Mr. Marco Gonzalez
Secretariat for the Montreal Protocol
P. O. Box 30552, Nairobi, Kenya

Dr. H.J. Banks
10 Beltana Road
Pialligo, ACT 2609 Australia

Dr. Nahum Marban Mendoza
Autonomic University of Chapingo
PO Box 56230
Chapingo, Mexico

Dear Mr. Gonzalez, Dr. Banks, and Dr. Mendoza:

Please find attached the United States government response to the questions provided by MBTOC regarding the U.S. 2005 supplemental and 2006 CUE request. These responses are organized by sector for your convenience.

In preparing the CUE nominations and these responses, we have considered all resources available to us, including but not limited to: MBTOC reports, published articles, research reports, and personal communications with researchers and growers. We strive to answer MBTOC questions based on a thorough examination of all relevant material. In the future, it may facilitate our understanding of specific aspects of questions if MBTOC could provide data, or references to the relevant data, that are the basis for some of its questions. We believe this could assist us in providing MBTOC with as complete and accurate a response as possible.

With respect to the U.S. requests in two tobacco-related sectors, we have recently consulted with these applicant groups and the U.S. Government withdraws our nominations for these two sectors that were considered by MBTOC in its June 2004 report. Specifically, we withdraw for consideration our CUE requests for CUN2003/056UScN7 (Nursery float trays for tobacco seedlings) and US56N13 (tobacco – seedlings).

In our bilateral meeting at the Open Ended Working Group, information was requested on the precise details of any movement of CUE applicants to different sectors between the 2005 and 2006 CUE requests. Table 1 below summarizes all such changes.

Table 1. Description of What U.S.A. Applications Have Been Moved To New Sectors

Recategorized Applicants:	From 2005	To 2006
Ham	Commodities	Ham
CA Rose Nursery	Ornamentals	Fruit, Nut, and Flower Nursery
Western Raspberry Nursery	Orchard Seedlings	Fruit, Nut, and Flower Nursery
CA Assoc. of Nurserymen - Deciduous Fruit & Nut Tree Growers	Orchard Seedlings	Fruit, Nut, and Flower Nursery

For your convenience, Table 2 below displays the name of each of the sector specific responses to MBTOC questions in separate electronic files.

Table 2. List of Electronic Filenames

Title of Electronic Files
CUN2003 Stru USA NPMA Dried Commodities and Structures Reply to June 2004 Questions.pdf
CUN2003 Comm USA Dry Cured Pork Products Reply to June 2004 Questions.pdf
CUN2003 Soil USA Eggplant & Peppers Reply to June 2004 Questions.pdf
CUN2003 Soil USA Orchard Replant Request to Reconsider June 2004.pdf
CUN2003 Soil USA Ornamentals Reply to June 2004 Questions.pdf
CUN2003 Soil USA Strawberry Fruit Reply to June 2004 Questions.pdf
CUN2003 Soil USA Strawberry Runners Reply to June 2004 Questions.pdf
CUN2003 Stru USA 01 Mills & Processors Reply to June 2004 Questions.pdf
CUN2003 Soil USA Tomato Reply to June 2004 Questions.pdf
USA 2006 BUNI – Refined Nomination Package.xls

As a final point, the United States requests that MBTOC reconsider its recommendation to cut our request in the orchard replant sector. A detailed explanation describing the need for the amount of methyl bromide included in our request is attached.

I hope that the information provided in this response helps the MBTOC in its deliberations at its next meeting. Should you need further clarification on these questions, please contact John Thompson (ThompsonJE2@state.gov or 1 202 647 9799) on these matters.

Sincerely,

Claudia A. McMurray
Deputy Assistant Secretary for Environment

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Post Harvest Use by NPMA for Facilities and Commodities.
Document Number	CUN 2003/, US56N10
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1: Key Pests for Methyl Bromide Request: Facilities

Genus and species of major pests for which the use of Methyl Bromide is critical	Common Name	Specific Reason why Methyl Bromide is Needed
Tribolium confusum	Confused flour beetle	Pest status is due to health hazard: allergens; plus body parts, exuviae, and excretia violate FDA regulations[1]. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not adequate.
Tribolium castaneum	Red flour beetle	
Trogoderma variable	Warehouse beetle	Health hazard: choking and allergens; plus body parts, exuviae, and excretia violate FDA regulations. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not adequate.
Lasioderma serricorne	Cigarette beetle	Food contamination violates FDA regulations. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking of some products; oils and butter go rancid with heat) so phosphine and heat are not adequate.
Sitophilus oryzae	Rice weevil	
Plodia interpunctella	Indianmeal moth	
Oryzaephilus mercator	Merchant grain beetle	
Cryptolestes pusillus	Flat grain beetle	

[1] FDA regulations can be found at: http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm and http://www.cfsan.fda.gov/~dms/dalbook.html.

Table 2: Key Pests for Methyl Bromide Request: Commodities

Genus and species for which the use of Methyl Bromide is critical	Common Name	Specific Reason why Methyl Bromide is Needed
Cydia pomonella	Codling moth	MB is used mainly where rapid fumigations are needed to meet customer timelines during critical market windows and peak production periods. During peak production months, phosphine fumigation takes three times longer than conventional MB fumigation and 17 times longer than vacuum MB fumigation. The required duration of phosphine fumigation increases as commodity temperature decreases, making its use impractical during the cold winter months. No technically or economically feasible alternatives exist at present during these critical periods.
Amyelois transitella	Navel orangeworm	
Plodia interpunctella	Indianmeal moth	
Tribolium castaneum	Red Flour Beetle	
Cadra figulilella	Raisin Moth	
Carpophilus sp.	Dried Fruit Beetle	
Ectomyelois ceratoniae	Carob pod moth	
Carpophilus spp., *Haptoncus* spp.	Nitidulid beetles	

Amount Of Methyl Bromide Nominated

Table 3. Amount of methyl bromide Nominated by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description
144,863	144,863	No difference between the years because this is a new CUE. This was added as a supplemental request for 2005.

Economic Impacts

There was no economic assessment conducted for this sector because the background economic information was not available from the applicant.

Response to Questions

MBTOC Question 1 - MBTOC is unable to assess this CUN. The Party has requested amounts for treatment of cheese plants, and in addition for a range of commodities listed as spices and herbs, cocoa, dried milk, other commodities and processed foods. MBTOC recognizes the need for MB for cheese stores and for the dried milk. MBTOC can determine no reason why alternatives cannot be used for all or most of the spices and herbs, cocoa, and processed foods. Alternatives registered for some of all these commodities in the U.S. include irradiation, ethylene oxide, phosphine, steam, and propylene oxide. In addition most of the use designated as for other commodities may qualify as QPS treatments. The Party is requested to disaggregate the commodity groups, specifying the target organism and state any regulatory or technical reasons why each of the possible alternatives cannot be used for each separate commodity group and target.

U.S. Response - The commodity and structures groups and amount of methyl bromide nominated are listed by specific type of use in Table 4. In this sector, many of the requesting facilities use methyl bromide for fumigation of both the structure and the commodity being processed in that structure. A discussion of the target pests and the regulatory, technical and economic feasibility of control using alternatives are provided below for each type of use.

Table 4. Type of use and Amount of Methyl Bromide Nominated for 2006 (kg) And Location of Pest List

	Processed Foods (chips, cookies, crackers, Pasta, etc)	Cheese processing Plants	Spices and Herbs	Cocoa	Dried Milk	Other Commodity[1]
Kg Nominated	89,861	3,596	5,869	76,899	503	4,352
Key Pests	Table 1 and listed below		Table 2 and listed below			

Commodity: Processed Foods (chips, crackers, cookies, pasta), Cheese Processing Plants

Key Pests:

Flour beetles – *Tribolium* spp.
Indian meal moths – *Plodia interpunctella*
Cigarette beetles – *Lasioderma serricorne*
Dermestid beetles – *Trogoderma* spp.
Drug store beetles – *Stegobium paniceum*
Saw-toothed grain beetles – *Oryzerphilus surinamenis*
Warehouse beetles – *Trogoderma variabile*

Shortcomings of alternatives:

1. Irradiation – Space treatments with fumigants are utilized to target pest infestations in harborage areas such as equipment, and overhead spaces where airborne food particles may accumulate. Irradiation could not be utilized in the same manner as conventional fumigants that are used to treat an entire processing or storage facility. In addition, this technology is not considered a feasible alternative due to cost of purchasing and operating equipment, logistics for treatment, and concerns of consumer acceptance of irradiated foods.

2. Ethylene oxide – This alternative is not available for this use because it is not labeled for this commodity and no food additive tolerances are in place.

3. Propylene oxide – This alternative is not available for this use because it is not labeled for this commodity and no food additive tolerances are in place.

4. Heat and Phosphine – Heat treatments or phosphine fumigations require longer treatment durations than that for methyl bromide. In the food industry, increased downtime equals lost productivity. As an example, estimated cost/day for downtime in an average pasta facility was $125,000. In addition, heat treatments are typically utilized several times per year, which in turn significantly increases downtime (usually 2 to 4 times/year and at some facilities, heat treatments are performed monthly). This simple cost value, however, does not represent all costs associated with heat or phosphine alternatives. Significant capital

[1] Includes tea on pallets, coffee beans, tomatoes, bell peppers, citrus and cassava.

outlay would be necessary to upgrade equipment or systems (electrical, plumbing, etc.) so that they are compatible with heat or phosphine. Costs would need to be budgeted for repairs incurred from either type of treatment. In addition, if in-place heat sources were inadequate, supplemental heat costs would be significant.

5. Steam – Not a practical treatment option for dry finished food products as this technique affects the quality of the finished product and can leave a residual moisture in the processing equipment.

Commodity: Spices and Herbs, and Other Commodity[2]

Key Pests:

Cigarette beetles – *Lasioderma serricorne*
Confused flour beetles – *Tribolium confusum*
Drug store beetles – *Stegobium paniceum*
Indian meal moths – *Plodia interpunctella*

Shortcomings of alternatives:

1. Irradiation – A large portion of spices and herbs and other commodities are currently treated with irradiation in the U.S. Due to logistics and cost issues, this treatment method is not always an available method. See comments above under processed foods.

2. Ethylene oxide – Many countries (Japan, some EEC, the United Kingdom) have banned the use of ethylene oxide (ETO) because it reacts with organic spice components to leave the harmful residues ethylene chlorohydrin and ethylene bromohydrin on spices. In Canada, ETO can not be used on vegetable seasonings or spice mixtures containing salts. ETO can result in unacceptable color changes (darkening) in some vegetable seasonings such as onion and garlic powder and off flavor in mustard and mustard flour.

   ETO is a suspected carcinogen currently under review by the U.S. EPA and is scheduled to be completed in 2006. The World Health Organization has recently upgraded ETO to a known carcinogen. Due to the instability and flammability of ETO, it must be mixed with carbon dioxide or nitrogen (formerly was mixed with CFCs).

   Source: M. Marcotte, "Effect of Irradiation on Spices, Herbs and Seasonings – Comparison with Ethylene Oxide Fumigation."

3. Propylene oxide – Banned in some countries for the residues it leaves in spices. There is one currently registered product in the U.S. and application methods are limited to fumigation chambers. Lack of facilities in the U.S. to perform vacuum fumigations

[2] Includes tea on pallets, coffee beans, tomatoes, bell peppers, citrus and cassava.

creates logistical problems. In addition, this technology is not considered a feasible alternative due to cost of purchasing and operating fumigation chambers.

4. Phosphine – See comments under processed foods and cocoa.

5. Steam – Results in the loss of volatile flavor and aroma components and color change. Steam can also increase moisture level of the commodity being treated, possibly resulting in the high level of mold contamination seen in spices and herbs and other commodities previously treated with ETO and steam.

Commodity: Cocoa

Key Pests:

Indian meal moth – *Plodia interpunctella*
Cigarette beetle – *Lasioderma serricome*
Foreign grain beetle – *Ahasuerus advena*
Cocoa moth species
Warehouse moths – *Plodia* spp. and *Ephestia* spp.
Coffee bean weevils – *Araecerus fasciculatus*

Shortcomings of alternatives:

1. Irradiation – See comments under processed foods. There is currently no equipment present at facilities receiving cocoa beans at U.S. ports, and any such equipment would need to be capable of processing large volumes of product during the seasonal delivery period in order to be considered commercially feasible in today's market. Equipment would also have to be capable of penetrating bulk packaged cocoa. Due to logistics and cost issues, this treatment method is not economically viable.

2. Ethylene oxide – This product is not available for cocoa because it is not labeled for this commodity and no food additive tolerances in place.

3. Propylene oxide – This product is not available for cocoa because it is not labeled for use on cocoa in California. See above comments under spices and herbs.

4. Phosphine – The major reason phosphine is not considered a viable alternative for treating cocoa beans is related to the increased time that it takes to treat cocoa, and the large influx of shipments during peak periods of the year. Most fumigation work is completed in large cocoa storage facilities close to waterfronts. Large bulk ships with up to 200,000 burlap bags of cocoa arrive at different times of the year. September through April is the peak delivery months of cocoa into the U.S., depending on harvest time. Ships are typically heavily infested with insects; sometimes infestations are so heavy that workers must wear full-face protection to protect against insects interfering with their normal work operations (30 plus insects per thousand cubic feet counts are normal).

During discharge, cocoa beans are covered with large tarps to prevent cross-infestation with other cocoa stored at a warehouse site. Cocoa at these warehouses is owned by numerous brokers and processors who use these large warehouses as storage and to complete on-time delivery of product to processing plants. Most of these warehouses are not heated and range in temperature from 40-55° F during the busy delivery months. The recommended exposure time for phosphine at temperatures of 40-55° F is 5 to 10 days, while methyl bromide is 16 to 24 hours according to the label.

Most warehouse employees (both skilled and unskilled laborers) would have to be laid off whenever a shipment arrives at their location due to the length of fumigation exposure time. Fumigation costs would almost double due to the longer reentry times and much longer security and monitoring needs. For example, a fumigation with a 24-hour exposure period can be completed (i.e., preparation, fumigation, ventilation and cleanup) in 30 to 35 hours, whereas a fumigation with a 96 hour exposure period requires approximately five days to complete. Most of the cocoa is shipped to processors on an on-time delivery system. If left infested, the product's quality and quantity would be further reduced and could cause cross-infestation of other product already treated. The cocoa would eventually become unusable according to FDA standards, if not treated.

5. Steam – See comments under spices and herbs. Steam is used to sterilize cocoa beans during processing, but only when the beans immediately go into the next phrase of processing. Beans that are steamed will develop mold within 24 hours, thus ruining them. For cocoa beans to be steamed in lieu of fumigation, they would have to be removed from the bags in which they are packed, steamed, dried and then re-packaged. Cocoa beans typically undergo extensive processing, and the additional cost of steam treatment in lieu of fumigation would increase processing costs beyond typical profit margins in the industry.

References

2006 Bromide Usage Numerical Index (BUNI) – Refined Nomination Package. Attached to U.S. Response to Questions as an Excel Spreadsheet.

Marcotte, M. 2000. Effect of Irradiation on Spices, Herbs and Seasonings – Comparison with Ethylene Oxide Fumigation. http://www.food-irradiation.com/Spices.htm.

Zammer, C. 2004. Food Irradiation: Is it a matter of Good Taste? Food Quality June/July 2004.

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Post Harvest Use on Dry Cured Pork Products
Document Number	CUN 2003/048, Us56N6
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide on Dry Cured Pork Products

Region where methyl bromide use is requested	Genus and species for which the use of Methyl Bromide is critical	Specific Reason why Methyl Bromide is Needed
Kentucky, Missouri, North Carolina, South Carolina, Tennessee, Virginia	**Red Legged Ham Beetle** *Necrobia rufipes* – common pest	The adults feed on the cured meat. The larvae burrow into the meat and fat. The larvae are commonly referred to as a “Ham Borer”
	Cheese/Ham Skipper *Piophila casei* – common pest	The Skippers are larval stages of small flies and they burrow into the cured meat.
	Dermested beetles *Dermestes* spp-common pests	The adults and larvae feed on the cured meat.
	Ham Mites Several mite species -- common pest	The mites feed on the surface of the cured meat.

