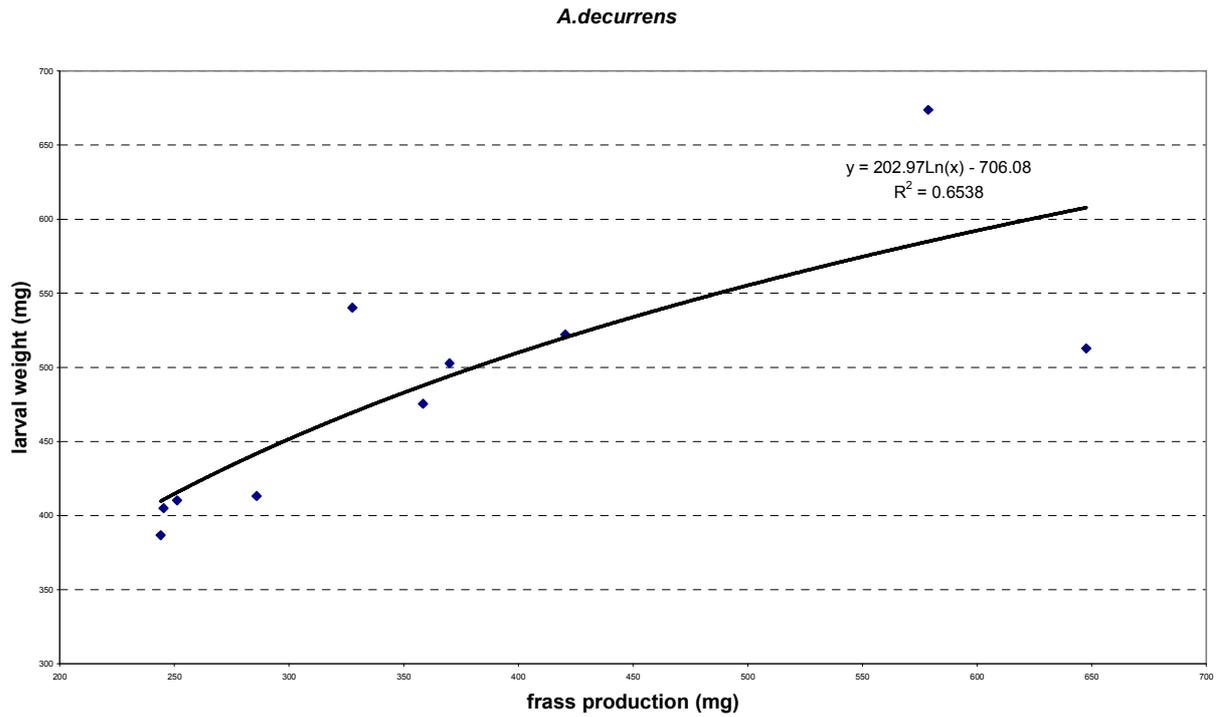


Fig. 7. The effect on larval frass production of Mobait[®] addition to Btk applications on *A. mearnsii*.

