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JAPAN IMPLEMENTATION PRACTICES ON ACCURATE RECORDING OF METHYL BROMIDE USE AND ITS REDUCTION IN QUARANTINE PHYTOSANITARY MEASURES

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ABSTRACT

Decision XXIII/5 Paragraph 1 of Montreal Protocol on the substances that deplete ozone layer encourages parties to follow the recommendation of the Commission on Phytosanitary Measures of the International Plant Protection Convention that data on current usage of methyl bromide as a Phytosanitary measure should be accurately recorded and collated, including information on the quantities of methyl bromide used in kilograms, a description of the articles fumigated and target pests. When plants are imported, they are subject to plant quarantine inspection at the entry. If quarantine pest insects are intercepted by plant quarantine inspector, they are treated with Quarantine Phytosanitary measures such as fumigation by methyl bromide, hydrogen cyanide or aluminum phosphide. Japan established those recording system for quarantine fumigation and undertakes properly as one of the operation practices. In this presentation, items entered in fumigation record sheet are shown such as name of the company of pest control operation, plant articles, chamber category of gas holding capability and air tightness, methyl bromide application amount (kg), dose rate (g/m^3) and name of target pest insects. Japan recording and collating system meets all requirements of the Decision XXIII/5 paragraph 1 of Montreal Protocol. Japan has made much effort to reduce methyl bromide use as much as possible. Fumigation chamber holders are expected to keep high gas holding capability for the minimum use and emission of methyl bromide. Dose rates are set in fumigation schedule in view of a kind of plant article, grain temperature, fumigation duration time and gas holding capability etc. Furthermore various means to reduce methyl bromide use are shown in every aspect such as choice of appropriate size of fumigation chamber to the commodity and improvement of non quarantine pest insects. Japan Government enforces those regulations to require people concerned to implement to make effort for reduction of methyl bromide use.

Key words: Plant quarantine treatment, IPPC, Commission on Phytosanitary Measures, methyl bromide, accurate recording of the use of methyl bromide, decision of Montreal Protocol, gas holding capability, air tightness of fumigation chamber, fumigation schedule, dose rate.

INTRODUCTION

When plant and plant products are imported in Japan, they are subject to plant quarantine inspection at the entry. If quarantine pest insects are intercepted by plant quarantine inspector,

they are treated with Quarantine Phytosanitary measures such as fumigation by methyl bromide, hydrogen cyanide or aluminum phosphide. Japan has undertaken recording system as one of the quarantine practices. In this presentation, all items entered in fumigation record sheet are shown very in detail.

Japan has made much effort to reduce methyl bromide use as much as possible. Amounts of methyl bromide use for the quarantine treatment (tones) are shown in table 1^{*1}. Dose rates are prescribed very in detail in terms of various factors for ensuring fumigation effectiveness and minimum use and emission of methyl bromide. Fumigation chambers are expected to keep air tightness very high. Dose rates are prescribed very in detail as fumigation schedule on kinds of plant article, grain temperature, fumigation time and category of gas holding capability and air tightness of fumigation chamber etc. because fumigation effectiveness could definitely depend upon those factors. Extracts of prescribed dose rates are shown in table 2 and table 3^{*2}. In addition, very many way of fumigation practices are actually implemented to reduce methyl bromide use.

Table 1. Amount of methyl bromide use for the quarantine treatment (tones)*¹

Year	1995	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011
Amount	2,448	1,591	1,403	1,306	1,165	1,039	867	706	542	511	547

Table 2. Dose rates (g/m³) for bagged commodity in the chamber of gas holding capability of category super A at the loading rate of more than 0.5 tones/m³ with fumigation time of 48 hours^{*3}

Commodity	Grain temperature (°C)		
	T<10	20>T≥10	T>20
Bagged rice, wheat, cocoa and coffee bean etc.	19	15	12
Bagged maize, milo and millet etc.	25	20	15
Bagged soybean, kidney and peanut etc.	31	26	19
Bagged buchwheat, safflower seed and rice, maize and soybean flour etc.	38	30	22

