United States Supplemental Request for 2006

The dried bean sectors it the only sector for which the United States is submitting a new request for a 2006 methyl bromide CUE.

1. Dried Beans

Dried beans in California have no alternative to control cowpea weevil in garbanzo and blackeye beans. The phosphine label does not list cowpea weevil on its efficacy list. The state of California requires that the pest be specifically listed on the label for a legal application of the pesticide. Heat is unacceptable as the temperatures required to destroy the larvae of cowpea weevils within the beans would cook the product and make them unmarketable.

The U.S. supplemental request for dried beans in 2006 is for 7.07 metric tons of methyl bromide, which is the same amount being requested for 2007. The basis for the 2006 request is the same as that described in detail for our 2007 request, so please refer to those documents for our analysis of the need for methyl bromide in this sector.

United States Request for Reconsideration for 2006

The U.S. requests reconsideration for sectors referred back to MBTOC at MOP-16, and has provided the following clarifications and additional information to assist MBTOC in its further discussions. The additional information is provided on a sector by sector basis.

1. Dry commodities/structures (cocoa beans)

Overview of the U.S. Nomination

The U.S. requested 61.519 metric tons of methyl bromide for use on cocoa beans in the U.S. for both 2005 and 2006. This is a request at the national level to treat cocoa beans.

The U. S. nomination is only for those food commodities, such as cocoa, where the use of alternatives is not suitable. In the U. S. there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide, making these alternatives technically and/or economically infeasible.
- Constraints of the alternatives: some types of commodities (e.g., those containing high levels of fats and oils) prevent the use of heat as an alternative because of its effect on the final product (e.g., rancidity) or because it changes the nature of the final product (e.g. cooking it).
- Transition to newly available alternatives: Sulfuryl fluoride recently received a Federal registration for use on small grains (flour, rice, oats, etc.) but not for other foods. State registrations for small grains have not yet been issued in all states. Further, it will take some time for applicators to be trained in the use of this chemical and for its incorporation into a pest control program. A registration decision concerning the establishment of sulfuryl fluoride tolerances on other processed food ingredients in a treated facility is still pending.
- Time to complete fumigation: e.g., the use of some methyl bromide alternatives can add a delay to production by requiring additional time to complete the fumigation process. Production delays can result in significant economic impacts to the processors. Capacity of fumigation chambers can become an issue. If, for example, fumigation capacity for cocoa beans is fully utilized, moving to an alternative that requires a longer in-chamber time would require construction of additional fumigation capacity incurring large capital costs.

Overview of MBTOC's prior Recommendation

MBTOC recommended a 25% cut to a level of 46.139 metric tons for 2006[1]. The basis for this suggested reduction was "for phasein of alternatives".

[1] The original recommendation for 2005 was for a cut of 10% to a level of 55.367 metric tons. The cut was rejected by the Parties at the November MOP and the full request was granted. It is now not clear if the recommended amount for 2006 remains at 46.139, a 25% cut from the requested amount, or, whether the amount will be adjusted to reflect a 15% reduction for a recommended quantity of 52.291.

MBTOC further stated “Frequent fumigations indicate that there are poor or no measures to prevent re-infestation, resulting in additional and perhaps unnecessary use of MB.”

U.S. Response to MBTOC's prior recommendations

To clarify the U.S. request, shipments of cocoa beans are fumigated once each and then distributed throughout the U.S. for further processing into finished products such as cocoa powder, chocolates, etc, and we therefore disagree that cuts to our request based on the frequency of fumigation are appropriate. Although phosphine (aluminium phosphide) is labeled for use on cocoa beans in the US, the time required to complete a fumigation is more than 96 hours compared with 24 hours for a methyl bromide fumigation. This extra time imposes a cost on the manufacturers of finished cocoa products. According to the International Cocoa Organization (www.icco.org) “Some countries also use plastic strips containing Dichlorovos for continuous chemical control, though these are banned in some countries and the U.S. is withdrawing permission to use it.”

Methyl bromide is the cost-effective fumigant to use on cocoa beans. The short time required allows rapid turn-over of existing fumigation capacity.

Technical and Economic Assessment of MBTOC/TEAP Report.

No technical assessment of the performance of alternatives, or economic assessment of the impact of converting to alternatives was provided by MBTOC. No economic data were provided to support a 25% reduction schedule as suggested by MBTOC.

To support the MBTOC’s recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of longer treatment times, and the economic feasibility of a four year transition time.

U.S. 2006 nomination

The U.S. has considered the issues raised by MBTOC, but continues to support our request for 61.519 metric tons of methyl bromide for use on cocoa beans for 2006, which is an increase of 15.380 metric tons over the MBTOC recommended amount of 46.139 metric tons.

2. Dry commodities/structures (processed foods, herbs, spices, dried milk, cheese processing)

Overview of the U.S. Nomination

The U.S. requested 83.344 metric tons of methyl bromide for use on processed foods (71.889 metric tons), herbs and spices (4.695 metric tons), dried milk (0.402 metric tons), cheese processing facilities (2.876 metric tons), and other commodities (3.482 metric tons) for 2006. This is a request at the national level.

The U. S. nomination is only for those facilities where the use of alternatives is not suitable. In U. S. food processing plants there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide, making these alternatives technically and/or economically infeasible.
- Geographic distribution of the facilities: some facilities are situated in areas where key pests may occur at low levels, such as those located in the northern part of the U. S. In such cases, the U. S. is only nominating a CUE for facilities where the key pest pressure is moderate to high.
- Age and type of facility: older food processing facilities, especially those constructed of wood, experience more frequent and severe pest infestations that must be controlled by fumigation.
- Constraints of the alternatives: some types of commodities (e.g., those containing high levels of fats and oils) prevent the use of heat as an alternative because of its effect on the final product (e.g., rancidity). Further, the corrosive nature of phosphine on certain metals prevents its use in mechanical and electrical areas of the facilities.
- Transition to newly available alternatives: Sulfuryl fluoride recently received a Federal registration for use on small grains (flour, rice, oats, etc.) but not for other foods. State registrations for small grains have not yet been issued in all states. Further, it will take some time for applicators to be trained in the use of this chemical and for its incorporation into a pest control program. A registration decision concerning the establishment of sulfuryl fluoride tolerances on other processed food ingredients in a treated facility is still pending.
- Delay in plant operations: e.g., the use of some methyl bromide alternatives can add a delay to production by requiring additional time to complete the fumigation process. Production delays can result in significant economic impacts to the processors.

Overview of MBTOC's prior Recommendation

MBTOC recommended 47.925 metric tons for processed dry foods[2], 3.13 metric tons for herbs and spices, nothing for dried milk, 2.876 metric tons for cheese processing facilities (the full

[2] As is the case for cocoa (above) because the cut for 2005 was rejected by the Parties at the November MOP, it is not clear whether the amounts recommended by MBTOC for 2006 will remain as recommended (a cut of approximately 20% in addition to a lower use rate) or will be changed to a 10% cut again, in addition to the lower use rate) in recognition of the higher 2005 amount.

amount requested) and 2.321 metric tons for other commodities. The total recommendation was for 56.253 metric tons of methyl bromide for these uses in 2006.