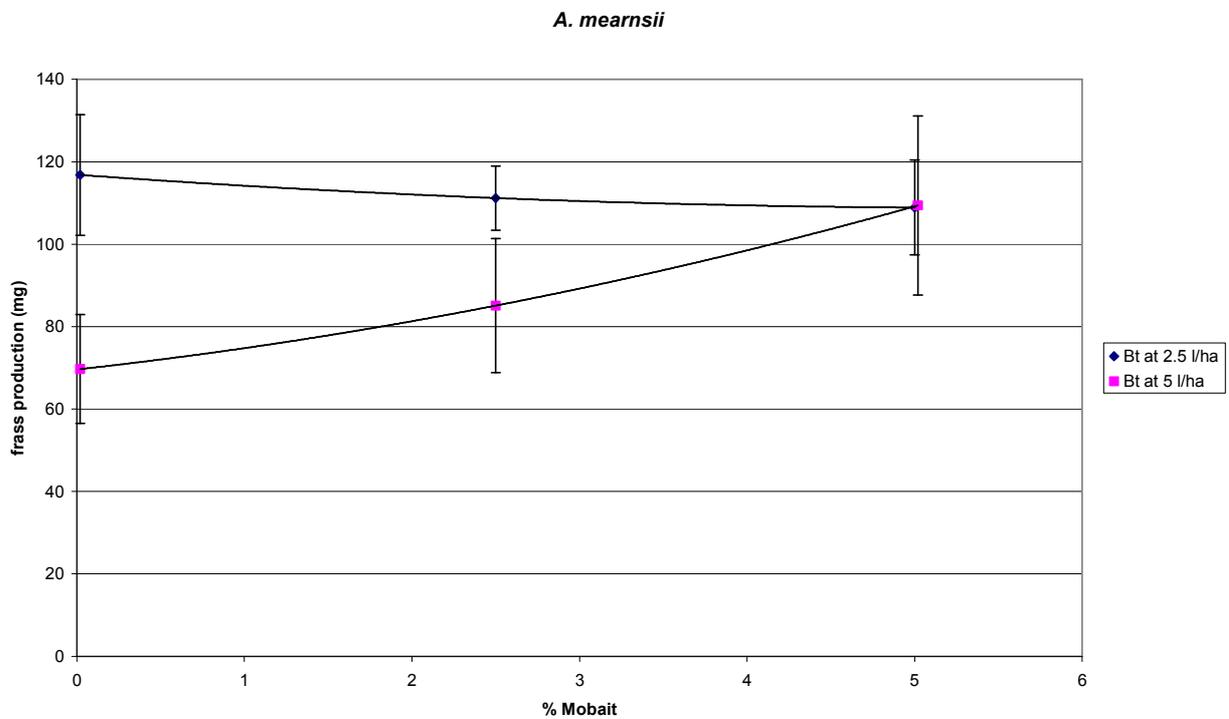
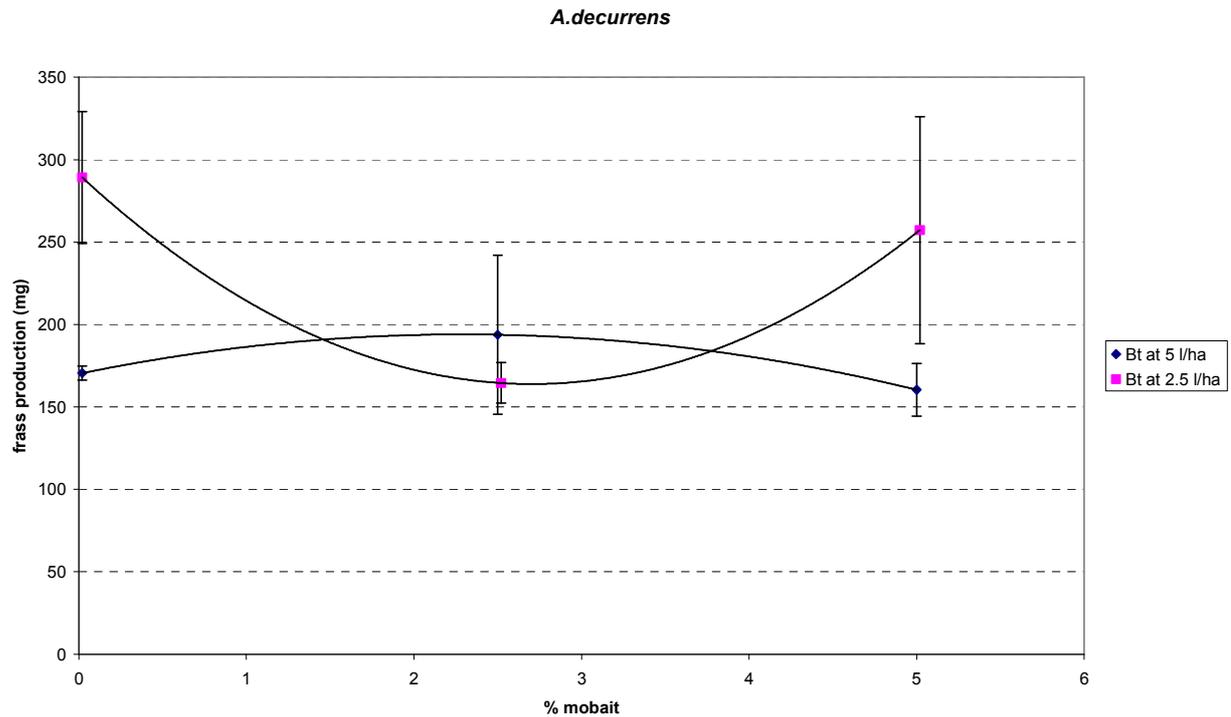


Fig. 8. The effect on larval frass production of Mobait® addition to Btk applications on *A. decurrens*.



DISCUSSION

Mobait® is described as a feeding stimulant based on food grade flavourings and vegetable gums (Appendix 1) and was the only accessible product to investigate feeding stimulation. It is labelled as an imitation molasses stimulant. However, it is not surprising that it failed to elicit any improvement on the efficacy of formulation of Btk used in the painted apple moth eradication programme. The Foray 48B product already incorporates molasses as a carrier and ‘sticker’ for Btk. The addition of a similar adjuvant appeared to create additional variability, but even this was inconsistent, and it did not provide any improved larval mortality. However, the use of Mobait® may well be of value as an adjuvant for dry Btk formulations such as Dipel® and it will be used as a sticker for the application of Virrtus, a nucleopolyhedral virus (NPV) in Part III of this programme.