Table 3. Dose rates (g/m³) for bulk commodity in the silo of gas holding capability of category super A at the loading rate of more than 0.5 tones/m³ with fumigation time of 48 hours^{*3}

Commodity	Grain temperature (°C)		
	T<10	20>T≥10	T>20
Bulked rice and wheat etc.	27	22	16
Bulked maize, milo and millet etc.	36	29	22
Bulked soybean, kidney and peanut etc.	39	31	23

Import plant inspection

When plant is at the entry, consignee should submit import plant inspection application form No. 4*³ to plant quarantine inspector. Then consignment is inspected. If quarantine pests are found intercepted, names of the pests are entered in the form. Consignee is required to undertake Phytosanitary measures to the consignment.

Phytosanitary treatment

Being entrusted by consignee, pest control operator submits Phytosanitary treatment plan for the approval of plant inspector. When it is approved by the inspector, consignment is brought into fumigation chamber. Pest control operator to undertake quarantine treatment is certified by the plant quarantine authorities. Fumigation chamber for the consignment is also designated by plant quarantine authorities. Consignment is undertaken quarantine treatment by the pest control operator. When be completed, fumigation success or failure is checked by plant quarantine inspector with the confirmation of the test insect condition of life or death and/or with the level of remaining gas concentration at the fumigation termination time. When fumigation treatment is judged success, consignment is subject to custom clearance.

Methyl bromide fumigation record sheet

When plant quarantine fumigation is undertaken, fumigation operation recording sheet of form 3⁴ is required to submit to the director of plant quarantine station by the people of designated fumigation chamber prior to fumigation. Items, which are supposed to be entered concerning methyl bromide use, are included below.

Name of the company of pest control operation:

Name of vessel:

Name of plant article treated with methyl bromide:

Its quantities (metric tones):

Name of fumigation chamber holder:

Name of fumigation chamber:

Chamber capacity (m³):

Loading rate (tones/m³) of consignment in the chamber:

Chamber category in terms of gas holding capability and air tightness:

Methyl bromide application amount (kg):

Application dose rate (g/m³):

Existence of circulation apparatus: Yes or No

Ventilation use: Yes or No

Date of dose application: Year/ Month/ Day/ Time

Chamber space temperature: degree centigrade

Grain temperature: degree centigrade

Name of facility owner, people responsible to pest control operation and workers in the presence of dose application:

Remaining gas concentration at the termination of fumigation treatment: mg/l

Test insect condition: Life or death

Fumigation judgments by plant quarantine inspector: Success or failure

Name of plant quarantine inspector:

Names of target pest insect are entered in the import plant inspection application sheet by plant quarantine inspector.

Full compliance of fumigation recording practice to Decision XXIII/5 paragraph 1

Information mentioned above to be required to enter in the fumigation recording sheet is fully complied with the ones suggested in the Decision XXIII/5 paragraph 1 which mentions only the quantities of methyl bromide used in kilograms, name of the articles fumigated and target pests.

Various efforts to reduce use and emission of methyl bromide in the use of quarantine treatment

Methyl bromide fumigation as Phytosanitary treatment of plant quarantine is strictly put into practice for the consignment in which quarantine pest insects are found intercepted. Quarantine pests of 780 species and non quarantine pests of 226 species have been clearly listed^{*3} on the basis of pest risk analysis based in International Standards of Phytosanitary Measures (ISPM) 2. Pests, which are not listed, are regarded as quarantine pests by the clarification. Many species of grain insect pests have been come to be classified as non-quarantine pest in very earlier time, so that methyl bromide use has been reduced significantly. This is one of the big factors to decrease methyl bromide use in quarantine treatment. Also it is also one of the factors to reduce use of methyl bromide that import commodity, in which quarantine pests could not be found intercepted, has got increased and particularly unsown timber import, which is subject to plant quarantine, has been getting significantly decreased.