U.S. Response to MBTOC's prior recommendations
USG agrees that in general, a use rate of 20g/m^3 should allow for adequate control of pests in mills and processing facilities but reserves the right to re-visit this issue should we become aware of data demonstrating that this level is not adequate to control pests in the specific circumstances of the nomination when appropriate practices (*eg* careful sealing of the building/container and other 'best practices') are followed.

USG also agrees that there are alternatives for controlling pests in dried milk and therefore withdraws the requested amount of 0.402 metric tons for this purpose.

USG does not agree that it is appropriate to cut 10% (or 20%) from the requested use for transition to alternatives and for improved sealing.

To take the simpler issue first, there is no evidence that facilities for which this request for methyl bromide is being made are failing to seal the facilities properly. As far as the phase-in of alternatives is concerned, the Montreal Protocol calls for a critical use nomination being granted when there are no alternatives that are both technically and economically feasible.

Over the last decade, food processing facilities in the United States have reduced the number of methyl bromide fumigations by incorporating many of the alternatives to methyl bromide use identified by MBTOC. The most critical alternative implemented is IPM strategies, especially sanitation, in all areas of a facility. Plants are now being monitored for pest populations, using visual inspections, pheromone traps, light traps and electrocution traps. When insect pests are found, plants will attempt to contain the infestation with treatments of low volatility pesticides applied to both surfaces and cracks and crevices. These techniques do not disinfest a facility but are critical in monitoring and managing pests. However, when all these methods fail to control a pest problem, facilities will resort to phosphine, heat, and if all else fails, to methyl bromide.

Many facilities in the United States also are using both phosphine and heat treatments to disinfest at least portions of their plants. Phosphine, alone and in combination with carbon dioxide, is often used to treat both incoming grains and finished products. Unfortunately, phosphine is corrosive to copper, silver, gold and their alloys. These metals are critical components of both the computers that run the machines as well as some of the machines themselves. Therefore, phosphine is not feasible in all areas of food processing facilities. Additionally, phosphine requires more time to kill insect pests than does methyl bromide, so plants need to be shut down longer to achieve mortality, resulting in economic losses. There are also reports of stored product pests becoming resist to phosphine (Taylor, 1989; Bell, 2000; Mueller, 2002).

Heat treatments have a number of problems in this industry. Not all areas of a plant can be efficiently treated with heat. Some food substances, for instance oils and butters will become rancid with heat treatments. Not all finished food products can be heated for the length of time heat is required for efficient kill of pests. In addition, geography of the United States plays a crucial role in the use of heat treatments. Food processing plants in the northern United States will experience winters with several weeks of sustaining temperatures of -32° to -35° C (-30° to -25° F). In these areas plants have heaters and the power plants have the capacity to supply excess power as needed. However, the southern and parts of the western zones of the United States are geographically quite different. Winter temperatures there seldom reach –1.2° C (30° F) and when temperatures should fall that low, it is typically for only a few hours one night. For many winters, these areas of the U. S. don't freeze at all. Subsequently, these facilities do not have heaters, nor do the power plants have enough power to allow them to heat such large areas and sustain the temperatures necessary for an effective kill of pest populations. Additionally, escaping insects can survive these outdoor temperatures and re-enter the facility after treatment, even when low volatility pesticides are used to treat the surfaces exiting the plant. Still, many southern and western facilities use heat treatments as a spot treatment whereas the northern facilities can use heat treatments more extensively.

In addition, there are economic costs incurred when alternatives are used that are over and above costs when using methyl bromide to control pests. Economic costs in the post-harvest uses of the food-processing sector can be characterized as arising from three contributing factors. First, the direct pest control costs are increased in most cases because heat treatment is more expensive, and labor is increased because of longer treatment time and increased number of treatments. For food-processing facilities that are not already using heat, capital expenditure is also required to retrofit them suitable for heat treatment. Moreover, additional production downtimes for the use of alternatives are unavoidable. Many facilities operate at or near full production capacity and alternatives that take longer than methyl bromide or require more frequent application can result in manufacturing slowdowns, shutdowns, and shipping delays. Slowing down production would result in additional costs relative to the costs incurred by methyl bromide users.

The potential economic losses associated with the use of heat treatment mainly originate from the cost of capital investment. Although economic costs were not calculated for these specific types of food processing facilities, they were calculated for milling facilities. In the milling facilities the estimated economic loss per 1000 m^3 ranges from $2,023 to $12,439, depending on the product being milled. The estimated economic losses as a percentage of gross revenue ranges from 3% to 18% and the estimated economic loss as a percentage of net revenue are over 45% for all the CUE applicants in the food-processing (milling) sector. We expect losses of a similar scale in this segment of the food processing sector as well.

The industries that use methyl bromide for commodity fumigation are, in general, subject to limited pricing power, changing market conditions, and government regulations. Companies within these industries operate in a highly competitive global marketplace characterized by high sales volume, low profit margins, and rapid turnover of inventories. The results suggest that heat treatment is not economically viable as an alternative for methyl bromide in existing facilities that still use methyl bromide.

Sulfuryl Fluoride is not registered for use on herbs and spices. Heat is not an appropriate treatment, as it will degrade the quality of the spice/herb. Although phosphine (aluminium phosphide) is labeled for use on spices and herbs in the U.S., the time required to complete a fumigation is more than 96 hours compared with 24 hours for a methyl bromide fumigation. This extra time imposes a cost on the manufacturers of these products. Because the market is a highly competitive and globalized one, characterized by high sales volume, low profit margins, and rapid turnover of inventories, phosphine may not be an economically feasible alternative for methyl bromide in this use.

Technical and Economic Assessment of MBTOC/TEAP Report.
We have not been provided by MBTOC with information on the technical assessment of the performance of alternatives, the economic assessment on the impact of converting to alternatives, and in particular the economic data used to support a 10% reduction.

To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of longer treatment times, and the economic feasibility of a 10% reduction.

U.S. 2006 nomination
Therefore the U.S. is requesting that and additional amount (over the MBTOC recommended amount of 56.253 metric tons) of 12.865 metric tons by granted brining the sector total to 69.118 metric tons of methyl bromide.

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3. Mills and Processors

Overview of the U.S. Nomination

The U.S. requested 505.982 metric tons of methyl bromide for use in mills and food processing facilities for 2006. The request was distributed as follows: 114.305 metric tons for rice mills, 14.742 metric tons for bakeries, 48.081 metric tons for pet food facilities, and 328.854 metric tons for flour mills. This is a request at the national level.

