

Low-dose methyl bromide fumigation as a quarantine treatment against fruit flies

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Market Access Protocols

- Commodities that are hosts of **fruit flies** need protocols to access markets that have quarantine barriers to trade
- Fruit flies pose a major quarantine risk to many trading partners
- Horticultural industries need disinfestation treatments
 - Effective against the pest
 - Maintain fruit quality
 - Fit smoothly into (multiple) transport and handling systems
 - (air-freight/sea-freight)
 - Are cost effective



Queensland fruit fly
Bactrocera tryoni



Treatment technology

Cold storage

Cool the fruit

1 - 3°C for

12 – 21 days



Vapour heat

Heat the fruit

47°C for 15 min

Same day



Irradiation

Gamma/e-beam/X-ray

150 – 400 Gy

Same day

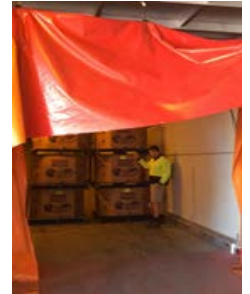


MB fumigation

32-48 g/m³ MB

at 11-21°C

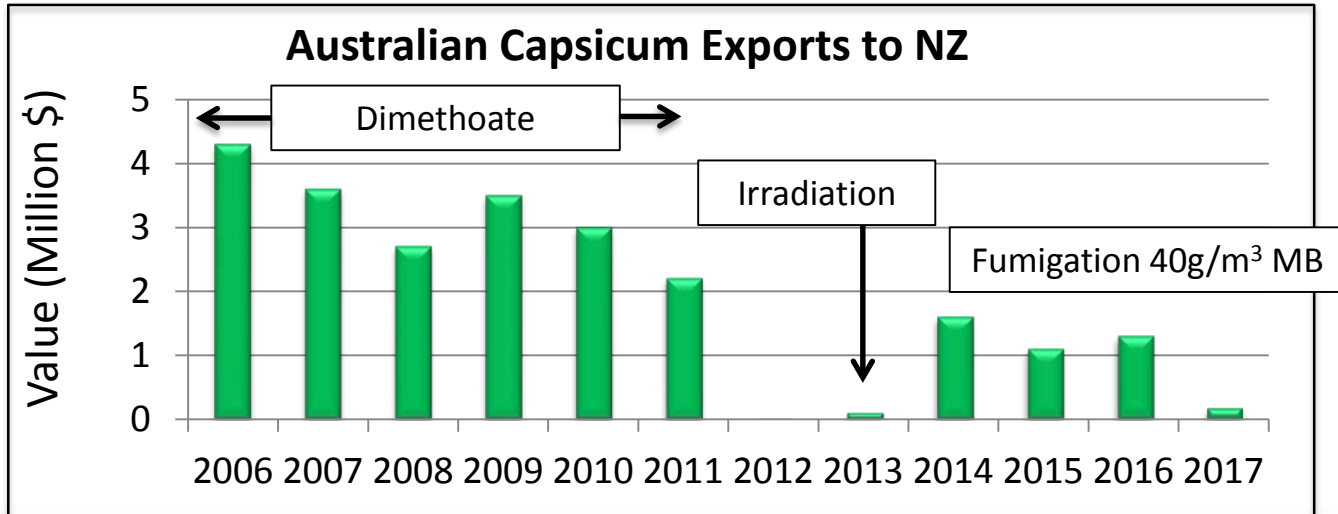
Same day



Capsicums



- In-line flood-spray with dimethoate since 1994
- 2011 postharvest use on capsicums suspended by APVMA
- **Heat** – required efficacy levels cause fruit damage
- **Cold** – 12 days too long, quality issues
- **Irradiation** – thrips, vectors
- **Traditional MB** (40g/m³ at 17°C for 2 h)



What is low-dose methyl bromide?