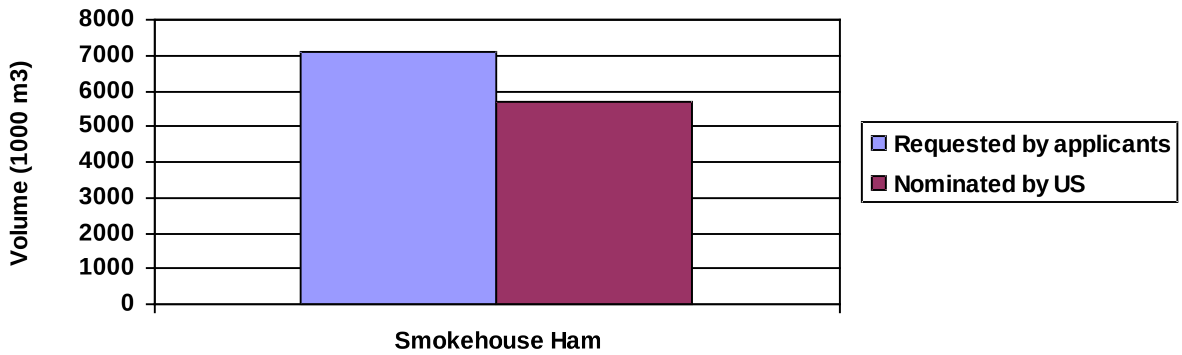
Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated* by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description
135,397	135,742	Amounts have changed from original U.S. 2005 nomination due to re-categorization and new CUEs (National Country Ham, Nahunta Pork Center, and American Association of Meat Processors). Reduction in use rate imposed by U.S. on applicants.

- 2005 Nomination includes 2005 Supplemental Requested nomination amount.

FIGURE 1. U.S. VOLUME REQUESTED AND NOMINATED FOR SMOKEHOUSE HAM



Footnote: The requested volumes are sum total for all CUE applications. The nominated volume reflects reductions to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on the nominated volume.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

RESPONSE TO QUESTIONS

MBTOC Question 1 – MBTOC is unable to assess this CUN. A CUE of 0.907 tonnes was approved by the EMOP for this use for 2005. The Party states historical use have varied from 972 kg and 1659 kg per year for the past few years. MBTOC does not recognize any viable alternatives for the use, but requests clarification of the reasons for the large increase in quantity of use leading to the nomination and further information on why this need is critical?

US Response - There are more than 1,650 pork production facilities in the United States. Of these, approximately 850 facilities currently use methyl bromide to fumigate dry cured pork products.

Initially in 2002, Gwaltney of Smithfield was the only CUE applicant from the entire dry cured pork product industry. The U.S. government contacted several other dry cured pork produced to determine how they controlled these pests. At this time (late 2002), several other producers (the National Country Ham Association, Wayco Ham Company, Ozark Country Hams, Nahunta Pork Center, and the American Association of Meat Processors) indicated that they would like to apply for a CUE as well. However, they did not have adequate time to adequately gather and prepare the information for a CUE application for consideration in the first round for 2005. While the U.S. was aware of these additional producers, it did not have the necessary information to complete the application package. Therefore, the initial amount of methyl bromide requested in 2002 did not reflect the total use of methyl bromide in the industry because it only reflected the amount needed by this single applicant, Gwaltney.

In 2003, CUE applications were received from the National Country Ham Association, Nahunta Pork Center, and the American Association of Meat Processors. The amount of methyl bromide requested in these 2003 CUE's represented a majority of the pork production facilities in the U.S. The U.S. has not been contacted by any additional pork producers and considers the current request to reflect the need for methyl bromide in this industry sector.

There are no registered alternatives for use on dry cured pork products in the U.S. Dry cured pork producers need methyl bromide because of the damage that can occur due to insect and mites. It is common for producers of dry cured pork products to experience pest pressure from insects such as the ham skipper, the red legged ham beetle, and mites. These insects infest and feed on meat as it cures and ages. Infested products are not acceptable to consumers. Environmental conditions such as temperature and humidity in and around the curing facility influence the level of pest pressure. In general, higher temperature and humidity levels in the facilities result in higher pest pressure; in the southeastern states where many facilities are located, temperatures and humidity are high for long periods of time. There are no registered alternatives for use on dry cured pork products in the U.S.

References

2006 Bromide Usage Numerical Index (BUNI) – Refined Nomination Package. Attached to U.S. Response to Questions as an Excel Spreadsheet.

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use for Eggplant and Pepper Grown in Open Fields on Plastic Mulch
Document Number	CUN 2003/050,058, Usc6N3, Usc6N9
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide in Eggplant and Peppers

Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide is needed
Michigan	**Crown and root rots** caused by the soil-borne fungus *Phytophthora capsici*.	Fumigation practices need to be completed by the first week of May to allow growers to plant early and capture the early market for premium prices, as well as ensuring demand for their crop during the entire growing season (especially during the mid and late season. Under moderate to severe pressure the alternatives are not feasible because they have to be applied later when the soil has warmed up.
Georgia and Southeast U.S. excluding Florida	**Yellow and purple nutsedge** (*Cyperus esculentus, C. rotundus*); **Plant-parasitic nematodes** (*Meloidogyne incognita; Pratylenchus sp*) **Pythium root and collar rot**s (*P.irregulare, P. myriotylum, P. ultimum, P. aphanidermatum*) **Crown and root rot** (*Phytophthora capsici*) **Southern Blight** (*Sclerotium rolfsii*)	Only MB can effectively control the target pests found in the southeastern United States where pest pressures commonly exist at moderate to severe levels. Most, if not all of these states are limited in the use of the alternative 1,3-D because of underlying karst topography throughout the region. Halosulfuron, while effective against nutsedge, is only registered for use on row middles in peppers. Metam-sodium has limited pest control capabilities and should never be used as a stand-alone fumigant (Noling, 2003).
Florida	**Yellow & purple nutsedges** (*Cyperus rotundus & C. esculentus*) **Phytophthora Blight** (*Phytophthora* spp.) **Root-knot nematodes** (*Meloidogyne* spp.) **Damping-off Disease** (*Rhizoctonia solani*, *Pythium* spp.) **Nightshade** (*Solanum* spp.)	Only MB can effectively control the target pests found in Florida where pest pressures commonly exist at moderate to severe levels. Use of 1,3-dichloropropene is restricted in key growing areas of Florida underlain by karst geology and sandy (porous) sub-soils, geological features that could lead to ground-water contamination. While approximately 40 % of Florida's vegetable production land has these soil constraints, 1,3-dichloropropene is prohibited in key growing areas like Dade County, where 100% of the growing area is affected (U.S. EPA, 2002, Noling, 2003). Metam-sodium has limited pest control capabilities and should never be used as a stand-alone fumigant (Noling, 2003). Halosulfuron, which is effective against nutsedge, is only registered for use in row middles in peppers.

Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide is needed
California	**Crown and root rots** caused by soil-borne fungi – particularly *Phytophthora capsici.* **Plant-parasitic nematodes**, primarily root knot (*Meloidogyne* spp.)	Registered alternative fumigants, fungicides, and nematicides are not as cost-effective and do not provide the same level of pest control as methyl bromide. One application of methyl bromide can last more than a year (within a particular field), whereas alternative chemicals must be applied annually. Regulatory constraints restrict the use of 1,3-D as an alternative.

Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated* by the U.S. in 2005 and 2006 - Eggplants

2005 (kg)	2006 (kg)	Description of Differences Between Years
76,726	101,245	Michigan's request was added. New data on extent of pest pressure showed a higher incidence of moderate to severe nutsedge pressure in the SE US and resulted in an increase in the US request.

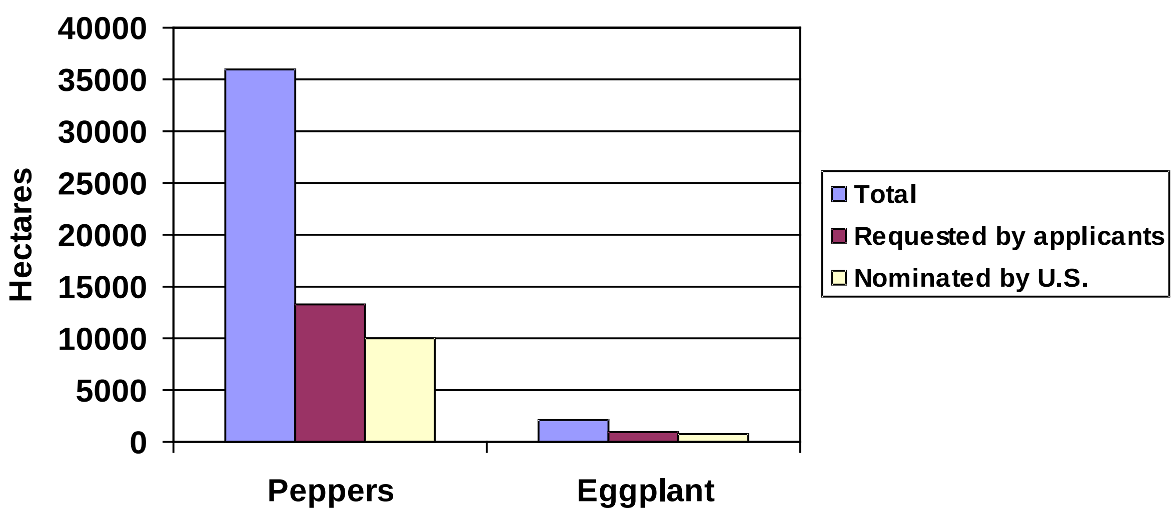
* 2005 Nomination includes 2005 Supplemental Requested nomination amount.

Table 3. Amount of methyl bromide Nominated* by the U.S. in 2005 and 2006 - Peppers

2005 (kg)	2006 (kg)	Description of Differences Between Years
1,094,747	1,498,530	Michigan's request was added. New data on extent of pest pressure showed a higher incidence of moderate to severe nutsedge pressure in the SE US and resulted in an increase in the US request.

* 2005 Nomination includes 2005 Supplemental Requested nomination amount.

Figure 1. U.S. Total, Requested, and Nominated Hectares of Peppers and Eggplant



Footnote: Total hectares, based on United States Department of Agriculture Statistics, are national acreage in production for this sector. The requested hectares are sum total of all areas in the CUE applications. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or “BUNI” **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

ECONOMIC IMPACTS

The economic impacts were assessed using four economic parameters: 1. loss per hectare, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

RESPONSE TO QUESTIONS

MBTOC Question 1 – MBTOC is concerned that much of the research conducted on uses of alternatives is conducted on peppers or tomato and extrapolated to eggplant production, particularly on the impact of nutsedge infestation. Are there results of commercial trials available on MB and alternatives for these specific crops and circumstances?

US Response - As far as EPA is aware, there are no results as yet from commercial trials in the USA that use eggplants specifically as the crop system in which to compare the efficacy of MB with alternative fumigants as nutsedge control agents. Research has been done in peppers, and this work was mentioned when in the discussion of MB alternatives in the eggplant and pepper CUNs. However, since eggplants are in the same family (Solanaceae) as both peppers and tomatoes, and are grown in the same regions of the USA as those crops, EPA believes that research done on peppers and tomatoes is applicable to eggplants also.

A summary of results of research studying various MB alternatives was presented in the technical discussions included in the 2003 eggplant and pepper CUNs. These are reproduced below. An important aspect that should be kept in mind when considering research on MB alternatives is that promising herbicides and fungicides that could serve as MB alternatives, at least when combined with alternative fumigants (e.g., pebulate) are not yet available to US eggplant and pepper producers due to their lack of registration.

Summary of suitability of some key MB alternative fumigants and herbicides for nutsedge control in vegetable production that are directly applicable to eggplant and peppers:

1,3 D + chloropicrin: This combination will not adequately control nutsedge. 1,3-dichloropropene cannot be used in key pepper growing areas of the U.S. where karst topography exists due to ground-water contamination concerns. Where 1,3-dichloropropene use is allowed, set back restrictions (~ 100 meters from occupied structures; ~ 30 meters for emulsified formulations applied via chemigation) may limit the proportion of the field that can be treated. In addition, because of a 28-day waiting period between application and planting (compared to 14 days for MB), growers could lose half of the harvest season and miss higher-end market windows, mainly for spring fumigations (i.e., fall harvests). (SE Pepper Consortium, CUE # 03-0041).

Metam-sodium: Metam sodium provides limited and erratic performance at suppressing all major eggplant and pepper pathogens and pests. Also, there is a 21-day waiting period at the time of application until planting compared to 14 days for MB. Such a delay causes the higher-end market windows to be missed—particularly for the spring plantings (i.e., fall harvests). Beginning the application cycle earlier is not an option since crops from the previous fumigation cycle must be cleaned up prior to metam application. (Georgia CUE # 03-0049; Kelley, 2003). Repeated applications of MITC (the breakdown product of metam sodium) are known to enhance its biodegradation (and reduce efficacy) as a result of increased populations of adapted microorganisms (Dungan and Yates, 2003).

Metam-sodium + chloropicrin: Trials in tomato have shown inconsistent efficacy of this formulation against fungal pests, though it is generally better than metam-sodium alone (Locascio and Dickson 1998, Csinos et al. 1999). Low efficacy in even small-plot trials indicates that this is not a technically feasible alternative for commercially produced eggplants or peppers at this time.

Herbicides and fungicides: Furfural has shown good efficacy against the fungal pests cited as key targets by Michigan eggplant growers, although results are based on small plot trials conducted in eggplants and other vegetables (please see the “Summary of Technical Feasibility in the eggplant and pepper CUNs for further discussion). However, furfural is not yet registered for any crop in the U.S. Halosulfuron, which has shown good efficacy against nutsedge is available for eggplants and peppers in the USA, but can only be applied to row-middles, loses effectiveness if rain occurs soon after application, and has significant plant-back restrictions (0-36 months). Thus, nutsedges could still survive near crop plants, and rainfall – frequent and locally unpredictable during the vegetable growing season of the southern USA – would often render halosulfuron ineffective as an MB alternative.

Numerous research trials have indicated that pebulate would work as well as MB in combination with 1,3 D and chloropicrin formulations to control nutsedge weeds in a variety of US vegetables, including eggplants and peppers. Pebulate is no longer registered for use in the USA and no manufacturer has sought to reregister it. Other herbicide options, while less promising for nutsedge control, were discussed in some detail in the eggplant and pepper CUNs.

MBTOC Question 2 – Clarification is requested on the specific weed and disease incidence for the 2 crops and how the specific pests and cultural needs and practices affect the feasibility of alternatives for the 2 crops.

US Response - As was discussed in the CUN, for Michigan eggplants, *Phytopthora* incidence is ubiquitous and difficult to control with MB alternatives or cultural practices because of relatively cool climates and the ability of this pathogen to disperse in irrigation water. This factor also affects incidence of this pathogen in the warmer climates of the southeastern USA, a region that has also requested a CUN, in part, for use against this pest.

However, a far more critical use of MB in this region is to control yellow and purple nutsedges in eggplants, peppers, as well as cucurbit vegetables. It is generally accepted by scientific experts that the incidence of these weeds in the southern USA is very high.

Earlier this year, Dr. Stanley Culpepper of the University of Georgia submitted to EPA the results of a survey intended to characterize the incidence of nutsedges in their operations. In this survey, extension agents in 34 Georgia vegetable producing counties were polled to better understand the level of nutsedge infestation in eggplants and peppers, among other vegetable crops. Their responses are based on their extensive interactions with vegetable growers in their jurisdictions. The portion of the survey data related to eggplants and peppers is summarized below:

TABLE 4. PERCENT CURRENT NUTSEDGE INFESTATION IN GEORGIA COUNTIES WHILE METHYL BROMIDE IS AVAILABLE (CULPEPPER, 2003).*

Crop	No Infestation	Light Infestation	Moderate Infestation	Severe Infestation
Pepper	1.3	18.9	65.6	14.2
Eggplant	1.0	40.6	39.0	19.4

*Footnote: No infestation = no nutsedge infesting production area. Light infestation = < 5 nutsedge plants per square yard. Moderate infestation = 5 to 30 nutsedge plants per square yard. Severe infestations = >30 nutsedge plants per square yard.
In the BUNI "High Key Pest Distribution" was calculated by added the moderate plus severe infestation. Low Key Pest Distribution was calculated by adding the severe infestation plus one half the moderate infestation.