The U. S. nomination is only for those facilities where the use of alternatives is not suitable. In U. S. food processing plants there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide, making these alternatives technically and/or economically infeasible.
- Geographic distribution of the facilities: some facilities are situated in areas where key pests may occur at low levels, such as those located in the northern part of the U. S. In such cases, the U. S. is only nominating a CUE for facilities where the key pest pressure is moderate to high.
- Age and type of facility: older food processing facilities, especially those constructed of wood, experience more frequent and severe pest infestations that must be controlled by fumigation.
- Constraints of the alternatives: some types of commodities (e.g., those containing high levels of fats and oils) prevent the use of heat as an alternative because of its effect on the final product (e.g., rancidity). Further, the corrosive nature of phosphine on certain metals prevents its use in mechanical and electrical areas of the facilities.
- Transition to newly available alternatives: Sulfuryl fluoride recently received a Federal registration for small grains such as flour, rice, oats, etc. State registrations have not yet been issued for all states. Further, it will take some time for applicators to be trained in the use of this chemical and for its incorporation into a pest control program. A registration decision concerning the establishment of sulfuryl fluoride tolerances on other processed food ingredients in a treated facility is still pending.
- Delay in plant operations: e.g., the use of some methyl bromide alternatives can add a delay to production by requiring additional time to complete the fumigation process. Production delays can result in significant economic impacts to the processors.

Overview of MBTOC's prior Recommendation

MBTOC recommended a total of 394.843 metric tons of methyl bromide for this sector distributed as follows: 73.745 metric tons for rice mills, 14.742 metric tons for bakery uses, 43.273 for dry pet food premises, and 263.083 for flour mills. The total recommendation was for 394.843 metric tons of methyl for these uses in 2006.

U.S. Response to MBTOC's prior recommendations

MBTOC stated that proper sealing should allow rice mills to reduce their use rate from 31g/m 3 to 20 g/m3. Although there is no evidence that proper sealing procedures are not followed and that is the reason for the higher use rate than is common for the remainder of the sector, USG agrees that in general, a use rate of 20g/m^3 should allow for adequate control of pests but reserves the right to re-visit this issue should we become aware of data demonstrating that this level is not adequate to control pests in the specific circumstances of the nomination when appropriate practices (*eg* careful sealing of the building/container and other 'best practices') are followed. This reduction results in an amended U.S. request of 73.745 metric tons of methyl bromide for this portion of the sector as recommended by MBTOC.

MBTOC appears to believe that better sealing in rice facilities is necessary because they believe that facilities are treated five times per year. In this industry, the majority of the milling facilities are old and located in the southern US[3] (close to where rice is produced in Florida, Texas, Louisiana, Arkansas and California) where pest pressures are high and where insects are able to survive easily when driven outdoors by fumigation. In addition, bringing new batches of rice into the facilities can result in a re-infestation. USG does not think that there is further scope for reduction in rice mills.

MBTOC recommended that the use rate for pet food facilities be reduced from 22 to 20 g/m^3. USG agrees that in general, a use rate of 20g/m^3 should allow for adequate control of pests but reserves the right to re-visit this issue should we become aware of data demonstrating that this level is not adequate to control pests in the specific circumstances of the nomination when appropriate practices (*eg* careful sealing of the building/container and other 'best practices') are followed. This reduction results in an amended U.S. request of 44.417 metric tons of methyl bromide for this portion of the sector, an increase of 1.144 metric tons over the MBTOC recommended amount of 43.273 metric tons

MBTOC further recommended that the request for methyl bromide used in pet food facilities be reduced by 10% "to allow progressive adoption of fumigant alternatives such as sulfuryl fluoride (recently registered for flour mills (sic)[4], continuing adoption of heat technologies, improved sealing of buildings, and increased optimization of IPM techniques."

Sulfuryl fluoride is not registered for use on dry pet food. There is at present a legal question as to whether a registration is required (authorizing statute refers to "foods for human and other animals") or not required. Until this issue is clarified sulfuryl fluoride cannot be used on pet foods.

MBTOC has recommended a further reduction of 10% in the amount of methyl bromide that can be used to fumigate flour mills, citing increased adoption of sulfuryl fluoride in particular, and adoption of other alternatives more generally.

Addressing first the issue of sulfuryl fluoride; as already noted, sulfuryl fluoride is not registered in all States, nor is it registered on the additional components that transform flour into bread,

[3] Location of the facilities is dictated by close proximity to the raw ingredients and to major markets. For example, the 22 rice mills are located primarily in Gulf Coast states and California.
[4] There is a Federal registration for sulfuryl fluoride use in flour mills, rice mills, and other small grain mills, however, many states have registration requirements in addition to the Federal requirements and until a pesticide has obtained a state 'label' it cannot be used. At present Sulfuryl Fluoride is registered in neither California nor New York and so cannot be use in those states.

cake, pancake and other mixes. It cannot, therefore, be used at all in some jurisdictions nor can it be used in many areas of 'combined' processing facilities.

The Montreal Protocol calls for a critical use nomination being granted when there are no alternatives that are both technically and economically feasible, There are companies that have committed themselves to using alternatives to methyl bromide regardless of the cost differences as long as they can continue to meet necessary sanitary standards. One such company shared their experience with sulfuryl fluoride with us[5]

A nine story flour mill (1.2 million cubic feet[6]) was fumigated with sulfuryl fluoride. The fumigation took place from October 1st to October 3rd. When this facility has been fumigated with methyl bromide the typical amount used has been between 1200 and 1500 lbs[7]. The fumigation with sulfuryl fluoride used 5250 lbs. at a temperature of 82[8] F over a 36 hour rather than a 24 hour period. Although fumigation with sulfuryl fluoride requires that the material be left in place for a longer period than is required for methyl bromide, this component does not add to the cost of the alternative in this instance as it is the practice of this company to conduct fumigations over a three day period to allow adequate time for preparation and for the gas to dissipate at the conclusion of the fumigation.

The cost of a methyl bromide fumigation is approximately $18,500 of which approximately 30-40% is the cost of the chemical. The remaining costs are preparing and sealing the building, monitoring, and unsealing at the conclusion of the fumigation. The cost of the sulfuryl fluoride fumigation was $48,000, nearly three times the cost of the methyl bromide fumigation. The ancillary costs (prepping, sealing, monitoring, unsealing, etc.) are the same for both treatments, the cost difference is due to the difference in the price and amount used of the sulfuryl fluoride.

At present the company that produces sulfuryl fluoride is offering sulfuryl fluoride at a price per pound that is equal to or below the price of methyl bromide. What is not known is whether this practice will continue when methyl bromide is no longer available. There is currently a sulfuryl fluoride product (Vikane®) that is registered for non-food uses[9]. The market price is $10/lb. Although we expect that the food use sulfuryl fluoride (Profume®) to be less expensive, it is currently impossible to determine the market price. This compares to a methyl bromide cost of approximately $1.5 to $3.0 per pound.

