MONITORING OF ATMOSPHERIC FUMIGANTS IN THE HORTICULTURAL AREA OF IBARAKI, JAPAN

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Methyl Bromide (CH_3Br) is a major fumigant used in Japan to control soil-borne diseases in crops such as cucumbers, gingers, tomatoes, melons, green peppers, etc. The use of CH_3Br as a soil fumigant is to be phased out by 2005, but no new chemical or non-chemical alternative has yet emerged as its substitute. For now, 1,3-dichloropropene, chloropicrin, dazomet, *etc*. are seen as the best alternatives to CH_3Br for preplant fumigation, and their sales are increasing steadily in Japan. In practice, however, they are not sufficient to take the place of CH_3Br, the impact of these chemicals on the environment and human is not well understood, and these are considered risky and unsuitable as long-term replacements.

It is already difficult to satisfy demand for CH_3Br as a soil fumigant adequately, whereas there are not remarkable changes in the amount of 1,3-dichloropropene, chloropicrin, dazomet that have been used in major CH_3Br use areas. The reason is that both chemical and non-chemical alternatives have almost never been distributed, so the majority of growers have coped with it by reducing dosage of CH_3Br from over-dosage as before, and the amount of these soil fumigants have increased in other areas. Nevertheless, under the Protocol, from 1 January 2001 a 50% cut in production and consumption of CH_3Br, based on 1991 levels, was scheduled in Japan. Therefore, it is predicted that the consumption of these chemical alternatives will increase more.

The machinery injection methods can reduce the dosage of soil fumigants and its emission during exposure period. However, such injection techniques are not appropriate to Japanese horticulture, as fields are generally too small to employ those methods. Glowers themselves usually apply soil fumigants without depending on special applicators. Manual application methods are currently in vogue. Besides agricultural fields and residential areas coexist, so it is impossible to enough buffer zone around occupied structures. Restrictions on CH_3Br use in Japan due to air quality concerns prompted air monitoring and improved application methods of soil fumigants in horticultural areas.

The air monitoring method was optimized as below. Air concentrations were measured at a 1.2-m height above the soil near the occupied structures in horticultural areas, Ibaraki Prefecture. Air samples for these chemicals were collected using 4 STS-25 air samplers (Perkin Elmer) and multi-bed absorbent

tubes packed with graphite carbon black (100 m^2/g, 60/80 mesh, 190 mg) and carbon molecular sieve (1200 m^2/g, 60/80 mesh, 100 mg) at a pumping rate of 20 ml per minute. Each sampling periods were 8 or 12 hours. These air samples were analyzed by ATD-GC-MS (automatic thermal desorption system-gas chromatography-mass spectrometry). Quantitation limits of CH_3Br, 1,3-dichloropropene, chloropicrin and MITC (methyl isothiocyanate) are 0.1, 0.1 and 0.2 and 0.01 μg/m^3, respectively.

Monitoring was conducted within the areas and periods of most use. Air samples were collected at each one location in the Ami and Ina area, Ibaraki Prefecture, from February 6 to April 26, 2000. At each location, 8-hours samples were collected once a week. Air samples were collected at four locations in the Hokota area, Ibaraki Prefecture, from September 5 to November 28, 2000. At each location, 12-hours samples were collected once a week.

In case of the Ami area, growers used 1,3-dichloropropene popularly, so 1,3-dichloropropene in the atmosphere was detected frequently. Air concentrations measured off-site during several months ranged from none detected to 616 μg/m^3, and most samples contained several μg/m^3 of 1,3-dichloropropene. The highest measured concentration of CH_3Br was 190 μg/m^3, but these high concentrations were temporary. Most measured concentrations of CH_3Br, chloropicrin, and MITC were less than quantitation limits. The sampling site of the Ina area had a seedling grower near, so CH_3Br was detected frequently. Air concentrations measured off-site during several months ranged from none detected to 937 μg/m^3, and most samples contained more than some μg/m^3 level of CH_3Br and 1,3-dichloropropene. High concentrations of CH_3Br were detected every soil fumigation.

Restrictions on CH_3Br usage required an intensive search for improved technologies to reduce both dosage and emission from fumigated plots into the atmosphere, while maintaining its effectiveness for disease and weed control. Further, such monitoring are required as part of an ongoing effort to evaluate seasonal exposures to soil fumigants and determine if current restrictions provide adequate safety for people who lived and working in areas where soil fumigations occur to multiple fields.

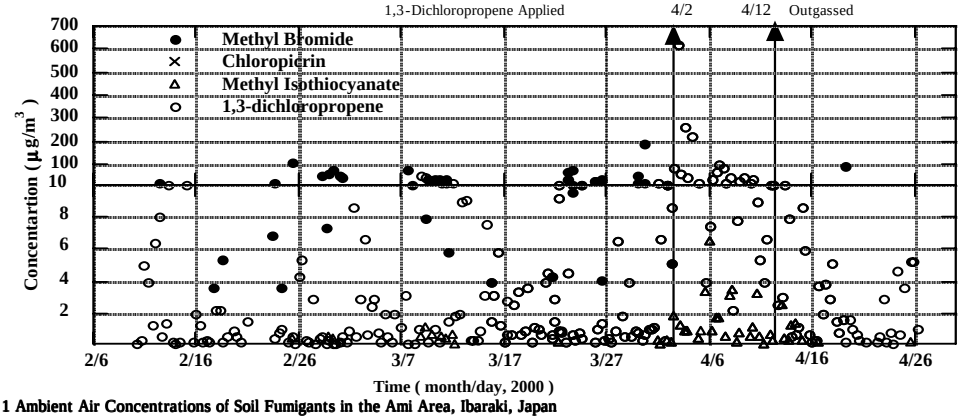

Fig. 1 Ambient Air Concentrations of Soil Fumigants in the Ami Area, Ibaraki, Japan

***Concentration (μg/m 3) : 8-hour time-weighted average.**