TABLE 5. PERCENT ANTICIPATED NUTSEDGE INFESTATION THE YEAR AFTER THE INABILITY TO USE METHYL BROMIDE (CULPEPPER, 2003). *

Crop	No Infestation	Light Infestation	Moderate Infestation	Severe Infestation
Pepper	0.0	9.1	31.6	59.3
Eggplant	0.2	11.9	50.3	37.6

*Footnote: No infestation = no nutsedge infesting production area. Light infestation = < 5 nutsedge plants per square yard. Moderate infestation = 5 to 30 nutsedge plants per square yard. Severe infestations = >30 nutsedge plants per square yard.
In the BUNI "High Key Pest Distribution" was calculated by added the moderate plus severe infestation. Low Key Pest Distribution was calculated by adding the severe infestation plus one half the moderate infestation.

While this survey focused on Georgia, we expect that the levels of nutsedge infestations reported for these crops is likely to be representative of that in other areas of the southern USA.

The impact of specific pests and cultural needs and practices was discussed in the CUNs for peppers, eggplants and cucurbits; this impact is similar for all these crops. A brief summary of this discussion follows below:

In Michigan, the MB alternatives 1,3 D (with or without chloropicrin) and metam-sodium cannot be used in a timely manner due to low soil temperatures. If forced to rely on these options, growers would not only have the limited efficacy discussed in the eggplant and pepper CUNs, but would also miss key market windows where much of their revenue is derived. The widespread distribution and ease of spread of the target disease pests makes it virtually impossible for growers to select and maintain pest free fields. In the southern USA, these MB alternatives have the efficacy problems described above as regards nutsedge control. In addition, nutsedges are also widespread pests in this region, are capable of surviving adverse conditions such as high temperatures and flooding, and have a very high reproductive potential from tubers.

MBTOC Question 3 – While recognizing that the dosage rates of MB, as MB/Pic mixtures, on a per total area basis is relatively low, further information is sought on the scope for reduction in the nominated quantity through the use of barrier film technology, e.g., VIF, to reduce emissions and improve fumigant efficiency. There may also be potential for further increases in use of strip fumigation, perhaps combined with herbicide use".

US Response – While tarping is already used on all related crops, and related emissions have been reduced to the greatest extent feasible, virtually impenetrable film (VIF) has thus far not shown to be adaptable to the warm, wet climates of the southern USA where eggplants and pepper growers are requesting MB. VIF has poor application characteristics: it must be unrolled slower to prevent tearing, photodegradation is a problem when used for multiple crops, and there are problems with disposal in many localities. Growers report that it deteriorates easily under these climate conditions (Aerts 2003). While Michigan has a cooler climate, the effect of VIF on disease pathogen survival remains unknown. Thus, for all pepper and eggplant production areas that have requested MB this year, the US government believes that VIF is not a commercially viable option for reducing emissions. As regards increases in strip fumigation, there are no effective herbicides as yet registered for these crops that would adequately control nutsedges. Halosulfuron, while available for these crops, has the limitations already discussed (above), and for those reasons, we believe it would not be commercially viable in combination with strip fumigation as a means of reducing emissions.

MBTOC Question 4 – The 2006 nomination for eggplants and peppers represent increases in nomination over those approved by the EMOP of 33 and 487 tonnes respectively. With allowance for newly nominated quantities in 2005, these quantities are still substantial increases. Specific information is sought on the reasons for the increase bin nominated quantities.

US Response – The U.S. received new information on the extent of pest pressure in the Southeast U.S. This information was based on a survey conducted in Georgia by Stanley Culpepper at the University of Georgia (see Table 4 & 5 above). These survey results demonstrate that moderate to severe pest pressure was present at a much higher level than our earlier estimates suggested. When these new estimates were used in the Bromide Usage Analysis Information (BUNI) they indicated that more hectares of eggplant and peppers had a critical need for methyl bromide.

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USA, Request to Reconsider Orchard Replant Recommendation Amount

NOMINATING PARTY:	The United States of America
BRIEF DESCRIPTIVE TITLE OF NOMINATION:	Request to Reconsider the Amount Recommended for 2006 Methyl Bromide Critical Use Nomination for Preplant Soil Use for Orchard Replant
DOCUMENT NUMBER	CUN 2003/056, Uso6N7
DATE	August 12, 2004

TABLE 1. REGION, KEY PESTS, AND SPECIFIC REASON FOR METHYL BROMIDE IN ORCHARD REPLANT

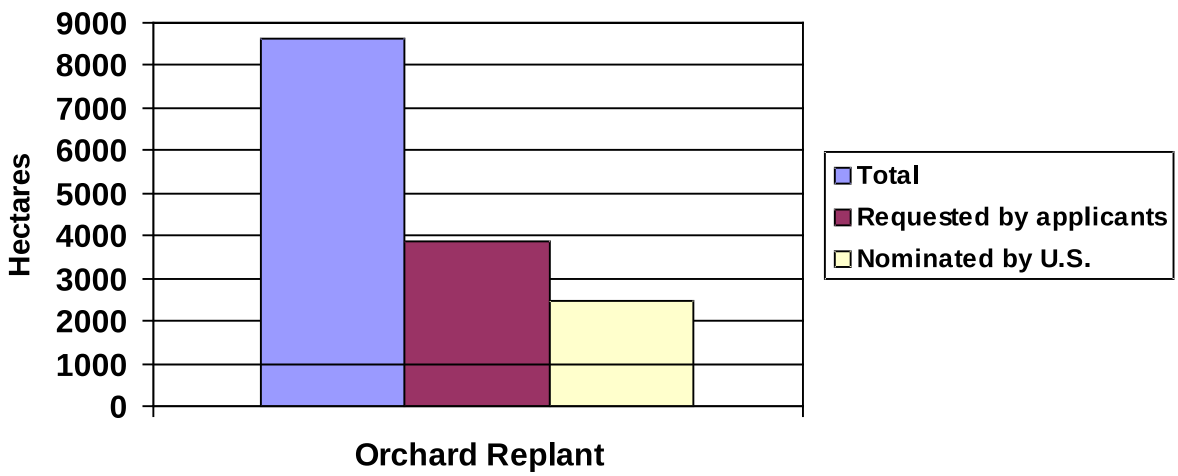
REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO GENUS AND, IF KNOWN, TO SPECIES LEVEL	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED
California Grape and Tree Fruit League—Stone Fruit	Replant problem is a disease complex comprised of interactions between various pathogens and environmental factors. **Nematodes (Primary pests):** *Meloidogyne* (root knot); *Criconemella* (ring); *Xiphinema* (dagger); *Pratylenchus* (root lesion); and *Tylenchulus* (citrus) **Pathogens:** *Armellaria*, *Phytophthora*, and various fungi, depending on orchard location and conditions that are thought to contribute to orchard replant disorder. **Insect:** *Pollyphylla decemlineata* (tenlined June beetle)	Some alternatives, such as 1,3-D, may be effective in reducing the effects of orchard replant disorder where there are no legal restriction and in light, sandy loam soils, and where there is acceptable soil moisture. In other situations, where soils are medium to heavy, or where township caps are applicable, MB is the only compound that can effectively target root remnants from previous orchard trees.
California Walnut Commission (Central Valley and coastal valleys)	Replant problem caused by interactions of pests and environment primarily **Nematodes:** (in ~85% of orchards) *Pratylenchus vulnus*, *Mesocriconema xenoplax*, *Meloidogyne* spp.	Township caps and unacceptable soil moisture (>12% at over 1 meter depths in medium and heavy soils) limit 1,3-D use (the best alternative) to approximately only 30% of orchard land.
Almond Hullers and Processors Association (California)	Replant problem is a disease complex comprising an interaction of pests (primarily nematodes) and environmental factors. Nematodes: *Meloidogyne incognita* (root knot), *Pratylenchus vulnus* (root lesion), *Mesocriconema xenoplax* (ring), *Xiphinema americanum* (dagger)	Many new almond orchards were planted between 1979 and 1982. These orchards will soon need to be replanted as the life of the orchard is reaching its maximum (25-30 years). Because no virgin land is available, replant problems will occur in these locations. Because of township caps and water moisture issues, the best alternative, 1,3-D is not available or effective as a replacement. Therefore, MB is considered critical for this industry.

Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description of Differences Between Years
706,176	827,994	New data was used on total combined impacts. CA anticipates higher use for the next few years due to cyclical replacement of orchard crops. Reduction in use rate imposed.

Figure 1. U.S. Total, Requested, and Nominated Hectares of Orchard replant



Footnote: Total hectares, based on United States Department of Agriculture Statistics, are U.S. hectares in production for this sector in 2002. The requested hectares are sum total of all areas in the CUE applications. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total kilograms of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

Economic Impacts

The economic impacts were assessed using four economic parameters: 1. loss per hectare, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

REQUEST TO RECONSIDER ORCHARD REPLANT SITUATION

Purpose. The United States requests that MBTOC reconsider the amount of methyl bromide (MB) it recommended for the Orchard Replant sector for 2006. We believe that there are circumstances that justify an allocation of the nominated amount (839.755 metric tonnes) of MB. Indeed, MBTOC itself notes that the alternatives that may be available in this area have not been well proven. Although we are committed to further research in this area (please see "Research—Alternative Strategies" section below), we believe that nominating countries, and their respective farmers, should not have to bear the substantial risk of orchard failure until suggested alternatives have been more fully tested and proven to be effective.

Rationale. Because of the cyclic and long-term nature of the replant crops, we believe that the use of MB by the Orchard Replant sector does not adhere to the general model for annual, or even some perennial crops. Almond orchards, for example, have a 20 year, or longer, production cycle and replacement of orchards planted in the late 1970s and early 1980s (when a large number of almond orchards were established) will be necessary within the next five or six years. We believe that the baseline for MB use during the last five years is not representative of the critical needs of this sector since MB is used only once in the life of an orchard and orchards are productive for 20 to 40 years. Over 25,000 hectares of orchards will have to be replaced each year to maintain current crop bearing hectares, which is comparable to the number of hectares planted prior to 2000 in California (Tables 3 and 4). Therefore, comparative use of MB should be for those orchards planted years ago. Because there currently does not appear to be a "drop-in" replacement for MB for this sector, it is likely that a combination of chemical and non-chemical strategies will have to be used to successfully manage orchard replant disorder (McKenry, 1999). Until such time as the optimum replacements have been proven, however, we believe there is a critical need for MB to help in the successful establishment of orchard and vineyard plants.

This sector supports ongoing research to assess the efficacy of various disease management strategies, but *now* they must use a proven management tool for new orchards that will be productive for the next several decades. We believe that critical soil and regulatory impacts on orchards are actually at the higher end of the calculated impact range of affected orchards, such that a greater amount of MB will be required to prevent a significant economic loss. MBTOC is correct that the "…main constraint to the adoption of alternatives is the inability to identify definitively what is causing replant disease and implement appropriate response" and in the near future current research should help elucidate the complex nature of orchard replant disorder. MBTOC is also correct that "…the industry is aware of technically feasible and available alternatives and use of VIF for emission reduction". Unfortunately for orchard producers, this disorder manifests itself differentially, depending on the orchard location, type of crop, type of soil, and even type of crop that was previously planted in the replant site (McKenry, 1999; Messenger and Braun, 2000). Consequently, the short term ability of orchard farmers to produce acceptable yields will be reduced without MB, a proven effective management tool, in situations where alternatives have not been effective or where they are not allowed.

Background. The U.S. Nomination within the Orchard Replant sector was for areas where alternatives were not suitable, either because of legal restrictions or physical features such as unacceptable soil moisture. For most sites of orchard replant with stone fruit, grapes, walnuts, and almonds in California, MB is a critical tool for establishing healthy, long lived orchards. Only some of the orchard sites in California are currently able to effectively use alternative measures to manage orchard replant disorder, the disease complex that is associated with various pathogens (primarily nematodes, some fungi, and possibly at least one insect species) and environmental factors such as soils, moisture, climate, and nutrition (Browne et al., 2002; McKenry, 1999).

Many aspects of the etiology of this disease complex are currently not known. Orchard replant “problem” or “disorder” presents a difficult challenge to growers when replanting orchards and vineyards, considering the long-term investment (typically fruit orchards and vineyards can produce for 20-25 years, walnut orchards can produce for 40 years, and almond orchards produce on average 25-30 years) that is necessary for fruit and nut orchard production. Because of the perennial nature of orchards, fumigation of orchards occurs only once during the bearing life of the trees, and so the most efficient system to produce the healthiest trees is necessary to avoid early tree removal, added costs, and lost revenue due to necessity of planting and then replanting orchards if replant disorder is not initially addressed.

According to an in-depth report on orchard replant (McKenry, 1999), in 1999, at least 85% of California walnut hectares are infested with one or more problem nematodes (*Pratylenchus vulnus*, *Criconemella xenoplax*, or *Meloidogyne* spp.). No rootstocks are currently available that have sufficient resistance to control these pests. About 60% of vineyards are infested with problem nematodes, although tolerant rootstocks can help ameliorate the replant problem for some nematodes. However, vineyards are also susceptible to Phylloxera and Armillaria root rots. At least 60% of cling peach areas are infested with *Criconemella xenoplax* and another 35% of stone fruit plantings are infested with *P. vulnus* or *C. xenoplax*. Around 35% of almond plantings are infested with *C. xenoplax* and/or *P. vulnus;* 15% of almond orchards are infected with bacterial canker, and 5% are infected with oak root fungus.

Replant disorder is affected by environmental conditions or stress, such that disease management can be effective in some areas but not in others. Effective fumigation prior to replanting orchards can reduce pest populations by 99.9% in the top 1.5 meters while killing remnant roots from previous orchard trees. Even if pests can be sufficiently controlled, old plant roots must be removed or made unavailable as nutrients over a period of time to allow the establishment of healthy, actively growing trees. For the fruit and nut industries, MB is critical considering the once in an orchard-life (20-40 years) fumigation requirement.

1,3-D Alternative. Fumigation improves the growth of trees in the beginning stages of orchard establishment—“…even ‘resistant’ rootstocks grow poorly their first year or two without such soil treatments” (McKenry, 1999). An effective pre-plant fumigation should kill 99.9% of nematode pests in the top 1.5 meters of orchard soils, and should kill the roots remaining from the previous orchard planting (McKenry, 1999). If growers relied solely on post-planting drip treatments it would be difficult to achieve greater than 50-75% nematode control for longer than 6-9 months—especially since no remnant roots are killed, allowing a refuge for nematode pests. Pre-plant fumigation also provides a means for avoiding repeated post-plant nematicide applications during the years following planting; thus reducing costs and further pesticide applications. Thus, the importance of an effective pre-plant fumigation treatment is critical to an orchard’s survival as an ongoing commercial operation.

Prior to 1990, 1,3-D was considered at least as good as MB for treatment of replant problem (McKenry, 1999). However, due to environmental and health concerns (it is a B2 carcinogen and was found off of treatment sites) 1,3-D was banned and MB became the predominant treatment for orchard replant. With the re-labeling of 1,3-D in the mid-1990s there were new restrictions on its use and application rate, including township caps in California, and reduced rates that were considered ineffective for some severe replant situations (reduced to 325 kg/ha from 427 kg/ha). MB, therefore, remains the standard for the industry when establishing nearly all of California's orchards, except in the few with light soils, with appropriate moisture conditions, where lower rates of 1,3-D can be effective (McKenry, 1999). [Each township is allowed a maximum of approximately 41,000 kg per year, in a township of approximately 9300 ha; at 225 kg/ha, 180 ha can be treated with 1,3-D per township.]

Many areas of California that are amenable to these crops have soil types and moisture characteristics that prevent alternatives from acting effectively to successfully manage replant disorder; some areas are also subject to township caps for 1,3-D, the best alternative. In addition, nearly all orchards, due to location, soil type, or other environmental conditions, are susceptible to the replant problem, and therefore, require MB fumigation prior to orchard replant. Areas with soils that contain less than 12% moisture at approximately 1.5 meters and can be sufficiently moistened in the top 30 cm, and are not restricted in their use of 1,3-D, may find 1,3-D an effective alternative to MB. In other situations that do not have these soil and moisture characteristics, MB is the only effective treatment.

Generally, it will not be possible to expand the use of the best alternative, 1,3-D to a greater percent of orchard replant situations because of physical and legal restrictions. At current label rates, 1,3-D can be effective in light soils, but not medium to heavy soils where moisture content below 1-1.5 meters and on the surface reduces the number of effective sites. In addition, only if township cap limitations were reduced would there be a likelihood that 1,3-D could supplant the critical need for MB in many orchards. This is not a realistic scenario given environmental, regulatory, and health concerns for 1,3-D (as well as metam-sodium) in California. Furthermore, prior to label cancellation in 1990, 1,3-D was used at a higher rate (427 kg/ha) than the current maximum label rate (375 kg/ha), established after its reintroduction for perennials in 1996 (McKenry, 1999). The higher rate was considered significantly more effective than the current rate (where 1,3-D is allowed under township cap restrictions). Rates are unlikely to be increased due to the probable carcinogenic nature of 1,3-D (B2 carcinogen). Aside from township caps, efficacy of 1,3-D is highly dependent on soil type, requiring light soils to be most effective at the current label rates.

Recent Decrease in Hectares Planted and Treated. The orchard hectares planted and treated has decreased in recent years (Table 3). However, in order to maintain the bearing hectares, the hectares planted, and subsequently treated, will have to increase, which is why the U.S. requested more MB than was used since 2000.

Table 3. Hectares planted in California.

Hectares Planted	1997	1998	1999	2000	2001	2002
Almond	14,055	17,328	11,977	8,011	5,900	3,992
Walnut	3,035	2,458	3,417	2,627	1,175	1,442

Grapes	3,049	2,964	2,028	2,394	1,635	848
Stone Fruits*	3,397	3,902	2,780	3,281	2,649	2,330
Orchard Hectares Planted	**23,536**	**26,652**	**20,201**	**16,312**	**11,359**	**8,612**
Orchard Hectares Treated with MeBr	7,610	4,993	6,168	3,514	3,020	1,737
Percent Hectares Treated	32%	19%	31%	22%	27%	20%

* Available data includes peaches, nectarines, plums and prunes, but not cherries.
Source: California Agricultural Statistics Service and California Tree Fruit Association.

To maintain bearing orchard hectares (Table 4), the hectares that will need to be replaced each year are equal to the bearing hectares divided by the average bearing life of the orchards. Over 25,000 hectares of orchards will have to be replaced each year in California to maintain the orchard bearing hectares, which is comparable to the number of California orchard hectares planted in the late 1990s.

Table 4. Bearing hectares, California.

	Almonds	Walnuts	Grapes	Stone Fruits	Total
Bearing Hectares 2003, California	214,575	86,235	139,271	104,453	544,534
Average Bearing Life (years)	22	36	19	18	
Average Replacement per Year (hectares)	9,753	2,395	7,330	5,803	25,282
Projected Treated Hectares 2006	**486**	**810**	**433**	**2,132**	**3,860**
Average Percent to be Treated	**5%**	**34%**	**6%**	**37%**	**15%**

Source: California Agricultural Statistics Service.

Research—Alternative Strategies. The applicants of this sector are supporting research for the development of technologies and strategies to improve the efficacy of alternatives, such as: deep injection methods, soil moisture management by improving drip technologies, use of fallow, chemical/non-chemical combinations, herbicides to kill remnant roots, use of “virgin” soils as amendments to try to reduce the severity of replant problem, resistant rootstocks when available, and irrigation regimes to improve consistency of metam-sodium distribution.

Because this sector applies MB only once in the life of the orchard, use of alternatives to replace MB will have to be well considered in light of their long-term impacts on fruit and nut production. McKenry (1999) has hypothesized that there are four distinct, but interacting, components to the replant problem. All of the components do not have to be present for the occurrence of replant problem, so the symptoms vary from location to location. Some components are time-dependent and do not occur until years after orchard replant. The four components of replant problem are hypothesized: 1) rejection (unknown factors resulting in failure of plants to thrive), 2) physical or chemical soil barriers to root development, 3) presence of known soil pathogens and pests, and 4) nutrient requirements of young trees and vines. McKenry evaluated 136 regimes that included various rates and mixtures of fumigants, herbicides, fallow periods, cover crops, genetic rootstocks, tarps, soil treatments (e.g., marigold extract drench), fertilizers, etc. Clearly, extensive and reliable field studies on these perennial crops require considerable time to conduct, and until replicated trials can be analyzed, we believe that MB is critical to establishing healthy orchards.

Research is currently being conducted by all applicants in this sector to find increasingly more effective ways of managing orchard replant disorder (e.g., Browne et al., 2002; Ferris and Walker, 2002; Martin, 2003; McKenry, 1999, 2001; Schneider et al., 1999, 2000; Trout et al., 2002). From 1992 to 2002, the expenditures on research have included $430,000 (California Walnut Commission), $250,000 (California Grape and Tree Fruit League), and $86,000 (Almond Hullers and Processors Association). While orchard replant uses MB only once in the orchard's life, the research being conducted will help integrate new methods and techniques to producing high quality fruit and nuts, as well as reduction of MB emissions. The substantial commitment to research, by all of the orchard and vineyard crop associations, continues.

Conclusion. The Orchard Replant sector has a critical need for the nominated amount of MB (i.e., 839.755 metric tonnes). This amount takes into consideration the unique nature of this sector, which uses MB only once in the planting of new orchards and vineyards on previously planted land. Orchard replant use of MB is the only proven means of disease management for perennial, high value crops in many orchard locations in California. Because of the long-term and cyclical nature of crops comprising this sector (typically 20 to 40 years), the general rule of a five-year baseline of use does not seem applicable. Numerous orchards planted in the late 1970s and early 1980s will have to be replanted. Without a proven alternative to MB to manage orchard replant disorder, replanted orchards in the next few years still have a critical need for MB. Ongoing research continues to examine combinations of chemicals and cultural methods to replace MB, but until valid conclusions are reached, growers are in critical need of MB.

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Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use for Ornamentals Grown in Open Fields or in Protected Environments
Document Number	CUN 2003/, Us56N8
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide in Ornamentals

Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide needed
California and Florida	All soil borne diseases, weeds, and nematodes. Includes *Fusarium* spp., *Rhizoctonia* spp., *Phytoplithora*, Stromatinia, *Pythium* spp., and most soil nematodes i.e. *Meliodogyne* spp., and previous crop propagules. Specific pest problems vary by individual crop and variety. See Appendix C for more detailed information.	Due to the diversity and complexity of the cut flower and foliage industry, alternatives have not been found for all species. Some of the alternatives that have been found for other crops have not yet been demonstrated to be feasible for floriculture because of high cost, difficulties with quickly treating and replanting fields for multi-cropping, township caps, and buffer zone requirements (Elmore et al., 2003a).

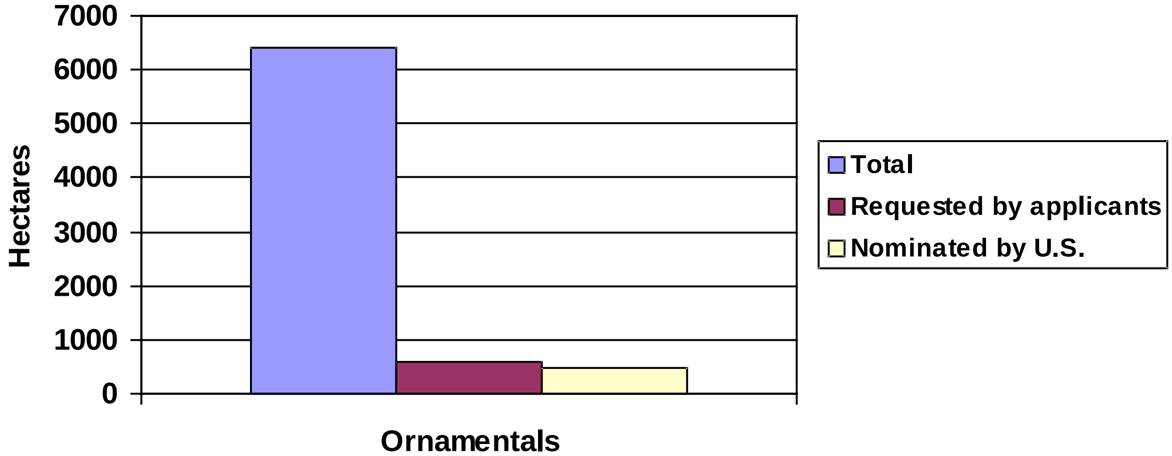
Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated* by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description
210,849	162,817	The U.S. imposed a reduction in the requested use rate on one applicant. There was one new CUE (CA Cut Flower Commission) application. One applicant from 2005, Yoder Brothers, has not to date submitted a 2006 application. One applicant, California Rose Growers was moved to the Fruit, Nut and Flower Nursery CUE.

* 2005 Nomination includes 2005 Supplemental Requested nomination amount.

Figure 1. U.S. Total, Requested, and Nominated Hectares of Ornamentals



Footnote: Total hectares, based on United States Department of Agriculture Statistics, are national acreage in production for this sector. The requested hectares are sum total of all areas in the CUE applications. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

Economic Impacts

The U.S. conducted an economic assessment to evaluate converting to metam sodium, 1,3-dichloropropene, or dazomet. When evaluating the loss per hectare, loss per kilogram of methyl bromide, loss as a percent of gross revenue, and loss as a percent of net revenue it was determined that the alternatives were not economically feasible.

The economic factors that most influence the feasibility of methyl bromide alternatives for fresh cut flower production are: (1) yield losses, referring to reductions in the quantity produced, (2) increased production costs, which may be due to the higher-cost of using an alternative, additional pest control requirements, and/or resulting shifts in other production or harvesting practices, and (3) missed market windows due to plant back time restrictions, which also affect the quantity and price received for the goods. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

Response to Questions

Background

In the United States cut flowers, cut foliage and bulb crops are grown in open fields and under cover (including glass, poly, and saran). There are three basic systems in place for ornamentals. Annuals are shallow rooted crops that represent 50 to 60 percent of the industry. They are often planted to a depth of 6 to 8 inches. Fumigants can be shanked into the preformed beds or drip-applied from drip tapes placed on tops of beds under plastic mulch. Bulb crops represent about 30 percent of the industry. Fumigants are applied on the flat by deep shanking. Bedding up generally occurs after planting the bulbs. Perennials are deep-rooted multi-year crops and represent 10 to 20 percent of the industry in California. Fumigation needs to penetrate to a depth of 2 to 3 feet and may require multi-level shanking.

The diversity of the cut flower, foliage, and bulb industry makes finding methyl bromide alternatives for each crop species complex, time consuming and costly. A single grower in California may grow as many as 100 species and/or varieties in a single year. Growers must find methyl bromide alternatives that will control previous crops grown on the site, as well as a diversity of key pests, which vary for each crop variety. One of the key pests is plant material from the previous crop, such as residual tubers, bulbs, and seeds. This plant material acts as reservoirs for nematodes and soil pathogens and are weeds themselves, as they are off-variety. Both yield and quality losses may occur from these pests.

The fumigation situation and need for methyl bromide varies by species. Additional research is needed before the transition to methyl bromide alternatives is complete. One major difficulty is that market desires require a high degree of flexibility in scheduling certain species and new cultivars. Therefore, the information on the sensitivity of each crop to fumigant alternatives as well as the pests is not known until crops have been in production for several cycles. Along with these issues, there are concerns about phytotoxicity and registration with alternative chemicals (Schneider, 2003; Elmore et al., 2003b).

The recent U.S. registration experience with iodomethane indicate that new chemistries can take several years to be registered by the U.S. EPA and the state regulatory agencies, such as California Department of Pesticide Regulation. In addition, township caps in California restrict the amount of 1,3-Dichloropropene, and thus 1,3-D + chloropicrin, that can be used in a given area (Trout, 2001). Buffer zones may also limit the adoption of alternatives.

Some of the alternatives that have been found for other crops are not be feasible for some floriculture crops because of high cost, difficulties with quickly treating and replanting fields for multi-cropping, and buffer zone requirements (Elmore, 2003a). Although some alternatives have shown potential to replace methyl bromide use in some situations, the in-field feasibility of the alternatives for each of the major species of ornamentals grown in the U.S. remains to be demonstrated. The industry has made progress in reducing the use of methyl bromide and additional research is ongoing. Because the ornamentals industry is complex (numerous species, each with its own pests and implementation issues), time is needed to determine methyl bromide alternatives for all species and varieties grown, including determining whether there are any phytotoxicity issues from using methyl bromide alternatives (Schneider, 2003). Ornamentals have a high value; as a result many manufacturers now avoid registering materials for ornamental crops because of liability due to potential phytotoxicity issues.

RESPONSE TO QUESTIONS

MBTOC Question A - The CUN states that time is required to transition to non-MB technologies in some subsectors of this nomination, but there is no decrease in nomination between 2005 and 2006.

US Response - The nomination request has remained similar ame between 2005 and 2006 because the applicants are still conducting tests to determine if the registered alternatives are technically and economically feasible. Because there can be over 100 species grown in an ornamental operation, the U.S. government recognizes that a great deal of work will be required to find a suitable alternative, despite the ongoing research. Significant research has been conducted with methyl iodide (currently undergoing registration review in the U.S.), which diverted resources from other alternatives. It is not currently known which, if any, of the alternatives will be able to replace the remaining uses of methyl bromide. It is anticipated that methyl bromide use will decrease, but due to the uncertainty involved, the U.S. has maintained the amount requested until suitable alternatives have been found.

MBTOC Question B – In order for MBTOC to be able to assess the need for MB under this CUN appropriately, Party is requested to disaggregate this CUN by region (California, Florida, Michigan) as conditions, principal crops, amounts and application rates arte different and to give at least the principal crops for which MB is nominated.

US Response - The U.S. is actively involved in locating the requested information through discussions with: the applicants, USDA/ NASS (National Agricultural Statistics Service), state governments, and marketing organizations. The U.S. is continuing to seek this information to provide it to MBTOC. This CUN included ornamental crops in California and Florida but did not include crops from Michigan. Table 3 provides a partial list of common ornamental crops and some of their key pests.

MBTOC Question 1 - Production of caladiums in Florida uses flat fumigation with high rates of MB. There would appear to be substantial potential for reduction of the quantity used through adoption of barrier films and strip fumigation in this industry. Clarification is requested on the barriers if any to adopting this approach while continuing research and deployment of alternatives?

US Response - Production of caladiums in Florida does use flat fumigation. HDPE barrier film is used and a solid tarp is needed to do this. The limitations to adopting VIF are described below in the response to Question 2.

There are also additional barriers to adopting strip fumigations. Caladiums are not cultivated in discrete rows that might allow strip fumigation. Caladiums are field grown in flat beds varying in width from 54” to 72”. There are from 65 to 150 beds in a block of caladiums depending on the grower. The length of the fields ranges from 800 feet to 2500 feet (244 – 762 meters). Caladiums are planted in rows, with 4, 5, or 6 rows per bed, utilizing seed hoppers with pick up chains and chutes for the chips to fall through as the planter moves down the field. They are grown in the field for up to 11 months. Further, they are irrigated by flooding from underground sources, utilizing mole drains. These drains both drain excess water and provide underground water to wick up for irrigation purposes. This technique is widely used by essentially all caladium growers. The water is ground water supplied by a series of ditches flowing generally from a large surface of water (lake). Nematode spread from a non-fumigated strip to a fumigated strip with irrigation water would be a serious problem. The movement of nematodes would likely negate many of the benefits of fumigating (Chase, 2004).

Finally, recent air monitoring work in California suggests that strip treatments have higher rates of methyl bromide emission than flat fumigation. When the air monitoring work is complete, the emission implications of strip treatments will be evaluated.

MBTOC Question 2 - The Party states that HDPE is used by some growers as a cover film in the fumigations and that some change from 98:2 to 67:33 MB/Pic formulations has taken place. What is limiting further adoption of barrier film technology and further reduction in MB use through adoption of MB/Pic 50:50 fumigation mixtures?

US Response - There are limitations to using VIF. There has been quite a bit of data developed regarding use of VIF that shows that in some situations it does work well to lower overall poundage of MB applied. However, the quality, availability and methods of application of VIF films have not been standardized or developed. New glues have been developed to fix one sheet to another but testing has not been completed to verify their effectiveness. These problems have generally hampered acceptance and use by growers in both California and Florida.

Work is being conducted to determine if VIF is feasible in the U.S. from a technical standpoint (e.g., does it hold up physically in field conditions, can it be glued to acceptable specifications, can the used film be disposed of properly, etc.) and economically feasible (e.g., cost of material, cost of application). However, the efficacy of VIF for U.S. agriculture may be different than that for Europe (Federal Register, 1998).

The limitation to using 50:50 MB/Pic fumigation mixtures is that it would not effectively destroy caladium tubers or pieces left in the field from the previous crops, and in addition would not eliminate several of the weeds that can be suppressed by the 67:33 MB/Pic mixture (Chase, 2004 and Elmore, 2003b). While chloropicrin has excellent disease controlling properties it is not ideally suited as an herbicidal agent. Similar issues are expected for other ornamental crops, especially those with underground crop material left in the field, such as tubers or bulbs.

MBTOC Question 3 - A listing is requested of the major ornamental crops still requiring MB in some form, tonnage nominated and reasons why MB is critical. This listing is for both 2005 and 2006 nominations.

US Response - A listing of all of the specific crops and pounds of MB needed by each crop is not available. For example, California requires records of pesticide application, but even these mandatory records do not segregate one use from another in the broad spectrum of field-grown cut flowers and cut greens. However, key crops include gladiolus, calla lily, *Ranunculus*, *Rhamnus*, myrtle, snapdragons, stock, Asiatic and oriental lilies, and many more. Several crops were also included in the CUN with information on the key pests (see Table 3 below).

The following list is not comprehensive, but is intended to demonstrate the complexity of the industry. In addition to the diseases and nematodes listed below, there are numerous weed species that are major problems in cut flower production. These weed species include the bulbs, tubers, or cormlets from a previous crop, yellow nutsedge (*Cyperus esculentus*), little mallow (*Malva parviflora*), and common sow thistle (*Sonchus oleracea*).

Table 3. Diseases & Nematodes of cut flower crops currently controlled with Methyl Bromide.

Crop	Key Pests	Scientific name
Antirrhinum	Nematodes Pythium root rot	*Belanolaimus longidorus, Criconomella* spp., *Dolichodorus heterocephalus* *Pythium irregulare* (documented resistance to mefenoxam is 25-50%)
Calla lily	Erwinia soft rot Pythium root rot	*Erwinia carotovora* *Pythium* spp. (resistance to mefenoxam suspected to be widespread
Delphinium	Sclerotinia stem rot	*Sclerotinia* spp.
Dianthus	Fusarium wilt	*Fusarium oxysporum* fsp. *Dianthii*
Eustoma	Fusarium wilt, root rot, and stem rot	*Fusarium oxysporum, F. solani,* and *F. avenaceaum*
Freesia	Fusarium wilt	*Fusarium* spp.
Gladiolus	Fusarium wilt Stromatinia neck rot	*Fusarium oxysporum* fsp. *Gladioli* *Stromatinia gladioli*
Helianthus	Downy mildew	*Plasmopara halstedii* (this is a soil-borne pathogen)
Hypericum	Root knot nematode Pythium root rot	*Meloidogyne* spp. *Pythium* spp.
Iris	Fusarium wilt	*Fusarium oxysporum* fsp. *Iridis*
Larkspur	Sclerotinia stem rot	*Sclerotinia sclerotiorum*
Liatris spicata	Sclerotinia stem rot	*Sclerotinia sclerotiorum*
Lilium	Pythium root rot	*Pythium* spp.
Matthiola	Sclerotinia stem rot Xanthomonas leaf spot	*Sclerotinia sclerotiorum* *Xanthomonas campestris* pv. *Campestris*
Ranunculus	Pythium root rot Xanthomonas leaf spot	*Pythium* spp. *Xanthomonas campestris*

Competition has caused the ornamentals industry to become more diversified than in the recent past. The US submitted the nomination for multiple species but used two species as examples: caladiums and ranunculus. The use of these two species is intended to demonstrate the complexity of issues in the cut flower industry. The cut flower industry is complex and, as noted above, there is no record of the specific crop species using MB. Therefore, the United States is not able to provide the tonnage required by each species, especially since the species planted varies depending on market demands.

The United States collected pesticide usage data for nursery and floriculture operations in a small number of states in 2000. The survey may not have included all of the species in the CUN; therefore the amounts discussed should be used as an indicator of the amount of MB used, and not an absolute amount. For example, it is not clear if data on caladiums or ranunculus were collected. However, methyl bromide is only used on a small percentage of the nursery and floriculture operations. For all nursery and floriculture, in California, MB was used in 6 percent of the operations, and in Florida MB was used on 1 percent of the operations. Out of the states surveyed, a total of 2 percent of the operations used MB. For only floriculture operations, the numbers were similar, with 6 percent of the operations using MB in California, less than 1% in Florida, a total of 2% for all states surveyed. For cut flowers, 12 percent of operation in CA and

9 percent over all surveyed states used MB. An insufficient number of reports were submitted for Florida, so this information is not available. Total amount applied in the surveyed states for cut flowers was 352,700 lb (159,982 kg) (USDA, 2002). This amount does not include cut foliage and may not include certain cut flower species. This data is not all-inclusive but is an indication of the way MB is being used in the industry.

The industry is working to reduce the amount of methyl bromide it uses. Usage data from California demonstrates the decrease in methyl bromide use. In 1998, approximately 514,000 pounds of methyl bromide were applied, whereas in 2001, approximately 208,000 pounds of methyl bromide were applied. Over the same period of time, the acreage has remained stable. Therefore, between the use of alternatives and reducing the rate of methyl bromide in MB/Pic mixtures, the industry has been able to greatly reduce methyl bromide consumption.

MB is critical because without it, some growers will suffer both yield and quality losses. In addition, growers who rotate several species of ornamentals on a particular field need to kill crop residue, such as tubers, from previous crops to eliminate contamination, as well as control other weeds and pathogens. The crop residue may act as a reservoir for nematodes and pathogens. Due to the diversity and complexity of the cut flower and foliage industry, alternatives have not yet been found for all species. Some of the alternatives that have been found for other crops may not be feasible for floriculture in general because of high cost, difficulties with quickly treating and replanting fields for multi-cropping, and buffer zone requirements. In addition, township caps limit the use of 1,3-Dichloropropene, and thus 1,3-D/Pic, in California. Other alternatives provide inconsistent control or have restrictions that limit their use at this time. Growers also need time to transition to the alternatives that become available through new registrations.

In this industry, the fumigation situation and need for methyl bromide varies by species. Despite research conducted so far, there is not enough grower experience and research to on the technical and economic feasibility of the alternatives to enable users to switch to alternatives by the 2006 growing season.

MBTOC Question 4 - The Party reports that dazomet is effective for chrysanthemums and carnations. How much of the CUN could be replaced using this alternative on these crops either alone or in combination with other practices?

US Response - In the CUN, the discussion on dazomet was intended to show that research is being conducted with dazomet and that there has been some success. Dazomet is being used with one or more of the other alternatives, which has allowed the industry to reduce overall MB consumption over the past ten years.

The effectiveness of dazomet in the question refers to the following from the CUN (included for reference):

> In some cut flowers (carnation and chrysanthemum) dazomet was effective against *Fusarium*, *Rhizoctonia*, *Erwinia*, and *Pseudomonas*. Appropriate aeration times, which are dependent on soil temperature, are needed to avoid phytotoxicity (Semer, 1987). In addition, plant back restrictions may cause some growers to be able to grow fewer crops in a year.

However, there are limitations to dazomet being used on other ornamental crops in addition to those mentioned above. The formulation available, a fine powder, is difficult to apply and marginally effective under the varied growing conditions. Finally, the manufacturer of the product recently sold rights to another company and that company has yet to determine the target markets within the U.S. Therefore, while Dazomet is used by some growers it is uncertain when a newer, more reliable, application-friendly product will be available so that its use may become more widespread.

It is not expected that the MB requested in this CUN will be used for chrysanthemums and carnations. In Florida, where cutting of mums are propagated for use around the world, the applicant is in the process of converting to steam. Also, many of the cut flowers of chrysanthemums and carnations are being imported from South America. Therefore, dazomet use on these crops is not expected to reduce the amount of MB nominated.

Dazomet cannot be used on caladiums since the fields do not have any overhead irrigation and water sealing the product is not possible under these conditions. This crop is irrigated by flooding from underground sources of water in most instances (described above in the response to Question 1).

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Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use for Strawberries Grown for Fruit in Open Fields on Plastic Tarps
Document Number	CUN 2003/059, USc6N11
Date	August 12, 2004

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide in Ornamentals

Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide needed
California	**Diseases:** Black root rot (*Rhizoctinia* and *Pythium* spp.), crown rot (*Phytophthora cactorum*), **Nematodes:** root knot nematode (*Meloidogyne* spp.) Sting nematode (*Belonolaimus* spp.) **Weeds:** Yellow nutsedge (*Cyperus esculentus*), purple nutsedge (*Cyperus rotundus*), ryegrass, and winter annual weeds.	At moderate to severe pest pressure only MB can effectively control the target pests found in California, specifically in areas where hilly terrain would provide less efficacy from the alternatives. Uses of alternatives are limited by regulatory restrictions such as the township caps on the amount of 1,3-dichloropropene that can be used. MB applications in strawberries are typically made using 67:33 or, where feasible, 57:43 mixtures with chloropicrin under plastic mulch. Related dosage rates of 196 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without compromising pest management.
Eastern U.S.	**Diseases:** Black Root Rot (*Pythium, Rhizoctonia*), Crown rot (*Phytopthora cactorum*), **Nematodes:** Root knot nematode (*Meloidogyne* spp.) **Weeds:** Yellow nutsedge (*Cyperus escultentus*), Purple nutsedge (*Cyperus rotundus)* Ryegrass (*Lolium* spp.)	At moderate to severe pest pressure only MB can effectively control the target pests found in the Eastern United States. In addition, buffer zones associated with the use of alternatives prevents their use in some situations. Related dosage rates of 151 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without compromising pest management.
Florida	**Diseases:** Phytophthora, Crown Rot (*P. citricola, P. cactorum*) **Nematodes:** Sting (*Belonolaimus longicaudatus*), Root-knot (*Meloidogyne* spp.) **Weeds:** Yellow nutsedge (*Cyperus esculentus*), Purple nutsedge (*Cyperus rotundus*), Carolina Geranium (*G. carolinianum*), Cut-leaf Evening Primrose (*Onoethera laciniata*)	At moderate to severe pest pressure only MB can effectively control the target pests found in Florida. In addition, the use of alternatives are limited in some areas because the soil overlays a vulnerable water table (karst topography). MB applications in strawberries are typically made using 67:33 or, where feasible, 50:50 mixtures with chloropicrin under plastic mulch. Related dosage rates of 185 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without compromising pest management.

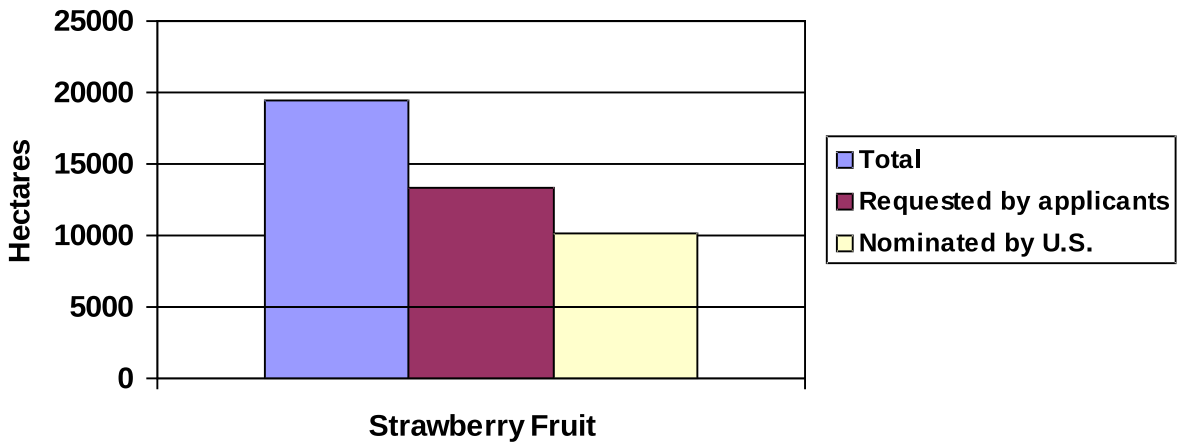
Amount Of Methyl Bromide Nominated

TABLE 2. AMOUNT OF METHYL BROMIDE NOMINATED BY THE U.S. IN 2005* AND 2006.

2005* (kg)	2006 (kg)	Description of Differences Between Years
2,187,535	1,918,400	The amount of methyl bromide nominated for California was reduced for 2006 because of increased use of alternatives. The estimates of key pest pressure in Florida and eastern U.S. were adjusted upwards based on new survey data. The U.S. imposed a reduction in use rate on California and Florida.

* 2005 Nomination includes 2005 Supplemental Requested nomination amount.

FIGURE 1. U.S. TOTAL, REQUESTED, AND NOMINATED HECTARES OF STRAWBERRY FRUIT



Footnote: Total hectares, based on United States Department of Agriculture Statistics, are national acreage in production for this sector. The requested hectares are sum total of all areas in the CUE applications. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

ECONOMIC IMPACTS

The economic impacts were assessed using four economic parameters: 1. loss per hectare, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

RESPONSE TO QUESTIONS

In general, there are a variety of alternatives to MB for production of strawberry fruit. The application is based on the technical grounds that no alternatives are available for moderate to severe pest pressure for root rot (e.g. Phytophthora) and nutsedge in certain areas, and that certain topographies and regulatory issues prevent the use of possible alternatives in several areas.

MBTOC considers several alternatives are technically feasible for the spectrum of target pests. This is recognized in the CUN. It accepts that use of 1,3-D and its mixtures with chloropicrin are presently restricted by local air quality regulations and certain topographies. MBTOC considers that other alternatives (e.g. Pic EC, metham sodium in combination with PIC) are technically suitable in at least some areas where regulatory issues, karst topography or slopes affect the use of 1,3-D.

MBTOC Question 1 - Further detail is requested on the dosage rates of MB used in the various regions covered by this CUN, with particular reference to scope for reduction in MB usage through adoption of mixtures of MB and chloropicrin containing high proportions of chloropicrin and use of tarping of low MB permeability. Clarification is also requested on proportion of the CUN that can use strip fumigation, with consequent dosage reductions, and the proportion of uptake of strip fumigation affected by State regulations.