Over the last decade, food processing facilities in the United States have reduced the number of methyl bromide fumigations by incorporating many of the alternatives identified by MBTOC. The most critical alternative implemented is IPM strategies, especially sanitation, in all areas of a facility. Plants are now being monitored for pest populations, using visual inspections,

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[5] The company has requested confidentiality. There is great concern within the industry that the perception that food facilities are infested with pests not become widespread. There was great fear on the part of company officials that if the company is identified with a pest management issue the public will boycott its products, feeling them (wrongly) to be unsanitary. The discussion was arranged under the auspices of the North American Millers Association and took place in Arlington Virginia in November of 2004.
[6] 1.2 million cubic feet is approximately 33,980 cubic meters.
[7] 1200 to 1500 lbs is 545 to 680 kg. The use rates have thus varied between 16 and 20 g/m^3.
[8] 5250 lbs is 2380 kg; 82 F is 28 C. The use rate is thus $70g/m^3$.
[9] Vikane® is primarily used as a termiticide for wood structures and furniture.

pheromone traps, light traps and electrocution traps. When insect pests are found, plants will attempt to contain the infestation with treatments of low volatility pesticides applied to both surfaces and cracks and crevices. These techniques do not disinfest a facility but are critical in monitoring and managing pests. However, when all these methods fail to control a pest problem, facilities will resort to phosphine, heat, and if all else fails, to methyl bromide.

Many facilities in the United States also are using both phosphine and heat treatments to disinfest at least portions of their plants. Phosphine, alone and in combination with carbon dioxide, is often used to treat both incoming grains and finished products. Unfortunately, phosphine is corrosive to copper, silver, gold and their alloys. These metals are critical components of both the computers that run the machines as well as some of the machines themselves. In the United States it is specifically against the label (illegal) to fumigate in areas with susceptible metals (at: http://oaspub.epa.gov/pestlabl/ppls). Therefore, phosphine is not feasible in all areas of food processing facilities. Additionally, phosphine requires more time to kill insect pests than does methyl bromide, so plants need to be shut down longer to achieve mortality, resulting in economic losses. There are also reports of stored product pests becoming resist to phosphine (Taylor, 1989; Bell, 2000; Mueller, 2002).

Heat treatments have a number of problems in this industry. Not all areas of a plant can be efficiently treated with heat. Some food substances, for instance oils and butters will become rancid with heat treatments. Not all finished food products can be heated for the length of time heat is required for efficient kill of pests. In addition, geography of the United States plays a crucial role in the use of heat treatments. Food processing plants in the northern United States will experience winters with several weeks of sustaining temperatures of -32° to -35° C (-30° to -25° F). In these areas plants have heaters and the power plants have the capacity to supply excess power as needed. However, the southern and parts of the western zones of the United States are geographically quite different. Winter temperatures there seldom reach –1.2° C (30° F) and when temperatures should fall that low, it is typically for only a few hours one night. For many winters, these areas of the U. S. don't freeze at all. Subsequently, these facilities do not have heaters, nor do the power plants have enough power to allow them to heat such large areas and sustain the temperatures necessary for an effective kill of pest populations. Additionally, escaping insects can survive these outdoor temperatures and re-enter the facility after treatment, even when low volatility pesticides are used to treat the surfaces exiting the plant. Still, many southern and western facilities use heat treatments as a spot treatment whereas the northern facilities can use heat treatments more extensively.

Potential economic losses were estimated for the food-processing facilities that have not been converted to heat treatment. This analysis only covers cases where heat treatment may potentially be technically feasible, and does not cover situations where heat would degrade the commodity being processed (those with fats and edible oils). Economic costs in the post-harvest uses of the food-processing sector can be characterized as arising from three contributing factors. First, the direct pest control costs are increased in most cases because heat treatment is more expensive, and labor is increased because of longer treatment time and increased number of treatments. For food-processing facilities that are not already using heat, capital expenditure is also required to retrofit them suitable for heat treatment. Moreover, additional production downtimes for the use of alternatives are unavoidable. Many facilities operate at or near full production capacity and alternatives that take longer than methyl bromide or require more frequent application can result in manufacturing slowdowns, shutdowns, and shipping delays. Slowing down production would result in additional costs to the methyl bromide users. Economic cost per 1000 m^3 was calculated as the additional costs of methyl bromide if methyl bromide users had to replace methyl bromide with heat treatment. Implementations of heat treatment likely have substantial cost implications to the facilities that have not been converted to heat in the food-processing sector.

Production downtime was estimated at two more days per fumigation with heat and total capital expenditures for heat treatment was assumed to be $1,076 per 1000 m^3 with 10-years lifespan with 10% interest rate from the data provided by the CUE applicants for post-harvesting uses. The potential economic losses associated with the use of heat treatment mainly originate from the cost of capital investment. The estimated economic loss per 1000 m^3 ranges from $2,023 for rice milling to $12,439 for flour/grain milling. The estimated economic losses as a percentage of gross revenue ranges from 3% to 18% and the estimated economic loss as a percentage of net revenue are over 45% for all the CUE applicants in the food-processing sector. The industries that use methyl bromide for commodity fumigation are, in general, subject to limited pricing power, changing market conditions, and government regulations. Companies within these industries operate in a highly competitive global marketplace characterized by high sales volume, low profit margins, and rapid turnover of inventories. The results suggest that heat treatment is not economically viable as an alternative for methyl bromide in existing facilities that still use methyl bromide.

For these reasons, both technical and economic, USG does not believe it is appropriate to assume that alternatives that are both technically and economically feasible will be available to substitute for currently used methyl bromide in flour mills and is requesting that the full request of 328.854 metric tons of methyl bromide, which is an additional 65.771 metric tons of methyl bromide over the MBTOC recommended amount of 263.083 metric tons.

Technical and Economic Assessment of MBTOC/TEAP Report.
We have not been provided by MBTOC with information on the technical assessment of the performance of alternatives, or the economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, and the economic feasibility of sulfuryl fluoride if it must be used at a higher rate than methyl bromide.

U.S. 2006 nomination
The USG is requesting an additional 66.915 metric tons of methyl bromide for 2006 over the MBTOC recommended amount of 394.843 metric tons for use in flour mills. This represents an amended request of 461.758 metric tons rather than the 505.982 metric tons of methyl bromide originally requested.

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4. ORCHARD REPLANT

Overview of MBTOC's prior Recommendation
The U.S. requested 827.994 metric tons of methyl bromide for use in orchard replant for 2006. The request was distributed as follows: 826.336 metric tons for orchard use and 1.658 metric tons for research purposes.

MBTOC recommended a reduced amount of 527.6 metric tons but appeared to agree that for certain conditions there are no feasible alternatives. Discussion with MBTOC members at the 16th MOP (Prague, November 2004) indicated that the basis for the recommended reduction was that MBTOC believes that alternatives are available for non-heavy (non-clay) soils. In addition during that discussion MBTOC members admitted that the amount of methyl bromide used in a given year could vary widely based on the health of the orchards and the economics of producing the crop.

U.S. Response to MBTOC's prior recommendations
USG technical experts remain skeptical that technically and economically feasible alternatives are available but observe that less methyl bromide is used in this sector. The U.S. does not agree with the technical basis of the MBTOC's rationale for the reduction, but will not contest it at this time. The U.S. reserves the right to re-visit this issue should we become aware of data demonstrating that there are no technically and economically feasible alternatives in the specific circumstances of the nomination.

U.S. 2006 nomination
The U.S., therefore, accepts the MBTOC recommendation of 527.6 metric tons.

5. ORNAMENTALS

Overview of the U.S. Nomination

The U.S. requested 162.817 metric tons of methyl bromide for use on ornamentals (cut flowers and foliage) for 2006. The request was distributed as follows: 158.797 metric tons for use on ornamentals and 4.060 metric tons for research purposes.

The U.S nomination is only for those areas where the alternatives are not suitable. In U.S. ornamental production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in ornamental production.
- Key target pests: the U.S. is only nominating a CUE where the key pest pressure is moderate to high.
- Regulatory constraints: e.g., in some areas of the United States 1,3-Dichloropropene use is limited due to township caps in California.
- Delay in planting and harvesting: e.g., the plant-back interval for telone+chloropicrin is two weeks longer than methyl bromide+chloropicrin. Delays in planting and harvesting result in users missing key market windows, and adversely affect revenues through lower prices. Cut flowers are often marketed for a certain time of year or holiday. Missing specific dates can result in very large revenue losses to the grower.

Overall, the ornamentals industry has hundreds of crop species and thousands of varieties. This diversity makes finding methyl bromide alternatives for each crop species complex, time consuming and costly (Schneider, 2003).

As part of the overall ornamentals industry, the cut flower, foliage, and bulb industry is very complex. For example, 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. For example, in ranunculus, residual tubers, bulbs, and seeds from the previous crop must be killed because they are reservoirs for nematodes and soil pathogens and considered to be weeds themselves as they are off-variety. Along with these issues, there are concerns about phytotoxicity and registration with alternative chemicals (Schneider, 2003; Elmore et al., 2003b). Recent experiences 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 that can be used in a given area (Trout, 2001). Buffer zones may also limit the adoption of alternatives.

Overview of the MBTOC's prior recommendation
MBTOC recommended for 2005 that 154.00 metric tons of methyl bromide be allowed for this use but was unable to assess this request for 2006, stating that more information was needed specific to the request and the circumstances of the nomination. Further, MBTOC stated that without additional information they would be unable to recommend above 84.00 metric tons of methyl bromide.

U.S. Response to MBTOC's prior recommendations

California
Although it is difficult to determine acreage information for cut flowers, production data for the major cut flower and bulb species grown is available (See Table 1) and estimates of the acreage have been made (See Table 2).

CALIFORNIA ORNAMENTALS - TABLE 1 PRODUCTION OF MAJOR SPECIES

SPECIES	# FLOWER BUNCHES IN 2003
Alstoemeria	892,789
Carnations	1,694,870
Delphinium	3,617,186
Gladiolus	Data not released
Gerbera	62,638,650
Iris	5,823,242
Lilium	6,247,027
Chrysanthemums	1,273,742
Pompons	6,350,127
Roses	7,360,729
Snapdragons	2,976,219

Source: *Prince & Prince, Inc. Survey*, 2003

CALIFORNIA ORNAMENTALS - TABLE 2 PARTIAL LISTING AND ESTIMATE OF CUT FLOWER AND FOLIAGE AREA PRODUCED IN CALIFORNIA IN 2002

CROP	AREA (USUALLY FIELD) - HA	AREA (USUALLY GREENHOUSE) M^2
Alstroemeria	8 (0.3%)	47,100 (3.2 %)
Antirrhinum (snapdragon)	126 (5%)	164,898 (11.3%)
Aster		57,598 (4%)
Calla lily	16 (0.6%)	
Carnation	30 (1.2%)	21,739 (1.5%)
Chrysanthemum	88 (3.3%)	281,023 (19 %)
Delphinium	22 (0.8%)	
Eucalyptus	54 (2%)	
Gerbera		214,413 (14.7%)
Gypsophila	55 (2%)	
Iris (Dutch)	18 (0.7%)	
Larkspur	6 (0.2%)	

Lilium	32 (1.2%)	205,959 (14.2%)
Limonium spp.	13 (0.5%)	
Lisianthus	13 (0.5%)	
Protea	190 (7.3%)	
Rose	41 (1.6% - all greenhouse)	123,557 (8.5%)
Stock (*Matthiola*)	26 (1%)	
Wax flower	317 (12%)	
Other	791 (30%)	59,177 (4%)
Greenhouse misc.	70 (2.7%)	278,700 (19%)
Field misc.	303 (11.6%)	
Cut greens misc.	389 (15%)	
Total	**2609**	**1,454,164 m^2 (145 ha)**

Florida
According to the 2002 Census of Agriculture, cut flowers and florist greens were grown on 3,402 ha (outdoors) and foliage plants were grown on 1,198 ha (outdoors). Approximately 2,511 additional ha of cut flowers, florist greens, and foliage plants were grown indoors (under glass) (2002 Census of Agriculture).

Caladiums are grown on 642 hectares. The remaining 776 hectares are for other species of cut flowers, foliage and bulb crops. Although it would be useful to have more accurate acreage information for each species this has been difficult to obtain for several reasons. 1) There are hundreds of species of cut flowers, foliage, and bulb crops grown, and often several species are grown in the same field in the same year. 2) The species grown are constantly changing and fluctuations may occur at any time. For example, several years ago sunflowers were not a major commercial crop in Florida and currently it is a major crop. 3) There are no records available that show which crops are grown at any one time. Due to the sheer number of species, and the constant fluctuation in the industry, the acreage of each species is unable to be determined. Table 3 shows a few of the major crops grown and the number of spikes or stems produced, although acreage information was not available. This information indicates that gladioli are another major crop grown in Florida, and would be expected to be grown on more acreage than some of the other crops.

The only three cut flower species identified by the Florida Agricultural Statistics Service are gladioli, lilies and snapdragon. These are assumed to have the highest acreage. These crops have also been identified by the applicant as using MB.

FLORIDA ORNAMENTALS - TABLE 3 CROP PRODUCTION FOR CERTAIN CUT FLOWER SPECIES[2]

	2001		**2002**		**2003**	
Crop	# of producers	Quantity sold (1000 spikes)[1]	# of producers	Quantity sold (1000 spikes)[1]	# of producers	Quantity sold (1000 spikes)
Gladioli	4	40,331	4	49,581	4	39,444
Snapdragons	5	6,806	4	4,415	4	4,757
Lilies	4	3,031	3	2,257	-	-
Other cut	-	-	9	-	10	-

flowers						

[1] Quantity of lilies sold 1000 stems.
[2] This table only includes data for growers with sales over $100,000.
Source: Foliage, Floriculture, and Cut Greens, 2003; Foliage, Floriculture, and Cut Greens, 2004

Using several data sources, a rough estimate of the number of acres of gladioli grown can be obtained. The quantity sold, shown in Table 3, was averaged and divided by an average yield, which was calculated using data from 1991 to 1998. This method resulted in approximately 638 ha of gladioli. This number does not take into account the variability in yield in an individual year or if yields have changed since 1998 (USDA, 1999).

FLORIDA ORNAMENTALS - TABLE 4 OTHER CUT FLOWER SPECIES GROWN IN FLORIDA

Crop	Crop Rotation Limitation
Delphinium	These species are often sensitive to the same insects and pests as the other cut flower, foliage and bulb species.
Larkspur	
Gerbera	
Lisianthus	
Sunflower	
Aster	
Chrysanthemum	

Technical and Economic Assessment of MBTOC/TEAP Report.
We have not been provided by MBTOC with information on their technical assessment of the performance of alternatives, or their economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of longer plant back intervals, and the economic feasibility if key market windows are missed.

U.S. 2006 nomination
The USG is reiterating its request for 162.817 metric tons of methyl bromide for use in this sector (cut flowers and foliage) which represents a request of 158.797 metric tons for direct use on ornamentals and 4.060 metric tons for research purposes.

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6. PEPPERS

Overview of the U.S. Nomination

The U.S. requested 1,498.53 metric tons of methyl bromide for use on pepper crops in the U.S. for 2006. This amount was requested for California (59.659 metric tons), Florida (1,006.074 metric tons), Georgia (242.761 metric tons), Michigan (9.482 metric tons), and a group of States in the southeastern part of the U.S. (77.711 metric tons).[10]

The U.S. nomination is only for those areas where the alternatives are not suitable. In U.S. pepper production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in pepper production.
- geographic distribution of key target pests[11]: i.e., some alternatives may be comparable to methyl bromide as long as key pests occur at low pressure, and in such cases the U.S. is only nominating a CUE for peppers where the key pest pressure is moderate to high. An example is areas of moderate to high nutsedge infestation in the Southeastern U.S.
- regulatory constraints: e.g., 1,3 D use is limited in Georgia and Florida due to the presence of karst geology and in California due to township caps.
- delay in planting and harvesting: e.g., the plant-back interval for 1,3 D + chloropicrin is two weeks longer than methyl bromide + chloropicrin, and in Michigan an additional delay would occur because soil temperature must be higher to fumigate with alternatives (this is a regulatory requirement). Delays in planting and harvesting result in users missing key market windows, and adversely affect revenues through lower prices. In addition, delay in planting and harvesting may preclude the planting and harvesting of an additional crop on the treated acreage, causing an additional economic loss.
- cold soil temperatures: some alternatives cannot be used effectively and are precluded from such uses by the label until the soil temperatures is above 40° F (approximately 5° C.)

Overview of MBTOC's prior Recommendation

MBTOC recommended 804.033 tons of methyl bromide for this use distributed as follows: 9.482 tons for Michigan; 172.629 tons for Georgia; 525.121 tons for Florida; 55.261 tons for the southeastern US; and 41.511 tons for California.

U.S. Response to MBTOC's prior recommendations

MBTOC does not appear to have accounted for the new information regarding the extent of nutsedge infestation affecting this crop. MBTOC suggests that alternatives are available in California, that growers are using more than 200kg/ha, and that alternatives are both technically

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[10] These states are: Alabama, Arkansas, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee, and Virginia. These States have similar climate and terrain and face similar pests.

[11] Key target pasts are those pests that cannot be controlled by available alternatives to methyl bromide.

and economically feasible in non-karst areas of the southeastern U.S. (including Georgia and Florida) so that 20% is deducted for that phasing of alternatives. We will address each of these issues separately.

a. MBTOC used their own numbers for nutgrass (nutsedge) rather than the numbers provided by the U.S.

   In 2003, Dr. Stanley Culpepper of the University of Georgia conducted a survey of land under cultivation with various crops to determine the proportion of land (by crop) that was infested with various levels of nutsedge. The values selected were those used in published literature and characterized as 'none' (no plants per square yard[12]), 'light' (fewer than five plants per square yard), 'moderate' (five to thirty plants per square yard), and 'severe' (more than thirty plants per square yard). This information was used to estimate nutsedge information for the entire southeastern region (including the State of Florida) because the entire region has similar climate, soils and rainfall. In the judgment of U.S. government experts, familiar with U.S. agriculture and with the southeastern growing regions in particular, nutsedge infestations are similar throughout the region[13]. For the previous year's estimates of nutsedge infestation (those used in the 2005 nomination), similar estimates were used throughout the southeastern growing region. These estimates were the fruit of a half dozen phone calls to growers with large tomato operations in one or more of the southeastern states. The estimates derived were applied to all crops in all of the southeastern states. The new data represented a significant improvement in accuracy over the previous estimates, in the judgment of U.S. experts familiar with the circumstances of the nomination. The USG is requesting restoration of the amount deducted for this factor.[14]

   Information used for the 2005 nomination was developed by asking some large tomato operations (growers with large tomato acreages in several states) to 'guestimate' the proportion of tomato-growing acreage impacted by 'none', 'light', 'moderate' and 'heavy' nutsedge infestations and to compare these across that various states in which the growers have operations. Information on the proportion of impacted tomato area was then used for other crops throughout the southeastern growing region.

   The effort to gather more refined and reliable estimates of the prevalence of this key pest was one of many improvements in estimating the amount of methyl bromide critically needed by U.S. agriculture, which was undertaken to provide MBTOC with the best information possible. Replacing U.S.-provided survey values with MBTOC-derived values with no explanation of how MBTOC is better able to make this judgment than are the U.S. officials familiar with actual conditions casts doubt on the integrity of the MBTOC deliberative process.

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[12] One square yard is approximately 9/10 of a square meter.

[13] Conversations with officials in the State of Florida regarding the extent of nutsedge infestation indicate that these officials believe that the infestation in Florida is more severe that in Georgia. They are currently investigating whether a survey of cultivated land in Florida for nutsedge infestation can be undertaken.

[14] The U.S. is unable to exactly determine how that various factors that MBTOC used were reflected in the final amounts. The U.S. technical experts had been promised a spreadsheet so that the amounts could be disaggregated but were not provided with one.

b. Alternatives are technically and economically feasible so a 20% reduction for phase-in of alternatives such as 1,3D/Pic or metam sodium was used: alternatives can be used in areas where 1,3-D use is not appropriate

MBTOC disagrees with the U.S. assessments of yield loss, which is the basis for the MBTOC recommendation of economic feasibility.

The U.S. assessments of yield loss were developed from technically appropriate studies relevant to the specific circumstances of the U.S. situation. Technically appropriate studies are those which:

- Included an untreated control for comparison purposes
- Included information on the (key) pests present in the treated area
- Give estimates of yield changes (differences)
- Include methyl bromide as a standard

The U.S. nomination was restricted to those situations where the presence and prevalence of pests ('key' pests) that could not be controlled by alternatives to methyl bromide was moderate to severe[15] and would result in yield loss.

The U.S. technical experts asked MBTOC to explain the basis for their decision[16] and were told that in some cases a meta analysis served as the basis, and in other cases the basis was 'experience'. The procedure MBTOC used, as we understand it, was not a meta analysis. A meta analysis includes a statistical analysis of the information, and compares only those studies which are similar enough from a statistical standpoint that they can be combined and analyzed as if they comprised one study. Further, the studies need to be identified, appraised and summarized according to an explicit and reproducible methodology that is designed to answer a specific research question. In this case, the appropriate research question would be the performance of alternatives to methyl bromide under the conditions of the U.S. nomination (i.e. with moderate to severe pressure from key pests). The studies used in the meta analysis are not listed and no indication is given of the criteria used to include or exclude a study from the analysis, which presents a serious problem in applying the results. Our understanding is that this analysis does include some studies conducted under circumstances that are not similar to the limited conditions included in the U.S. nomination, such as the presence of moderate to severe pest pressure.

The null hypothesis would be that alternatives work as well as methyl bromide in the conditions of the U.S. nomination. The U.S. nomination is specifically for the use of methyl bromide where key pests (pests not adequately controlled by alternatives to methyl bromide) are present at moderate to severe levels and/or soil, climate, terrain, or regulatory conditions are such that

[15] In the judgment of U.S. experts pressure was such that yield losses of the magnitude of those used in the economic assessment would be sustained.
[16] MBTOC asserted that alternatives were both technically and economically feasible for the pre-plant sectors of field grown peppers, strawberries, and tomatoes.

alternatives to methyl bromide either cannot be used or result in significant economic losses when used. These economic losses must be of sufficient magnitude that they render the alternative not economically feasible.

When asked for references, USG experts were directed to "the Porter paper in press". USG experts have examined a "Porter paper in press"[17] and find a number of concerns with respect to its application to the specific circumstances of the U.S. nomination. Although it is difficult to be certain how the MBTOC analysis was conducted and what it includes because it has not been reviewed and published and was not provided to the U.S. experts to evaluate[18], U.S. experts were able to make some educated guesses about the analysis[19].

A version of the paper was presented by Dr. Ian Porter at the Methyl Bromide Alternatives Organization meeting in San Diego, November 2003 and was the subject of some controversy and concern among a number of participants. Dr. Porter's paper included a number of papers, which U.S. experts believe are not appropriate for use in determining the usefulness of alternatives because the research was carried out under conditions of no pest pressure, and are therefore not relevant to the specific circumstances of our nomination[20]. If few or no pests are present, any alternative, or indeed not using any pesticide at all, will all work equally well. By including situations where there is no pest pressure one in effect adds (many) "100" to the equation[21] describing the differences in yield between crops grown using methyl bromide and those grown using an alternative. This has the effect of lowering the average difference between yields using methyl bromide and yields using an alternative. If a sufficient number of "100" are added, the result will be to (falsely) eliminate the yield differences between methyl bromide and the alternatives.

In other papers, pests were present but they were not the pests present in all of the U.S. circumstances. Taking the case of the southeastern US, for example, weeds, diseases, fungi, and nematodes all afflict the crops. Some of these pests can be controlled with alternatives, but some of the weeds, in particular nutsedges (nut grasses), nightshades, and some hard coated seeds, cannot. Situations without weeds will show small or no yield losses when alternatives are used

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[17] Porter,I., S. Mattner, R. Mann, R. Gounder, J. Banks, and P. Fraser. 1994. Strawberry Fruit Production and results from trials in Different Geographic Regions. A Presentation to the Methyl Bromide Alternatives Conference, Lisbon, September 1994.

[18] U.S. experts requested references from some of the authors of the studyso that the studies included could be evaluated against the circumstances of the U.S. nomination, but they have not been provided.

[19] Some of this material had been previously presented at the Methyl Bromide Alternatives Organization 2003 meeting (San Diego). At that time U.S. experts expressed their view that many if not most of the studies were not an appropriate application of the information.

[20] For example, some trials are used for residue tests. These tests are likely to be carried out in conditions of little or no pest pressure in order to have enough harvested fruit to to test for residue. The Porter paper does not indicate which of the studies used (but not cited) where for the purposes of examining pesticide residues.

[21] The actual procedure was to add in yields expressed as a percentage of (anticipated) yield using methyl bromide. How this yield was estimated is puzzling as many of the studies did not include a methyl bromide control. Because there was no indication of pest pressure in many instances, many of the entries indicated yields of approximately 100%, obviating the differences between methyl bromide and the alternatives.

while the true situation when (key) weeds are present is that there are relatively large yield losses. Including these factors again has the effect of adding "100" yield difference as many times as there are these papers.

If the issue in question was to average all papers, describing some "average" worldwide situation, the procedure would be correct. However, The U.S. submitted requests for continued methyl bromide use only in instances of sufficiently high pest pressure (not 'average' conditions) for pests which cannot be controlled by alternatives to methyl bromide.

In the case of crops other than strawberries, the basis for MBTOC's suggestion of no differences in yields between methyl bromide treatments and treatments with the alternatives is more difficult to assess. MBTOC indicated to us in recent meetings at MOP-16 that their expert judgment was the basis for the finding that alternatives were technically and economically feasible. It is impossible to determine from this statement whether the conditions used by the experts to make their findings are similar to the particular conditions of the U.S. nomination. Given what we already know about the applicability of the meta analysis for strawberries to the U.S. circumstances, we are concerned that MBTOC may not be limiting their evaluation to experience accrued in situations similar to those prevailing in the portions of the U.S. for which methyl bromide is requested, but rather relying on more generalized experience to make these judgments for which references have been provided. The U.S. disagrees with the MBTOC assessment of yield loss in the circumstances of the U.S. nomination.

Turning now to the component of economic loss that is a consequence of market timing we find that MBTOC has not accounted for losses arising from missing market windows, and other losses due to timing, such as shorter harvesting periods and loss of the opportunity to plant a 'follow-on' or second crop.

Experts are familiar with high prices for fresh produce early in the season, prices which decline as the produce becomes abundant (and more familiar) later in the season. The U.S. has provided marketing data documenting the existence of these market windows and their effects on the revenue and profits earned by farmers. Anecdotally, farmers tell us that virtually al of their net revenue (approximately 90%) above cost is earned during the short period of high prices. For some crops, 75% of the economic loss is due to missing a market window rather than through smaller crops, lower fruit quality, or higher costs of using alternatives

Many of the alternatives will cause farmers to miss the market window. In conditions of cold soil temperatures, such as in Michigan and coastal California, where the growing season is short, alternatives cannot be used until the soil temperatures reach at least 40 F. This temperature is reached 3-4 weeks into the growing season, delaying planting and consequently harvesting for that time. Because the Michigan growing season is already short due to the cold temperatures, even apart from missing the market window, delaying planting will result in a smaller harvestable amount. In other situations the "plant-back" interval is longer, by two weeks, relative to the methyl bromide plant back times. Requiring a longer interval before a crop can be planted will delay the harvesting, again causing a farmer to miss a market window. Some alternatives also require a different bed preparation, which will also delay the planting time. The strawberry crop in California is one example of this situation.

It is not clear that MBTOC considered the specific circumstances of the U.S. nomination, which are that methyl bromide is requested only for situations where regulatory concerns preclude use of an alternative or where there are 'key' pests present at moderate to severe levels, or where terrain conditions (temperature, topography) result in no alternative being technically and economically feasible. MBTOC has not referenced research findings to support their view that alternatives are both technically and economically feasible, while the U.S. has presented extensive results in the circumstances of the nomination to support our request.