Registration of methyl bromide for quarantine use

Methyl bromide for exclusive use of quarantine treatment was specifically registered in December 24th, 1994 which was independently registered away from methyl bromide for general regulated use. Therefore, it is not allowed to the general regulated use such as soil treatment or post harvest treatment. Methyl bromide for quarantine use has been specified with the red label put on the cylinder or the cartridge, so that it is easily recognized as quarantine use. Pest control operator is strictly required to use methyl bromide for quarantine use exclusively and not to misappropriate it to the regulated use.

Dose rates in grain fumigation schedule

Dose rates are respectively set in the fumigation schedule to ensure complete control under various fumigation conditions^{*2}. They are respectively set under consideration of many different factors such as grain loading type of bagged in chamber or bulk in silo, fumigation duration time, categories of plant articles in view of methyl bromide gas absorption, grain temperature, loading rate in chamber, category of air tightness and methyl bromide gas holding capability of the chamber and existence of installation of air circulation in the chamber. Factors related to fumigation conditions are mentioned below.

(1) Fumigation duration: Dose rates are set differently in view of fumigation duration time of 24, 48 and 72 hours. The longer fumigation time is taken, the less dose rate is set.

(2) Grain loading of bagged in chamber or bulk in silo: Usually, grain bags are piled up in the chamber and grain in bulk is put in the silo. Fumigant gas penetrates and spreads easier in the grain bags than in bulk, so dose rate for grain bag is set less than grain bulk in silo.

(3) Plant category with gas absorption: Dose rate is set in view of plant categories of methyl bromide gas absorption. To the plant articles of the less absorption of methyl bromide gas, the less dose rate is set. Dose rate to soy bean is more than wheat because soy bean absorbs more methyl bromide because soy bean has more protein contents than wheat. Flour absorbs more gas than grain, so dose rate of wheat flour is set more than wheat grain.

(4) Grain temperature: When grain temperature is higher, pest insect is more sensitive to the fumigant gas. So the higher grain temperature is, the less dose rate is set.

(5) Loading rate: It means loading volume of consignment in the chamber. It is expressed by tones/m³. More volume of grain is loaded in the chamber, more methyl bromide gas could be absorbed. Therefore more dose rate is necessary.

(6) Capability of gas holding and air tightness of fumigation chamber and air tightness: In Japan high capability of gas holding and high air tightness is extremely expected to fumigation chamber by the quarantine authorities because it should be kept higher level of gas with less leakage outside. Fumigation chambers for quarantine use are designated by the director of plant quarantine station with the way of the check either by gas holding capability or air tightness.

(7) Circulation system in the fumigation facility: Dose rate is set less with the existence of air circulation installation in the facility. Gas is easily distributed in the chamber with circulation system. So dose rate is set less for the chamber with the installation of circulation system.

Improvement of gas holding capability of fumigation chamber

Fumigation chambers for quarantine use are categorized by the check of gas holding capability^{*4}. Methyl bromide is put to the non loading chamber or silo at the dose rate of 10 g/m³ and remaining gas concentration is determined at 48 hours later of dose application. Designation standards of respective category in view of gas holding capability are set by the level of remaining gas concentration. When it is determined more than 85% of application dose rate, chamber is categorized as the class super A. With the remaining gas found more than 70 %, chamber is categorized as the class A, and chamber with more than 55% of remaining gas is as the class B, and more than 40% of remaining gas is as the class C. Chamber with the remaining gas of less than 40% is not designated to the use for quarantine treatment.

Improvement of air tightness of fumigation chamber

Upon the request from chamber owner, check of air tightness of the chamber could be applied instead of the check of gas holding capability^{*4}. For fumigation chamber to which air is sent inside, air pressure gets raised up to 55 mm Aq. and then it is left to lower to the height of 50 mm Aq. At five minutes later, to the chamber where gauge shows higher than 45 mm Aq., the chamber is categorized as class super A. When gauge heights shows between 5 and 45 mm Aq., the chamber is categorized as class A.