U.S. Response - The 2001 and 2002 average dosage (use) rate information and 2006 CUE nomination information for the regions covered by this CUN are presented in Table 3. All of the regions in the U.S. are using rates below 200 kg/ha of methyl bromide. MBTOC has asked for the scope for potential reductions using higher proportions of chloropicrin and tarping with low methyl bromide permeable film. Research on fumigant combinations with higher concentrations of chloropicrin are being conducted in several locations throughout the U.S. However, to date these alternative combinations have not always been as effective as methyl bromide. Table 4 shows an evaluation of combination fumigant studies comparing their yield to methyl bromide. In those studies only 44% of the fumigant combinations had yields equal to at least 95% of the methyl bromide treatment. This suggests that switching to combinations of fumigants and using higher levels of chloropicrin may not provide yields similar to methyl bromide, in particular with respect to the areas nominated by the U.S. because pest pressure is moderate to severe in these areas. Low permeability tarping has not been widely adopted in the U.S. for a number of reasons. Tarps are currently used on 93% of the California and 100% of the Florida soil applications. Regulations restrict low permeability film in California which accounts for approximately 76% of the total U.S. strawberry soil use. Under U.S. conditions VIF has poor application characteristics: it must be unrolled slower to prevent tearing, photodegradation is a problem when used for multiple crops, and there are problems with disposal in many localities. In addition, to date field trials testing strip treatments using equivalent amounts of methyl bromide have not provided clear evidence that lower permeability films reduce emissions relative to other films. MBTOC asked about the proportion of the CUN where strip treatments are used. Currently strip treatments are used in the Southeast U.S. and Florida which account for ~ 24% of the U.S. CUN (see Table 3). The use of strip fumigation is limited in California by air quality standards because strip treatments can lead to higher rates of methyl bromide emissions.

Recent research in California has indicated that strip treatments may increase overall methyl bromide emissions compared to equivalent flat fumigations. Therefore, while strip treatments might reduce the total amount of methyl bromide used, it may increase overall air emissions. The U.S. is reviewing the air emissions information for a number of soil fumigants and hopes to make those findings available later this year. In addition to the emission of methyl bromide to the atmosphere, is the practical issue of the reduction in weed populations on a whole field scale. The control of perennial weed species in strip fumigation will allow the weeds to increase in the untreated portions of the field. While herbicides are available (see Table 7) for this use they posse additional costs, phytotoxicity concerns, and management challenges for the growers.

Table 3. Methyl Bromide 2001 and 2002 Two Year Average Use Information and 2006 Nomination.

	2001 & 2002 Average			2006 Nomination		
Applicant	**Kilograms**	**Hectares**	**Use Rate (kg/ha)**	**Kilograms**	**Hectares**	**Use Rate (kg/ha)**
CA Strawberry Commission	1,601,966	8,184	196	1,452,732	7,422	196
SouthEast Strawberry Consortium	278,957	1,851	151	152,294	1,010	151
Florida, FFVA – Strawberry	501,446	2,711	185	310,997	1,682	185

Footnote: Information taken from 2006 Bromide Usage Numerical Index (BUNI) tables.

Table 4. Summary of Research Results for Methyl Bromide Alternatives on U.S. Strawberry.

Alternatives	Total Number of Studies	Number of Studies with Yield at Least 95% of Methyl Bromide
Basamid (Dazomet) and combinations	27	12
Chloropicrin and combinations	58	36
Metam sodium (Vapam) and combinations	73	24
Solarization and Combinations	22	6
Telone (1,3-dichloropropene) and combinations	93	41
Average Number of Studies Showing Yield At Least 95% of Methyl Bromide		**119/273 = 44%**

MBTOC Question 2 - The part of the CUN relating to Californian production was based on a 1X township cap for 1,3-D. An estimate is requested for scope for further reduction in nominated quantity if a 2X cap is allowed.

U.S. Response - Out of environmental concerns regarding the quality of the ambient air, California regulates the amount of Telone™ that can be used in each township within the state. Specifically, Telone™ has been found by the State of California to be a carcinogen and regulations have been put in place to limit the cumulative lifetime exposure to bystanders. There are over four thousand townships (36 square miles or 9,300 ha each) represented in the California township assessment. The information used to develop the estimate of area impacted by township caps in California was from papers by Carpenter, Lynch, and Trout, cited below, supplemented by discussions with Dr. Trout to ensure that any recent regulatory changes have been properly accounted for.

The current rule in effect for California Telone™ use was used for the 2006 U.S. CUE nomination. This is based on Telone™ usage being allowed at the baseline amount (1X level), not the short term exemption limits (2X). The California Department of Pesticide Regulations (Cal DPR) was contacted for clarification on the Telone™ township cap question. Cal DPR explained the use of Telone™ starting in 2005 and beyond would be based on: current and historic use patterns in each individual township, future enhancements to the air concentration model and health impact models, and assumptions on the use of adjacent land in the models. Because of the uncertainties in all of these parameters they are currently unable to speculate what the future Telone™ township caps will be in California. Accordingly, we believe that the CUE must cover the level of MeBr needed to meet the existing 1X regulatory limit.

MBTOC Question 3 - Application of some alternatives through drip irrigation systems may be less successful than MB treatment on steeply sloping ground. As MB injection equipment can be used on slopes at present, are there any reasons why injection equipment cannot also be used for alternative fumigants, including 1,3-D mixtures.

U.S. Response – Shank injection of alternatives such as 1,3-D or 1,3-D with chloropicrin are feasible on hilly terrain. However, research results from California have suggested that this type of application is less effective than when applied through drip irrigation equipment. The technical and economic assessment for the eastern U.S. and Florida indicted a 14% yield loss and \$ 47 and \$ 62 loss per kilogram of methyl bromide respectively with the best 1,3-D and chloropicrin application techniques. Because of the lower efficacy, the California strawberry growers would need to use flat fumigation for effective pest control which would require 40% more material to be used than in a typical drip irrigation application to the beds. Growers with weed control problems would need to factor in the additional cost of a companion herbicide. In addition, the township cap issue would need to be evaluated again since more 1,3-D injected uses a different township cap multiplier than 1,3-D applied through drip irrigation equipment.

Question 4 - The Party is requested to supply data on MB usage in this sector for 2003 for the areas for which a CUE is sought and to provide information on changes to that consumption as reflected in the nomination for 2006.

U.S. Response – Available methyl bromide usage information is presented in Table 3 above. Unfortunately 2003 data is not yet available. The total hectares of strawberries for fruit in the U.S. were 19,486 in 2002. Estimates of future plantings suggest that the total will increase to 21,900 hectares or 3% per year (the historical average increase from 1997 to 2002. Therefore, while the U.S. strawberry area is estimated to increase by a total of 13% between 2002 and 2006 the CUE requested is 20% lower than the amount used in 2001 and 2002. Between 1997 and 2000 the U.S. had already reduced the use of methyl bromide in strawberries grown for fruit production by 24%.

MBTOC Question 5 - For the part of the CUN relating to Florida and SE USA the Party is requested to describe the technical basis for the estimate that moderate/severe nutsedge affects 40% and 30% CUN area in Florida and SE respectively.

US Response - A critical use of MB in this region is to control yellow and purple nutsedge. While it is generally accepted by scientific experts that the incidence of these weeds in the southern USA is very high, exact figures have been difficult to obtain. The U.S. estimate of moderate to severe nutsedge distribution is estimated to be between 30 to 40% of the area for both Florida and the eastern U.S.

Earlier this year, Dr. Stanley Culpepper of the University of Georgia submitted to EPA the results of a survey intended to characterize the incidence of nutsedge in vegetable operations. In this survey, extension agents in 34 Georgia vegetable producing counties were polled to better understand the level of nutsedge infestation in eggplants and peppers, among other vegetable crops. Their responses are based on their extensive interactions with vegetable growers in their jurisdictions. The portion of the survey data related to eggplants and peppers, used as a surrogate for strawberries, is summarized below (see Table 5 & 6).

Table 5. Percent Current Nutsedge Infestation in Georgia Counties While Methyl Bromide is Available (Culpepper, 2003).*

Crop	No Infestation	Light Infestation	Moderate Infestation	Severe Infestation
Pepper	1.3	18.9	65.6	14.2
Eggplant	1.0	40.6	39.0	19.4

*Footnote: No infestation = no nutsedge infesting production area. Light infestation = < 5 nutsedge plants per square yard. Moderate infestation = 5 to 30 nutsedge plants per square yard. Severe infestations = >30 nutsedge plants per square yard.
In the BUNI "High Key Pest Distribution" was calculated by added the moderate plus severe infestation. Low Key Pest Distribution was calculated by adding the severe infestation plus one half the moderate infestation.

Table 6. Percent Anticipated Nutsedge Infestation The Year After the Inability to Use Methyl Bromide (Culpepper, 2003). *

Crop	No Infestation	Light Infestation	Moderate Infestation	Severe Infestation
Pepper	0.0	9.1	31.6	59.3
Eggplant	0.2	11.9	50.3	37.6

*Footnote: No infestation = no nutsedge infesting production area. Light infestation = < 5 nutsedge plants per square yard. Moderate infestation = 5 to 30 nutsedge plants per square yard. Severe infestations = >30 nutsedge plants per square yard.
In the BUNI "High Key Pest Distribution" was calculated by added the moderate plus severe infestation. Low Key Pest Distribution was calculated by adding the severe infestation plus one half the moderate infestation.

While this survey focused on Georgia, the US believes it is reasonable to expect that the levels of nutsedge infestations reported for these crops is likely to be representative of other areas of the southern USA.

MBTOC Question 6 - In Florida, according to the CUN, karst topography prevents use of 1,3-D on 40% of the MB-using area. The Party is requested to describe the technical basis of this estimate or provide survey data to substantiate this area is impacted and to clarify the actual proportion of current strawberry crop CUN that cannot use 1,3-D due to restrictions relating to karst topography. Further detail is sought why other effective alternatives (e.g. Pic formulations, metham sodium in combination with Pic), assisted by specific herbicides if necessary, cannot be used to manage pests in these areas. Are there barriers to adoption of the combinations, with and without herbicides?

US Response – The estimates of the area impacted by karst geology in Florida, restricting the use of 1,3-D, were developed and mapped by the Florida Department of Agriculture (1984). The estimates of karst geology for Georgia and the southeast U.S. were developed from applicant and university survey information. In addition see the Reregistration Eligibility Decision (RED) for 1,3-D (U.S. EPA, 1998). A map of the karst geology in the U.S. is available online at http://www2.nature.nps.gov/nckri/map/maps/engineering_aspects/davies_map_PDF.pdf . The proportion of the current Florida strawberry crop that cannot use 1,3-D because of karst geology is 40% (see BUNI, 2006).

The comparative performance of additional alternatives such as 1,3-D plus chloropicrin, metam sodium with chloropicrin are presented below in Table 7. Based on these studies under moderate to severe pest pressure the alternatives would lead to an overall yield loss of 25%. Chloropicrin alone was not specifically evaluated because it does not provide adequate control of nematodes or weeds. Table 8 below lists the herbicides currently registered in the U.S. for strawberries. Of the registered herbicides only s-metolachlor will provide suppression of yellow nutsedge, but will provide no control of purple nutsedge at current label rates. One of the key barriers to adoption of a fumigant and herbicide combination is the lack of selective herbicides for strawberry weed control.

Table 7 Alternatives Yield Loss Data Summary

Alternative	*List Type of Pest*	*Range of Yield Loss*	Best Estimate of Yield Loss
1,3-Dichloropropene/ Chloropicrin	Weeds, nematodes and diseases	1% gain to 14% loss	14.4% (Shaw and Larson, 1999)
Chloropicrin/Metam sodium	Multiple pests	6.6-47%	27% Locascio, 1999
Metam sodium	Weeds, nematodes and diseases	16%-29.8%	29.8% (Shaw and Larson,1999)
Overall Loss Estimate for All Alternatives to Pests			**25%**

Table 8: Herbicides Labeled and IR-4 designated in the US to Control Nutsedge in Strawberries

Herbicide	Registered	Major Comments
Glyphosate	Yes	Non-selective, will not control nutsedge in the plant rows, no residual control
S-metolachlor	Yes	24(c) Florida. & California, suppression of yellow nutsedge at label rates, does not control purple nutsedge, high water solubility, low Koc
Paraquat	Yes	Non-selective, will not control nutsedge in the plant rows, no residual control

Terbacil	Yes	Only suppresses nutsedge, crop rotation restrictions, Organic Matter restrictions, not for use in Calf., used in Canada
Acifluorfen	No*	Potential injury in strawberry, yellow nutsedge control only
Halosulfuron-methyl	No	Potential crop injury, crop rotation restrictions, variable cultivar tolerances
Rimsulfuron	No	Only suppresses nutsedge, crop rotation restrictions
Thiazopyr	No*	"Nutsedge" suppression, can be used in low Organic Matter soils

Footnote: *IR-4 listed chemical

MBTOC Question 7 - In SE USA, in the area growing strawberries according to the CUN, buffer zones restrict use of 1,3-D on 90% of CUN area. The Party is requested to describe the technical basis of this estimate or provide survey data to substantiate this area is impacted and to clarify the actual proportion of current strawberry crop CUN that cannot use 1,3-D due to these restrictions. Further detail is sought why other effective alternatives (e.g. Pic formulations, metham sodium/Pic, dazomet/Pic), assisted by specific herbicides if necessary cannot be used to manage pests in these areas.

US Response – The U.S. estimates of the area impacted by 100 foot (30.5 m) buffer zones are 40% for the eastern U.S. and 1% for Florida. The 2006 CUN request used an estimate of 90% regulatory impacts in the eastern U.S. because the regulations required a 300 foot (91.4 m) buffer which has since been reduced to 100 feet on the alternative 1,3-dichloropropene. The current estimates used information from applicants and alternatives manufacturers including: average field size, the density of habitable structures near strawberry fields, population distributions, and surveys of extension agents. That information was used to make a professional judgment on the impact of buffers. For example, the eastern U.S. has many small pick-your-own strawberry farms (less than 4 hectares) where the impact of a 100 foot buffer is more pronounced than on the larger farms in California or Florida. Because of the significant impact that these estimates have on the overall request for methyl bromide, the U.S. EPA is evaluating additional methods to further substantiate and quantify the impacts of buffer zones.

One of the key barriers to adoption of a fumigant and herbicide combination (using fumigants such as chloropicrin, metam sodium with chloropicrin) is the lack of selective herbicides for strawberry weed control. Table 8 above lists the herbicides currently registered in the U.S. for strawberries. Of the registered herbicides only s-metolachlor will provide suppression of yellow nutsedge, but will provide no control of purple nutsedge at current label rates. An additional constraint is that under moderate to severe pest pressure there is an average of 25% yield loss with the alternatives (Table 7).

References

2006 Bromide Usage Numerical Index (BUNI) – Refined Nomination Package. Attached to U.S. Response to Questions as an Excel Spreadsheet.

Carpenter, Janet, Lori Lynch and Tom Trout. 2001. Township Limits on 1,3-DC will Impact Adjustment to Methyl bromide Phase-out. California Agriculture, Volume 55, Number 3.

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U.S. EPA. 1998. Reregistration Eligibility Decision (RED), 1,3-Dichlorpropene http://www.epa.gov/REDs/0328red.pdf

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use on Strawberries Nurseries Grown in Open Fields or in Protected Environments
Document Number	CUN 2003/060, Usc6N12
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide in Strawberry Nurseries

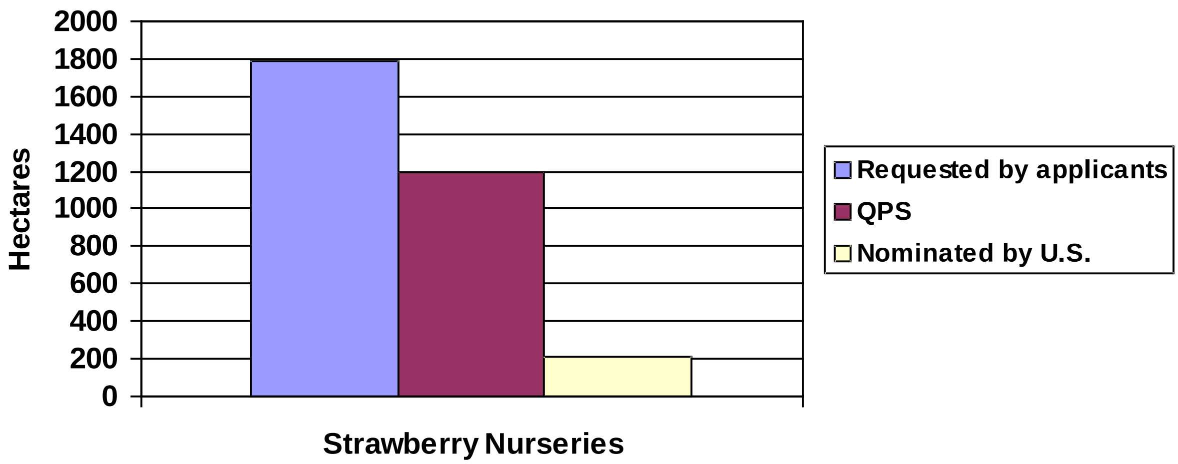
Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide is needed
Southeastern US	**Weeds:** Yellow nutsedge (*Cyperus esculentus*), Purple nutsedge (*Cyperus rotundus*) **Diseases:** Black root rot (*Rhizoctonia* and *Pythium spp.*); Crown rot (*Phytophthora cactorum*); root-knot nematodes (*Meloidogyne spp.*)	None of the available alternatives provide an acceptable level of control of nutsedge; the affected states' regulatory requirements to meet certification standards which amount to virtually complete control of fungal diseases and nematodes, is only attainable with methyl bromide
California	**Diseases**: Phytophthora Crown and Root Rots (*Phytophthora spp.*); Red Stele (*Phytophthora fragariae*); Verticillium Wilt (*Verticillium dahliae*); and possibly others **Nematodes:** Root-knot (*Meloidogyne spp.*); sting (*Belonolaimus spp.*); dagger (*Xiphinema spp.*); lesion (*Pratylenchus spp.*); foliar (*Aphelenchoides spp.*); needle (*Longidorus spp.*); stem (*Ditylenchus spp.*) **Weeds:** numerous weeds listed (e.g., annual bluegrass, bur clover, carpetweed, chickweed, field bindweed, goat grass, hairy nightshade, lambsquarter, malva, nutsedge, pig weed, portulaca, prostate spurge, puncture vine, purslane, vetch)	The State mandatory certification program has strict requirements for control of diseases and nematodes which amount to virtually complete control of the key pests. Given the growing situations encountered over the course of the 5-year transplant production cycle (a different growing location is used each year), none of the alternatives have thus far been shown to be consistently perform at a highly effective level at soil depths to 3 feet. Methyl iodide is considered by most researchers to be viable potential alternative, which is currently proposed for registration in the US.

Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description
54,988	56,291	We estimated a more representative average historical use for 2006 than 2005. Research amount included in increase.

FIGURE 1. U.S. REQUESTED, QUARANTINE AND PRESHIPMENT AND NOMINATED HECTARES OF STRAWBERRY NURSERIES



Footnote: The requested hectares are sum total of all acreages in the CUE applications. QPS = number of hectares qualifying as quarantine and pre-shipment. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

ECONOMIC IMPACTS

The economic impacts were assessed using four economic parameters: 1. loss per hectare, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

RESPONSE TO QUESTIONS

MBTOC Comment - A large amount (88%) of MB use has been exempted to meet certification requirements for QPS as determined under U.S. regulatory controls. Technical data provided with the nomination indicates that metam-sodium and chloropicrin are providing effective disease control for runner production, but 1,3-D/Pic or 1,3-D alone followed by metam-sodium, are reported not to be fully effective."

MBTOC Question 1 - The Party is requested to clarify how that part of the nomination that is not classified under the QPS exemption differs from that categorized as QPS. In particular

information is sought on whether it is required to meet the same performance standards as that categorized as QPS.

US Response - The same quality standards apply to the non-QPS nursery stock as the QPS plants, since in-county or in-state fruit grower customers would not want to purchase lesser quality plants and would be expected to obtain high quality plants elsewhere in the country to ensure they were the most robust specimens. This is based in part on available data that seems to indicate that runner plants produced in fields where lower yields and/or smaller plants were produced as a result of using less effective alternatives results in carryover losses at the fruit production level. Additionally, if one or more growers in the same general production area were trying to produce two quality levels of plants they would run the risk of having the mobile pests moving from the lesser quality plants to the high quality plants and possibly lose their certification status on the high quality plants.

MBTOC Question 2 - Clarification is requested on why metam sodium and chloropicrin as an alternative cannot be adopted more widely. The Party is requested to supply data to support the claimed lack of effectiveness of 1,3-D/Pic to the necessary depth.

US Response - The data summarized in the nomination document, which appear to indicate that metam-sodium and chloropicrin are suitable alternatives, are derived from tests which all lacked a full spectrum of the potential pest types (weeds, nematodes, diseases) and generally did not appear to have adequate and uniform levels of those pests that were present. This weakness appears to be true for all or most of the available studies designed for strawberry nursery uses, as well as those designed for fruit production situations. Accordingly, the results from such studies will give a number of false-positives for certain alternatives simply because they were able to provide adequate control when limited pest species were present, or when non-uniform or low pest levels were present. Numerous studies exist for strawberries and other crops that indicate the strengths and weaknesses of the various alternatives under different pest control situations. Collectively these data have value in providing an overview of the strengths and weaknesses of each potential alternative. The U.S. has not been able to find a comprehensive analysis of this nature. Such an analysis would be extremely time consuming, but would be the only way to validate the comparative performance opinions of the available researchers.

Although fumigation in the Southeastern States is generally accomplished in the fall, delays associated with a late harvest of the preceding crop and/or cold weather often necessitate that fumigation be conducted in March and April, which is immediately prior to planting. A similar situation exists in California. Use of the alternative metam-sodium will result in an additional 1-2 week plant back delay when applied alone and longer planting delays when applied sequentially before/after another fumigant (e.g., Telone, chloropicrin). Southeastern States have historically experienced 10-15% plant yield (runner) losses as a result of a 1-week planting delay.
Therefore even greater losses are possible with the longer plant back delays associated with metam-sodium use, even if metam-sodium were capable of providing levels of pest control comparable to methyl bromide at the required soil depths.

Another consideration is that certain studies indicate that chloropicrin can increase nutsedge weed populations rather than control them. Nutsedge is the principal weed pest in the

Southeastern States and it is projected to become a problem in California nurseries when methyl bromide is no longer available.

Long term performance of these alternatives is still not available. The applicants in California stated that they intend to look for additional studies, which better, defined the comparative efficacy and/or performance of chloropicrin, metam-sodium, and other alternatives at the deeper soil depths. They intend to submit such studies with their next application.

MBTOC Question 3 - The rate of MB used in the Southeastern States in MB/Pic mixtures is very high (413 kg/ha) by world standards. Clarification is sought as to why such a high rate is required and what scope there is for reduction to more normal levels, perhaps combined with emission reduction technologies such as barrier film use. [Note: Originally this comment was linked with Michigan growers; subsequently MBTOC was contacted and it was learned that this comment pertained to the SE States, rather than Michigan]

US Response - The methyl bromide rates currently used in the Southeastern States (413 kg/ha) are about 57 percent higher than those currently used in California (263 kg/ha). The applicant has stated that the higher use rate is required because of their need to control nutsedge. This weed is currently not present in California nurseries. Their experiences have shown that in many cases rates as high as 487 kg/ha of methyl bromide have been needed to control nutsedge. Previously, the Southeastern states indicated that they intend to evaluate the performance of methyl bromide rates as low as 310 kg/ha, so that growers could conceivably switch from the 67:33 to the 50:50 formulation. However, until these performances are fully evaluated, it would not be possible to lower methyl bromide rates and ensure efficacy. In any case, all methyl bromide use is done under tarps, and emissions and use have been controlled to the extent feasible.

References

2006 Bromide Usage Numerical Index (BUNI) – Refined Nomination Package. Attached to U.S. Response to Questions as an Excel Spreadsheet.

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Post Harvest Use for Food Processing Plants
Document Number	CUN 2003, US56N10
DATE	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Key Pests, and Specific Reason for Methyl Bromide in Mills and Food Processors

Genus and species of major pests for which the use of Methyl Bromide is critical	Common Name	Specific Reason why Methyl Bromide is Needed
Tribolium confusum	Confused flour beetle	Pest status is due to health hazard: allergens; plus body parts, exuviae, and excretia violate Food and Drug Administration (FDA) regulations[1]. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not adequate.
Tribolium castaneum	Red flour beetle	
Trogoderma variable	Warehouse beetle	Health hazard: choking and allergens; plus body parts, exuviae, and excretia violate FDA regulations[1]. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking) so phosphine and heat are not adequate.
Lasioderma serricorne	Cigarette beetle	Food contamination violates FDA regulations[1]. Methyl bromide is needed because these insects can occur in areas with electronic equipment and materials that cannot tolerate high temperatures (i.e. cooking of some products; oils and butter go rancid with heat) so phosphine and heat are not adequate.
Sitophilus oryzae	Rice weevil	
Plodia interpunctella	Indianmeal moth	
Oryzaephilus mercator	Merchant grain beetle	
Cryptolestes pusillus	Flat grain beetle	

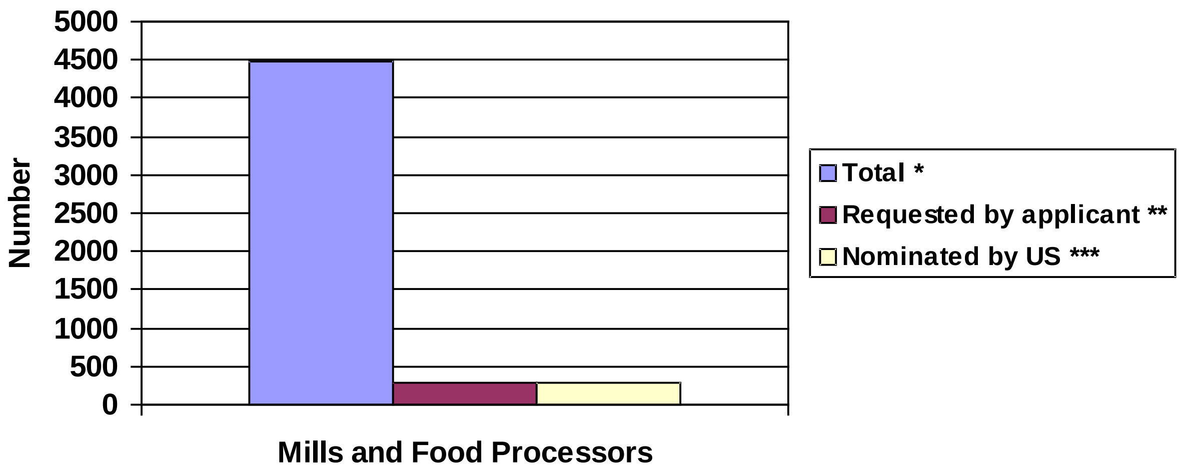
[1] FDA regulations can be found at: http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm and http://www.cfsan.fda.gov/~dms/dalbook.html.

Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description
536,328	505,982	The U.S. imposed a reduction in use rate on applicants, and reduced the applicant requests to account for their request for growth in the number of facilities treated.

FIGURE 1. U.S. TOTAL, REQUESTED, AND NOMINATED MILLS AND FOOD PROCESSORS



Footnotes:

* The total number of facilities (names and addresses listed in Appendix A) is based on US EPA's Facility Registry System (FRS) based on Standard Industrial Classification (SIC) codes for Flour Millers, Rice Millers, Pet Foods, and Food Processors. Only facilities with one or more EPA permits are included (4475 Facilities).

** Total number of facilities requesting methyl bromide (275 Facilities).

*** Total number of facilities included in the US Nomination (275 Facilities).

ECONOMIC IMPACTS

The economic impacts were assessed using four economic parameters: 1. loss per 1000 cubic foot, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

RESPONSE TO QUESTIONS

Question 1 - USA CUN 2003/051, USc6N4 For Mills and Processors MBTOC is unable to assess this sector because detailed information regarding the location, size, age, frequency of MB fumigation and historical usage data of each individual mill and plant was not included in the nomination.

Answer – Members of this sector are trying to comply with this request. However, these consortia request more time to compile these data as they need to ask for this information from their members, which in turn need to gather the information from the individual plants and their pest control operators/fumigation companies.

To illustrate the magnitude of this task, the names and addresses of facilities listed in Appendix A were produced from the US EPA's Facility Registry System (FRS) based on Standard Industrial Classification (SIC) codes for Flour Millers, Rice Millers, Pet Foods, and Food Processors. These facilities have one or more EPA permits. Detailed descriptions of the types of establishments that are included in each SIC codes are available from the US Department of Labor, Occupational Safety and Health Administration website located at **http://www.osha.gov/pls/imis/sicsearch.html**. EPA's Facility Registry System is publicly available and is located at **http://www.epa.gov/enviro/html/fii/ez.html**

Please note that only a small percentage of the facilities listed in Appendix A (Filename: CUN2003 Stru 02 Mills & Processors Reply to June 2004 Questions.xls) use methyl bromide to control pests. There is additional concern that release of the exact locations has homeland security issues.

MBTOC Question 2 - The Party may wish to adjust the quantity nominated in view of recent registration of one potential alternative (SF) for this usage.

US Response - There are two factors that will delay the adoption of sulfuryl fluoride (SF) as a methyl bromide replacement. Although sulfuryl fluoride was registered by U.S. EPA in January of 2004, it was registered only for the mills processing flour and rice that do not manufacture any food mixes or ingredients. In addition, US pesticide registration is a multi-part process; registration at the federal level must be followed by a state registration. The California, Florida, and New York state registrations are still pending. Because a lawsuit has been filed over the SF registration, the registration process in the remaining states is likely to be slowed.

A large, but currently unknown, number of mills that process flour also produce partial recipe products that contain such ingredients as sugar, baking soda, leavening agents, hydrogenated oils, etc. The registration of sulfuryl fluoride does not include tolerances for these ingredients and therefore SF could not be legally used in these facilities at this time. It is most likely that adoption of sulfuryl fluoride for some of these mills will be delayed until tolerances for these ingredients are sought by the registrant, reviewed by U.S. EPA, and granted (if they meet eligibility criteria).

As Figure 1 demonstrates, only a small proportion of the milling and food processing facilities in the US have applied to use methyl bromide. Because the US accelerated the registration of SF as a methyl bromide alternative the use on food additives was not included in the registration. The US will need to collect information on the extent of the number and location of facilities where these types of food additives are used and were included in our original CUE request. At the same time the US will attempt to clarify if any of these products are sold to countries where SF is not yet registered. As a consequence of the factors listed above, we do not believe it would be prudent to adjust the quantity nominated for these uses. However, we are committed to re-

reviewing the status and market penetration of SF as part of the domestic allocation procedure for 2006, and are committed to reducing the allocation to the extent that, at that time, SF is a viable alternative for the nominated uses.

References

2006 Bromide Usage Numerical Index (BUNI) – Refined Nomination Package. Attached to U.S. Response to Questions as an Excel Spreadsheet.

Appendix A. Names and Addresses of U.S. Post-harvest Facilities

A-1. Flour Millers (SIC Code 2041)

A-2. Rice Millers (SIC Code 2044)

A-3. Pet Foods (SIC Codes 2047, 2048)

A-4. Food Processors (SIC Codes 2043, 2045, 2051, 2052, 2096, 2099)

NOTE: Appendices are contained in the file: CUN2003 Stru 02 Mills & Processors Reply to June 2004 Questions.xls

Table 3. Number of Mills and Food Processing Facilities by Category

Region	State	Flour Mills	Food Processing	Pet Foods	Rice
Eastern	Delaware		1	5	
	Georgia	10	52	159	
	Kentucky	13	34	57	
	Maryland	2	47	33	
	North Carolina	19	45	119	
	New Jersey	4	64	9	
	Pennsylvania	29	84	88	
	South Carolina	10	31	32	
	Tennessee	14	42	40	1
	Virginia	31	30	38	
	West Virginia		3	2	
	Sub Total	132	433	582	1
Mountain	Alaska		2		
	Colorado	5	24	50	
	Idaho	3	6	15	
	Montana	4	1	7	
	Nevada		2	3	
	Utah	8	17	10	
	Wyoming			1	
	Sub Total	20	52	86	
North East	Connecticut		13	3	
	Massachusetts	4	39	2	
	Maine	1	6	2	
	New York	12	42	18	
	Rhode Island		1		
	Vermont		2	6	
North East	**Sub Total**	17	103	31	
Southern	Alabama	7	28	69	
	Arkansas	2	10	50	18
	Arizona		10	1	
	Florida	5	29	21	
	Louisiana	5	18	22	17
	Mississippi	7	12	33	3
	New Mexico	3	10	9	
	Oklahoma	2	12	31	
	Texas	12	65	61	3
	Sub Total	43	194	297	41
Tropical	AS			1	
	GU		1		
	Hawaii		1		
	Puerto Rico	7	28	29	2
	Sub Total	7	30	30	2
Upper Midwest	Iowa	43	54	256	
	Illinois	24	181	121	1
	Indiana	23	29	53	
	Kansas	33	27	147	
	Michigan	7	35	7	
	Minnesota	21	29	96	
	Missouri	55	54	147	2
	North Dakota	4	4	4	
	Nebraska	12	29	175	

	Ohio	23	68	77	
	South Dakota		2	15	
	Wisconsin	7	53	52	
	Sub Total	252	565	1150	3
Western	California	22	116	74	31
	Oregon	6	18	25	
	Washington	9	59	42	
	Sub Total	37	193	141	31
Grand Total		508	1570	2317	78

Footnote: These facilities have one or more EPA permits. Descriptions of the establishments that are included in each SIC codes are available from the US Department of Labor, Occupational Safety and Health Administration website located at http://www.osha.gov/pls/imis/sicsearch.html. EPA’s Facility Registry System is publicly available and is located at http://www.epa.gov/enviro/html/fii/ez.html

Nominating Party:	The United States of America
Brief Descriptive Title of Nomination:	Methyl Bromide Critical Use Nomination for Preplant Soil Use for Tomato Grown in Open Fields on Plastic Mulch
Document Number	CUN 2003/050,058, Usc6N3, Usc6N9
Date	August 12, 2004

Critical Need for Methyl Bromide

Table 1. Region, Key Pests, and Specific Reason for Methyl Bromide in Tomato

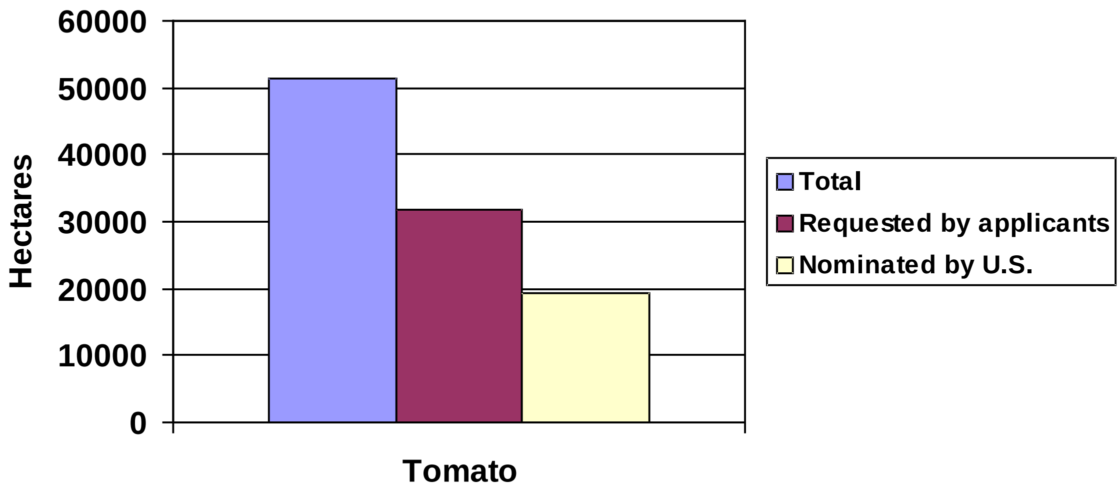
Region where methyl bromide use is requested	Key disease(s) and weed(s) to genus and, if known, to species level	Specific reasons why methyl bromide is needed
California	*Fusarium* wilt, *Verticillium* wilt, Root Knot nematodes, *Pythium* spp.	Registered alternatives do not provide consistent, efficient and economical control of listed pests; use of alternatives problematic in hilly terrain included in the nomination.
Michigan	Crown, root and fruit rot caused by *Phytophthora capsici*, *Fusarium oxysporum* wilt	Methyl bromide is currently the only product that can control these soil-borne pathogens and allow Michigan growers to deliver their produce during premium priced early market windows. Other control measures have plant back restrictions that put Michigan tomatoes outside the premium priced fresh market. Resistant varieties have not been identified.
Southeastern US	Nutsedges (*Cyperus rotundus and C. esculentus*) Root-Knot nematodes *Phytophthora* Crown and Root Rot *Fusarium* Wilt (*F. oxysporum*)	None of the listed MBTOC alternatives are effective in controlling the key pests in the Southeastern US at moderate to severe pest pressure. Use of alternatives is restricted in areas with karst topography.

Amount Of Methyl Bromide Nominated

Table 2. Amount of methyl bromide Nominated by the U.S. in 2005 and 2006.

2005 (kg)	2006 (kg)	Description of Differences Between Years
2,865,262	2,844,985	VA did not resubmit a CUE. New data on extent of pest pressure in SE US. CA provided additional information on their problem.

Figure 1. U.S. Total, Requested, and Nominated Hectares of Tomatoes



Footnote: Total hectares, based on United States Department of Agriculture Statistics, are national acreage in production for this sector. The requested hectares are sum total of all the hectares in the CUE applications. The nominated hectares reflect reductions of the requested hectares to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used. Total pounds of methyl bromide nominated by the United States government for this sector are based on these nominated hectares.
See the accompanying spreadsheet 2006 Bromide Usage Numerical Index or "BUNI" **(Filename: USA 2006 BUNI – Refined Nomination Package.xls)** for more detailed information on how the nominated amount was determined.

Economic Impacts

The economic impacts were assessed using four economic parameters: 1. loss per hectare, 2. loss per kilogram of methyl bromide, 3. loss as a percentage of gross revenue, and 4. loss as a percentage of net revenue. This assessment compares methyl bromide to the best available alternative to determine the economic feasibility of using that alternative. A range of alternatives were examined to determine the best available alternative scenario taking into account yield loss estimates and cost increase estimates. The result of the economic impact analysis is presented in the BUNI analysis. In this sector, no alternatives were found to be both technically and economically feasible for the particular circumstances nominated for the CUE.

Response to Questions

According to the nomination, no alternatives are available for severe fungal, nematode and nutsedge pressure in certain areas. Topography and regulatory issues prevent the use of one possible alternative (1,3-D). However several fumigant alternatives are providing effective control of pests (e.g. 1,3-D/Pic, Pic alone, metam sodium and Pic used in combination) and a number of herbicides (e.g. halosulfuron methyl, trifloxysulfuron) are available to control nutsedge.

MBTOC Question 1 - Information is sought on scope for reduction of the nomination with use of non- 1,3-D alternatives such as metam sodium/pic combinations in the areas with karst geology, the proportion of the crop affected by plantback restrictions using nutsedge herbicides (halosulfuron methyl and trifloxysulfuron), the restrictions, if any, on sequential application of alternatives where useful, and the scope for reduced MB dosages associated with use of VIF, strip treatment and herbicide (especially halosulfuron methyl and trifloxysulfuron) use.

US Response –

A. Metam sodium/chloropicrin combinations in areas with karst geology: In the southeastern United States, there are two major limitations with the use of metam sodium + chloropicrin combinations at this time, nematode control and worker safety. The most important limitation is that nematode control would be inadequate in most, if not all, of vegetable producing areas according to Dr. David Langston (plant pathologist, University of Georgia). Due to this reason, University of Georgia researchers did not include this combination in their 2004 research trials on the efficacy of methyl bromide alternatives in controlling soil-borne pests. Other researchers in Florida and Georgia have indicated that metam sodium does not provide adequate weed control under their growing conditions.

Locascio et al. (1997) studied MB alternatives on tomatoes grown in small plots at two Florida locations with high nutsedge infestation (see Table 3). Various treatments were tested on plots that had multiple pests. At the Bradenton site there was moderate to heavy *Fusarium* infestation; heavy purple nutsedge infestation and light root-knot nematode pressure. At Gainesville there was heavy infestation of yellow and purple nutsedge and moderate infestation of root-knot nematode. In pairwise statistical comparisons, the yield was significantly lower in metam-sodium treatments compared to MB at both sites. At Bradenton, the average yield from both metam-sodium treatments was 33% of the MB yields, suggesting a 67% yield loss from not using MB. At Gainesville the average yield of the two metam-sodium treatments was 56% of the MB yield, suggesting a 44% yield loss from not using MB. In considering metam sodium plus chloropicrin results, one must keep in mind that metam sodium alone does not provide adequate nematode control and that the addition of chloropicrin which controls plant pathogens would not be expected to improve nematicidal attributes of this fumigant.

Table 3. Fumigant Alternatives to Methyl Bromide for Polyethylene-Mulched Tomato (Locascio et al. 1997)

Chemicals	Rate (/ha)	Average Nutsedge Density (#/m^2)	Average Marketable Yield (ton/ha)	% Yield Loss (compared to MB)
UNTREATED (CONTROL)	-	300 [ab]	20.1 [a]	59.1
MB + Pic (67-33), chisel-injected	390 kg	90 [c]	49.1 [b]	---
1,3 D + Pic (83-17), chisel-injected	327 l	340 [a]	34.6 [c]	29.5
Metam Na, Flat Fumigation	300 l	320 [a]	22.6 [a]	54.0
Metam Na, drip irrigated	300 l	220 [b]	32.3 [c]	34.2

Footnotes: (1) Numbers followed by the same letter (within a column) are not significantly different at the 0.05 level of probability, using Duncan's multiple range test.
(2) Data shown are from the Gainesville/Horticultural Unit site, 1994 season (this was one of three sites included in this study). This site had relatively high nutsedge pressure, and data for both pest pressure and marketable yields for all treatments shown.

The second issue with a metam sodium application is the high worker exposure and worker safety concerns during the application process. To obtain adequate nutsedge control metam sodium has to be applied 3 to 4 inches deep and then followed immediately with the plastic laying operation. If the metam sodium is disked into the soil or if plastic laying operation is delayed the efficacy of metam sodium in controlling the nutsedge is lost. In an effort to overcome the exposure concerns researchers in the southeastern U.S. are testing a new application device in an effort to address the worker safety and exposure issues. The researchers have used the new applicator for the first time but now they have to wait until August/September 2004 to evaluate the efficacy of this method for the first time in controlling nutsedge. In order to be considered successful the new application equipment would need to provide satisfactory worker safety and improved pest control efficacy when used with metam sodium.

B. Halosulfuron and trifloxysulfuron, the proportion of the crop affected by plantback restrictions : Both of these herbicides are effective in the control of nutsedge. However there are several limitations to the use of these products. These limitations are discussed below.

Both herbicides have to be applied postemergence for adequate control of nutsedge. This means that nutsedge has to penetrate the plastic tarp prior to application of the herbicide. Typically the grower tries to grow 3 or more crops on a single laying of plastic mulch. Many of the fields are intensely populated with nutsedge and the plastic would be destroyed very quickly, most likely after one or two crops.

Another problem with postemergence applications is that even though both herbicides are effective in controlling nutsedge they do not contact the soil because of the plastic tarps and thus provide no residual nutsedge control. The spray either contacts the crop, the weed, or the plastic. Therefore, another flush of nutsedge could occur, under the plastic, immediately after the herbicide application. Nutsedge continually emerges for at least 8 to 9 months out of the year in the southeastern U.S. Both of these herbicides can be applied as sequential applications, halosulfuron can be applied twice per season and trifloxysulfuron can be applied up to 3 times per season. However, with an aggressive weed such as nutsedge and a long duration crop such as tomatoes, 6 month duration, two or three herbicide applications will not provide adequate control because the majority of the nutsedge plants are protected under the plastic tarp where they still compete with the tomato crop for water and nutrients.

Herbicide carryover is also an issue for trifloxysulfuron. The research that has been conducted indicates a high potential for phytotoxicity to subsequent vegetable crops and the labels carry plantback restrictions because of this. Rotational restrictions on the label vary from 3 to 18 months depending on crop. The transplanted bell peppers , cucurbits and tomatoes can be planted after 4 months but phytotoxicity restricts the planting of most of the other vegetables for at least 12 months. Therefore, this herbicide is not and will not be used as long as these phytotoxicity issues restrict rotational crops.

An additional limitation with trifloxysulfuron is that it is currently only labeled for use in Florida and Georgia. The other southeastern tomato growing states will not be able to use this pesticide until it is registered for use in their states.

For halosulfuron, the work is being done with the manufacturer to evaluate the potential to reduce the carryover restrictions on the label. Presently, residue carryover still poses a serious restriction to crops following a postemergence application of halosulfuron. The restricted crops include cabbage (15 months plant back), cole crops (18+ months plant back), and greens (36 months plant back). Trifloxysulfuron plant back restrictions are very similar to these restrictions. The southeastern U.S. tomato growers can typically grow 3 crops in less than 12 months. Therefore, an 18 month rotational restriction can limit their crop choices for 3 to 5 crop cycles.

Additional limitations to halosulfuron include potential crop injury with excessive rains (greater than 1 inch), which is not uncommon in areas of the southeastern U. S. The label restricts halosulfuron use in areas where soils are permeable, particularly where the ground water is shallow, because such use may result in ground water contamination.

C. Metam + pic on karst topography: As mentioned above in Part A, this treatment will not provide adequate nematode or perennial weed control.

D. Proportion of crop impacted by herbicide carryover: Based on the label restrictions, it is estimated that more than 90% of Georgia's production land (Culpepper, 2004) is impacted by herbicide carryover and the case would be similar in other southeastern states.

E. Strip treatments: From the information available to us all the tomato growers in the California, Michigan, and the southeastern U.S. are already using strip treatments with plastic tarps with their methyl bromide fumigations, therefore reductions in our nomination request would not be appropriate.

F. VIF: More research remains to be conducted in this arena. During 2004, several trials are in progress on the ability of a methyl bromide alternative fumigant and VIF to control nutsedge. There are several problems that remain to be addressed.

- Plant back. This spring a researcher waited 28 days after fumigating and laying VIF film. Two-thirds of his fumigant alternatives killed his crop. This type of experience demonstrates that in the future research will need to be conducted on plant back intervals using methyl bromide with VIF.
- VIF film is much more expensive (2 to 3 times more). The growers must remain economically competitive to survive.
- VIF film is more susceptible to photodegradation and does not last as long as current films. Currently films are used for multiple crops to reduce costs and avoid disturbing the treated soil.
- VIF film is more difficult to lay compared to a low density film because it is more prone to tearing. New equipment and techniques will need to be developed and tested for growers to use this product.

In conclusion, the tomato growers need more time to experiment with different technologies, alternative fumigants and herbicides to determine how they can integrate various technologies in tomato production to control various pests. 1

MBTOC Question 2 - The party is requested to clarify why in Michigan, the key pest, Phytophthora capsici, cannot be controlled by chloropicrin and why the use of substrate production systems which are used in similar climatic zones worldwide cannot be used more widely.

US Response - In Michigan, the tomato growers have traditionally used methyl bromide in combination with chloropicrin to control soil-borne *Phytophthora capsici*. This is the first year (2004) researchers at Michigan State University have field tested straight formulations of chloropicrin for the control of *P. capsici* and the results recorded in July showed that all chloropicrin treatments have plant losses caused by *P. capsici*. In the same field study methyl bromide treatments have no plant mortality caused by *P. capsici*. At this stage it is not clear whether or not chloropicrin alone will be a viable methyl bromide alternative. The researchers plan to record fruit yields as the fruit will mature in the later part of 2004 tomato growing season. The use of straight chloropicrin is also under scrutiny by state officials concerned for worker safety exposed to the high rate of chloropicrin being released during applications. The substrate production systems are not a viable alternative in Michigan because of very high cost of building such systems (Estes and Peet, 1999).

REFERENCES

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