A traditional treatment schedule

Flesh Temp (°C)	Conc MB (g/m ³) (C)	Time (h)	CT product g h /m ³
≥32	16	2	32
26 - 31	24	2	48
21 - 25	32	2	64
15 - 20	40	2	80
10 - 14	48	2	96
5 - 10	56	2	112

- Historically most treatments conducted for a treatment duration of 2 hours

Insects:

- 80 g h/m³ = 40 g/m³ x 2 hours
- 80 g h/m³ = 20 g/m³ x 4 hours

Fruit:

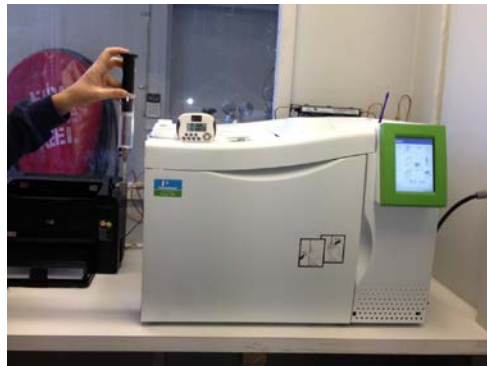
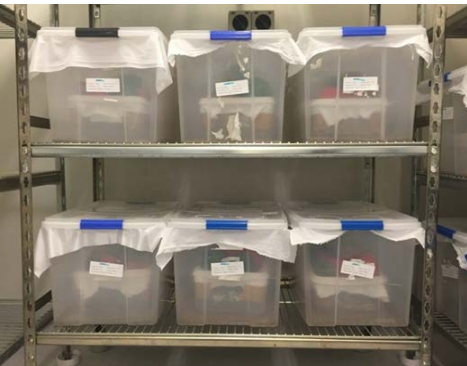
- Less damage from lower concentrations

Low-dose fumigation:

- Lower concentration of MB applied over a longer treatment time
 - Same mortality effect on the insect
 - Less injury to the fruit
 - Less MB used



What did we do?



Did it work?

- We are not trying to determine the most tolerant stage or the most tolerant species
- Instead conducting multiple confirmatory trials against all lifestages
- $\geq 99.99\%$ mortality (95% confidence)

Mortality of Qfly in Capsicums after methyl bromide fumigation with 18g/m^3 at 18°C for 5 h

Lifestage	Number of survivors	Total no. of insects treated	Corrected mortality* (95% confidence)
Egg	0	35,551	99.99157
First instar larvae	0	53,720	99.99442
Second instar larvae	0	40,371	99.99258
Third instar larvae	0	43,901	99.99318

*Couey and Chew (1986)

What about the quality?

Low dose MB
18g/m³ at 18°C for 5 h

Traditional MB
40g/m³ at 17°C for 2 h

“It appears that capsicums are, at best, marginally tolerant of fumigation with methyl bromide.” (Jessup 1994, NSW DPI)

- Damage was on the surface of the fruit.
- Some pitting in the form of sunken, water-soaked lesions, slight shrivelling, softening and rot development.
- The lesions formed on the fumigated fruit at about 4 days at 17°C after fumigation.



CONTROL TREATED

- After 10 days at 6°C followed by 6 days holding at 10°C
- **Quality parameters:** weight loss, total soluble solids, skin colour, skin quality, skin wrinkling, skin pitting, severity and incidence of rots.
- **No significant difference between control and treated fruit.**

Outcomes

Traditional schedule:

Flesh Temp (°C)	MB (g/m ³)	Duration (h)
≥32	16	2
26 - 31	24	2
21 - 25	32	2
15 - 20	40	2
10 - 14	48	2
5 - 10	56	2

Current research: low-dose MB

Commodity	Flesh Temp (°C)	MB (g/m ³)	Duration (h)	Survivors	CT product (g h m ³)
Capsicum	18	18	5	0	90
Nectarine	18	18	5.5	0	99
Peach	18	18	5.5	0	99

What have we accomplished

- First low-dose MB export protocol
 - **Nectarines** to China, May 2016
 - First shipments occurred last summer
- Protocols in negotiation
 - DAWR conducting protocol negotiation with NZ with **capsicum** data
 - DAWR conducting protocol negotiation with Thailand and USA with **nectarine** and **peach** data.
- New project to expand low-dose methyl bromide fumigation for industries where airfreight protocols are required, or not other options:
 - **Pumpkin, mangoes, plum, strawberry, apple, table grape, pear**
- Collaborating with WA scientists to generate equivalent data on Medfly.



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