For silo or grain elevator, air pressure is raised up to 550 mm Aq. by sending air to stop and left as it is. Gauge comes down to shows down to 500 mm Aq. and left to keep on gauge down. Twenty minutes later from time gauge shows 500 mm Aq., the silo, where gauge shows not less than 400 mm Aq., is categorized as super A. The silo, where gauge shows between not less than 200 mm Aq. and not more than 400 mm Aq., is categorized as class A.

Various measures for the least use and emission of methyl bromide

Various measures have been taken to reduce use and emission of methyl bromide for quarantine use as follows.

(1) Improvement of gas holding capacity and air tightness: Fumigation chamber facility holders have been encouraged to improve gas holding capability and/or air tightness. Currently majority of fumigation chambers, which are designated for quarantine treatment by the authorities, belongs to category of super A or class A.

(2) Operation by fumigation licensed expert: Fumigation operation is required by the instruction of licensed experts to secure safe operation and reliable fumigation effectiveness.

(3) Effort to avoid fumigation failure: If fumigation treatment by methyl bromide be judged failure, it is not allowed to repeat methyl bromide fumigation, but to use alternative method. Success of fumigation treatment should be confirmed by the check that all test insects be found dead and level of remaining gas concentration be found remained more than the prescribed level. If fumigation results are not met with those conditions, fumigation treatment is judged failure and it should be taken further disinfestations procedure. In this case it is usually to use aluminum phosphide or carbon dioxide which take longer time and more cost.

(4) Encouragement of the use of fumigation chamber appropriate to the size of commodity:

Methyl bromide use amount is applied adaptable to the size of fumigation chamber, not to the size of consignment. To small size of consignment, size of fumigation chamber should be appropriately small, not too big compared to the size of consignment.

(5) No mixed loading with the commodity of more absorption: If plants of different category of the absorption are mixed loading, dose rate is applied adaptable to the plant category of which absorption is bigger no matter how small size of the plant article is loaded. For example, maize absorbs more methyl bromide than wheat and rice. Wheat absorption is classified same as rice. So dose rate of rice and wheat is less than maize. Therefore dose rate for mix loading with bagged rice with wheat is rather less than dose rate for mixed loading of rice and maize no matter how small size of maize is put in the chamber to which dose rate is applied to maize.

(6) Encouragement to apply heat treatment for wood packing materials instead of methyl bromide fumigation: Heat treatment is much more encouraged than methyl bromide fumigation unless treatment is done under unavoidable circumstance that such as size of wood packing materials is too big to put in the facility of heat treatment or consignment is already put in the wood packing materials. In 2011, only 3,343 kg of methyl bromide was reported to use for the treatment of exporting wood packing materials which is only 0.6% of methyl bromide used in plant quarantine treatment .

(7) Improvement of list of non-quarantine pest insects and diseases: List of non quarantine pest insects has been elaborated by pest risk analysis based on International Standard of Phytosanitary Measure-2. Japan Government had made a list of non quarantine pests in the grain in early time to which methyl bromide had been used much resulting in vivid reduction of methyl bromide use. At present non quarantine pest insects and diseases were listed 226 species^{*3}. Improvement of the list of non-quarantine pest could be devoted a lot to make less use of methyl bromide.

(8) Development of phosphine gas generator from aluminum phosphide: Tablets or small balls formulation are used in the quarantine treatment as alternative to methyl bromide, however, people prefer methyl bromide fumigation to aluminum phosphide because it takes much longer time. Recently, some installation unit of phosphine gas generator from aluminum phosphide, which is set outside attached to the chamber, had been developed. Use of this unit will save dose rate and shorten fumigation duration which could be implemented soon.

(9) Development of alternatives to methyl bromide: To treat unsown timber and lumber, several alternatives have been developed which are of methyl iodide, mixture of methyl isothiocyanate and carbon dioxide (Ecofume) and mixture of methyl isothiocyanate, carbon dioxide and sulfuryl fluoride (Ecotwin). They are all registered for quarantine uses, however, it is under preparation to amend import plant quarantine regulation.

REFERENCE

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2. Outline on the Import Grain Quarantine
3. Notification of Plant Quarantine Enforcement Notification
4. Outline on the Fumigation Chamber Designation