REFERENCE

Kay, M.K. Steele, P. Taylor & D. Jones. 2005. Improving predictions of pest mortality prior to pest eradication operations: The influence of host species and provenance on the efficacy of *Bacillus thuringiensis* var. *kurstaki*. (unpubl. FBRC Report).

APPENDIX

Appendix I – Mobait fact sheet

**Nufarm Mobait
Insecticide Spray Additive Draft**

**Text for: 1L, 5L,
10L, 20L, 208L Label**

Date: 22.05.01

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Nufarm
Mobait®
Insecticide Spray Additive

Active Constituents:
265g/L Food Flavourings

A formulation of food grade flavourings and vegetable gums
designed to improve acceptance of insecticides.

Contents: 1 Litre
5 Litres
10 Litres
20 Litres
208 Litres

Nufarm Australia Limited
ACN 004 377 780
103-105 Pipe Road
Laverton North, Vic, 3026
Tel. (03) 9282 1000
Fax. (03) 9282 1001

® Mobait is a registered trademark
of Nufarm Australia Limited

DIRECTIONS FOR USE:

Crop/Situation	Rate/100L	Critical Comments
Broadacre & Cotton:	Aerial 500mL Ground 250mL	Good coverage is essential Always refer to the insecticide label before use.
Horticulture Vegetables, vine crops and orchards	Less than 150L/ha 250mL More than 150L/Ha 125mL	

General Rate Instructions

Up to 50L of water per ha use 500mL Mobait per 100L of water or 0.5%

LOW VOLUME GROUND APPLICATION:

From 50L to 150L of water per ha use 250mL Mobait per 100L of water or 0.25%

HIGH VOLUME GROUND APPLICATION:

For more than 150L of water per ha use 125mL Mobait per 100L of water or 0.125%

**NOT TO BE USED FOR ANY PURPOSE OR IN ANY MANNER CONTRARY TO THIS LABEL UNLESS
AUTHORISED UNDER APPROPRIATE LEGISLATION**

GENERAL INSTRUCTIONS

Mobait Insecticide Spray Additive is a formulation of food grade flavourings and vegetable gums designed to improve the acceptance of insecticides. Mobait encourages greater feeding activity on sprayed foliage, which will assist with insecticides that need to be ingested such as Bts, indoxycarb, Gemstar, spinosad, & IGRs. Mobait will encourage larvae to move from sheltered feeding sites to areas which have been treated with insecticide, which will assist when using contact foliar insecticides such as organophosphates, carbamates and synthetic pyrethroids Mobait improves the palatability of insecticides.

Mixing:

Fill spray tank half full of water and begin agitation. Add the desired rate of Mobait slowly to water before adding the insecticide. Continue agitation for 3 – 5 minutes before adding the insecticide.

Compatibility:

Mobait is compatible with the following products: Chlorpyrifos 500EC, Pirate®, Predator*, Tracer*, Success*, Methomyl, Larvin* 375, Dipel*, Sonic® EC, Astound® Duo, Steward*, Avatar*, Bt products, Gemstar*, Carbaryl 500, Endosulfan 350 EC, Lepidex 500, Tribase Blue®, Penncozeb 750 DF. Mobait is unlikely to cause compatibility problems, however Nufarm recommend a jar test before mixing with foliar nutrients and other pesticides not on this list.

**PROTECTION OF WILDLIFE, FISH,
CRUSTACEANS AND ENVIRONMENT**

DO NOT contaminate streams, rivers or waterways with the chemical or used containers.

STORAGE AND DISPOSAL

KEEP OUT OF REACH OF CHILDREN

Store in the closed original container in a cool, wellventilated area. Do not store for prolonged periods in direct sunlight. Triple or preferably pressure rinse containers before disposal. Add rinsings to spray tank. Do not dispose of undiluted chemicals on-site. If recycling, replace cap and return clean containers to

recycler or designated collection point. If not recycling, break, crush or puncture and bury empty containers in a local authority landfill. If no landfill is available, bury the containers below

500mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.

FIRST AID

If poisoning occurs, contact a doctor or Poisons Information Centre (Phone 13 1126). If skin contact occurs, remove contaminated clothing and wash skin thoroughly. Remove from contaminated area. Apply artificial respiration if not breathing. If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor.

MATERIAL SAFETY DATA SHEET

For further information refer to the Material Safety Data Sheet (MSDS).

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In case of emergency: Phone (1800) 033 498

Ask for shift supervisor. Toll free 24 hours.

Batch No.:

D.O.M.: