

Influence of Applied Dose and Exposure Time on Mortality of Peach Fruit Moth Eggs in Short Time Methyl Bromide Fumigation

Takashi MISUMI, Mutsuro GOTO, Hiromitsu NAITO, Mitsusada MIZOBUCHI,
Yukihiro SOMA and Fusao KAWAKAMI

Chemical & Physical Control Laboratory, Research Division,
Yokohama Plant Protection Station

Abstract: The laboratory scale test was conducted with different combinations of dose and exposure time in the same CT product to examine influence of applied dose and exposure time on mortality of the pest in short time methyl bromide fumigation. The peach fruit moth (*Carposina sasakii*) eggs on the filter paper were fumigated at 38 g/m³ for 1 hr, 19 g/m³ for 2 hrs, 12.7 g/m³ for 3 hrs, 6.3 g/m³ for 6 hrs and 3.8 g/m³ for 10 hrs at 15°C, respectively. Ratios of residual gas were 96–101% and CT Products were 36.4–38.4 mg·h/l. The mortality data showed that higher mortality was obtained from fumigation of longer exposure time, and that influence of exposure time on the mortality was larger than that of applied dose in the same CT product. The result of the test indicates that even if regulated CT product was satisfied on the way of fumigation, the fumigation has to be continued till the end of regulated fumigation time.

Key words: methyl bromide, fumigation, *Carposina sasakii*, CT product

Introduction

MONRO (1969) and BOND (1984) described that insecticidal efficacy of a fumigant such as methyl bromide (MB) against a given species of the pest is determined by the amount of the CT product (concentration × time; mg·h/l) which is known as an indicator of insecticidal efficacy in routine fumigation. If a standard CT product for a complete mortality of target pests was obtained in fumigation, the fumigation is made to be successful in the commercial fumigation.

On the other hand, perishable commodities such as fruit, vegetables and live plants are usually fumigated at high doses for short exposure time to avoid chemical injuries. In such fumigation, a regulated CT product would be often obtained easily on the way of fumigation, and the fumigation would be successful in the theory of CT product. However, influence of applied dose and exposure time on the mortality of insect is not clarified in short time MB fumigation. Here we report a result of the test for the subject.

Materials and Methods

Test insect

The peach fruit moth was obtained from the Aomori Apple Experimental Station. The insect was reared by using immature apples as described by KAWASHIMA (1991) in the rearing room at 25°C, 70% R. H. with a 16L : 8D photoperiod. Approximately a hundred of male and female adults in total were mated and then allowed to oviposit on the filter

paper for 24 hours in the cage. Eggs on the filter paper were stored at 25°C for one day and then preconditioned at 15°C over night until fumigation.

Fumigation and calculation of CT product

Fumigation was conducted in a 29.5 liter fiber-glass fumigation box (26.0 cm×28.0 cm×41.0 cm) equipped with a circulation fan, a ventilation apparatus, ports for gas application and sampling, a manometer and temperature probes. Eggs on the filter paper were placed in the fumigation box and MB was introduced with a syringe. Different combinations of MB dose and exposure time were applied for fumigation with 38 g/m³ for 1 hr, 19 g/m³ for 2 hrs, 12.7 g/m³ for 3 hrs, 6.3 g/m³ for 6 hrs and 3.8 g/m³ for 10 hrs in the same CT product (38 mg·h/l), respectively. Each fumigation was conducted at 15°C. Gas concentrations were measured with gas chromatograph (FID; GC8AIF, Shimadzu). Temperatures in the box were monitored with a multi-channel automatic temperature recorder (Hybrid Recorder: AH, Chino) during fumigation. Fumigation was followed by one hour of exhausting using the ventilation apparatus.

The CT product was calculated similarly to the method described by MONRO (1969) with three to seven of gas concentration records.

Determination of mortality

After fumigation, eggs on the filter papers were removed from fumigation box and then placed for three weeks in the rearing room mentioned above. Eggs were examined under a stereoscopic microscope, and the numbers of eggs in total and hatched were counted. The test was done in duplicate.

Results and Discussion

Table shows ratios of residual gas (100×gas concentration at the end of fumigation/applied dose), CT products and mortalities of eggs in fumigation with different dose and exposure time in the same CT product. Temperatures in the fumigation box ranged from 14.2 to 15.7°C

Ratios of residual gas were 96–101% and CT products were 36.4–38.4 mg·h/l, significant difference was not observed on the figures of ratios of residual gas and of CT

Table Mortalities of the peach fruit moth eggs fumigated with MB at different combinations of dose and exposure time in the same CT product of 38 mg·h/l at 15°C.

Dose (g/m ³)	Time (hrs)	Residual gas rate ¹⁾ (%)	CT product (mg·h/l)	No. of eggs treated (n)	Mortality ²⁾ (%±S.D.)
38.0	1	99	37.8	3,641	13.8±4.6
19.0	2	101	38.4	3,291	33.2±6.6
12.7	3	99	38.2	3,235	53.1±0.8
6.3	6	96	36.4	3,233	74.3±2.6
3.8	10	97	37.5	3,407	81.5±1.3

¹⁾ Ratio of residual gas=100×gas concentration at the end of fumigation/applied dose.

²⁾ Mortalities were corrected based on survivors in untreated control.

products in each fumigation. Mortality of untreated control insets was 12.2% in average. The mortality data shows that higher mortality ratio was obtained from fumigation in combination of longer exposure time and lower doses, and that influence of exposure time on the mortality was larger than that of an applied dose in the same CT product. The fact also indicates that even if regulated CT product was satisfied on the way of fumigation, the fumigation has to be continued till the end of regulated fumigation time. For example, even if a 120 mg·h/l of regulated CT product was satisfied for 2.5 hours on the way of fumigation under the standard of 48 g/m³ for 3 hours at 15°C, the fumigation has to be continued until the end of regulated exposure time of 3 hours to achieve a complete mortality of the peach fruit moth.

References

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和 文 摘 要

臭化メチル短時間くん蒸における投薬量及びくん蒸時間が
モモシンクイガ卵の殺虫効果に及ぼす影響

三角 隆・後藤睦郎・内藤浩光・溝淵三必・相馬幸博・川上房男

横浜植物防疫所調査研究部消毒技術開発担当

CT 値は殺虫効果の指標として用いられ、くん蒸中に規定の CT 値が確保されれば、そのくん蒸は適に行われたと判断される。CT 値が不足する場合はくん蒸時間を延長することにより規定の CT 値を確保する必要がある。生果実のくん蒸は、通常、高い濃度で短時間のくん蒸が行われるが、このようなくん蒸においては、くん蒸途中の測定で規定の CT 値が確保される事例が生じる。そこで、くん蒸途中の測定で規定の CT 値が確保された場合でもくん蒸を継続する必要があるか調査した。

CT 値を一定 (38 mg·h/l) とし、異なる薬量 (38, 19,

12.7, 6.3 及び 3.8 g/m³) 及びくん蒸時間 (1, 2, 3, 6 及び 10 時間) を設定して濾紙に産下させたモモシンクイガ *Carposina sasaki* の卵を臭化メチルくん蒸して殺虫率を比較した。その結果、CT 値がほぼ一定であるにもかかわらず、くん蒸時間が 1 時間から 10 時間へと長くなるに従って殺虫率は高くなった。このことは、くん蒸の途中で規定の CT 値が得られても、規定の時間までくん蒸を継続しなければ本来の殺虫効果が得られないこと、規定の CT 値を超えたからといってくん蒸時間を短縮することは適切ではないことを示している。