Georgia

Peppers are generally produced using mechanized practices that involve injection of methyl bromide to a depth of 20 – 25 cm. Weeds, especially nutsedge, are the most serious concern precipitating MB use in both transplant beds and the field although nightshade and hard coated seeds are also problems. Nutsedge species grow even under adverse conditions, resist traditional and modern methods of weed control, and are endemic to large tracts of pepper producing area in the Southeastern United States. Herbicides are applied to the row middles between raised production beds to manage grass and broadleaf weeds. Most preemergence herbicides do not provide effective control of nutsedge for one crop cycle let alone multiple crop cycles. Many of the newer sulfonyl urea herbicides are not as effective preemergence as is necessary to be effective under the plastic tarps as postemergence (60 to 70 percent for one crop cycle versus 90% postemergence). In addition to weeds, soil-borne fungal pathogens (such as *Phytophthora* blight) and plant-parasitic nematodes (e.g. *Meloidogyne* spp.) are endemic to the region and nearly all production areas have severe infestations, thereby necessitating annual treatment with a broad-spectrum soil fumigant. Fungal pests are expected to become serious problems for pepper production if MB were not available for pre-plant fumigation. Methyl bromide is believed to be the only treatment currently available that consistently provides reliable control of nutsedge species and the disease complex affecting pepper production. (Locascio et al., 1997).

Alternatives like 1,3-dichloropropene and metam sodium require a 21 to 28-day interval before planting, compared to 14 days for MB or methyl bromide with Pic. This interval can cause delays/adjustments in production schedules that could lead to missing specific market windows, thus reducing profits on pepper crops (Kelley, 2003

Nutsedge management has proven to be difficult due to the perennial growth habit of nutsedge and tubers as primary means of propagation. There are no herbicides which control nutsedge in the crop row. Paraquat and glyphosate will suppress emerged nutsedge, but cannot be used in the crop row because of potential crop injury (SE Pepper Consortium CUE 02-0041.) S-metolachlor can suppress yellow nutsedge for a single crop cycle but would need to be reapplied for multiple crops along with removing and replacing the existing plastic tarps. Approximately 81% of the Georgia pepper area is considered to have moderate to severe infestations of nutsedge (Culpepper, 2004). Research suggests that metam sodium can, in some situations, provide effective pest management for certain diseases and weeds. However, even though there have been nearly 50 years experience with metam sodium, (which breaks down to methyl isothiocyanate) nutsedge control results have been unpredictable.

Locascio et al. (1997) studied MB alternatives on tomatoes grown in small plots at two Florida locations with high nutsedge infestation. (The data from this tomato study are being cited because comparable pepper data are not available.)

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. The treatments at both locations included MB (67%) + chloropicrin (33%) chisel-injected at 390 kg/ha; metam-sodium (chisel-injected) at 300L/ha; metam-sodium drip-irrigated at 300L/ha; and 1,3-D + 17% chloropicrin chisel-injected at 327L/ha. 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. The yield of the 1,3-D treatment at Gainesville was 71% of the MB standard suggesting a 29% loss by not using MB (yield data for 1,3-D were not reported for Bradenton). In considering 1,3 D results, one must keep in mind that this MB alternative cannot be used in areas where karst geology exists

Further, due to regulatory restrictions resulting from groundwater contamination concerns, 1,3-D + chloropicrin cannot be used in large portions of the southeastern United States due to the presence of karst geology.

Furthermore, trials of metam-sodium and 1,3 D + chloropicrin (and various combinations thereof) are based on small plot research trials conducted in the Southeastern United States on crops other than peppers. For fungi and nutsedge, no on-farm, large-scale trials have yet been done. Some researchers have also reported that these MB alternatives degrade more rapidly in areas where they are applied repeatedly due to enhanced metabolism by soil microbes (Dungan and Yates 2003, Gamliel et al. 2003). This may compromise long-term efficacy of these compounds and appears to need further scientific scrutiny.

For the Southeastern United States, including Florida and Georgia, metam-sodium and 1,3 D + chloropicrin are alternatives for nutsedges and nematodes, respectively, the key target pests in these regions. However, peppers treated with metam-sodium, the best available alternative, have an estimated 44 percent yield decrease compared to MB. 1,3 D + chloropicrin is infeasible because it cannot used on karst geology or in Dade county, Florida, and because there is a 28-day planting delay.

There is also evidence that the efficacy of 1,3-D and metam-sodium declines in areas where it is repeatedly applied due to enhanced degradation of methyl isothiocyanate, the active ingredient, by soil microbes (Ashley et al. 1963, Ou et al. 1995, Verhagen et al. 1996, Gamliel et al. 2003).

In sum, neither of these MB alternatives is presently technically and economically feasible for control of key pests, and MB remains a critical use for peppers in the Southeastern United States.

The U.S. assessment that the alternatives are not technically and economically feasible rests on two kinds of losses[22]: changes in yields which result in a lesser amount harvested and therefore lower revenues to farmers, and later yields which resulted in further reduced revenues to farmers (missed market windows, shorter harvest periods, the inability to grow a second crop). The proportion of loss attributable to each component differs from sector to sector, and within sectors, depending on the local circumstances of the nomination. As an example, for tomatoes in both Michigan and the southeastern United States, approximately 70% to 75% of the loss is attributable to missing the high value market time and 25% to 30% of the loss is attributable to lower yield.

There are currently few alternatives to methyl bromide for use in peppers. Furthermore, there are factors that limit existing alternatives' usability and efficacy from place to place. These include pest complex, climate, and regulatory restrictions. As described above, the two most promising alternatives to methyl bromide in Georgia for control of nutsedge in peppers (1,3-D + chloropicrin and metam-sodium) are considered not technically feasible. This derives from regulatory restrictions and the magnitude of expected yield losses when they are used. MBTOC does not appear to have taken into account planting delays resulting from use of alternative pesticide treatments. These delays cause growers to lose all or part of a market window. In the case of peppers (in particular) missing the early part of the winter growing season causes hugely disproportionate losses in grower net revenues.

Florida

Peppers are generally produced using mechanized practices that involve injection of methyl bromide to a depth of 20 – 25 cm. Weeds, especially nutsedge, are the most serious concern precipitating MB use in both transplant beds and the field, although nightshade and hard coated seeds are also problems. Nutsedge species grow even under adverse conditions, resist traditional and modern methods of weed control, and are endemic to large tracts of pepper producing area in the Southeastern United States. Herbicides are applied to the row middles between raised production beds to manage grass and broadleaf weeds - but there are no currently registered herbicides that control nutsedges near pepper plants. In addition to weeds, soil-borne fungal pathogens and plant-parasitic nematodes are endemic to the region and nearly all production areas have severe infestations, thereby necessitating annual treatment with a broad-spectrum soil fumigant.

[22] From a theoretical perspective there are additional losses that should be included: differences in costs between methyl bromide and the alternatives and changes in yield quality. Cost differences between methyl bromide and the alternatives can occur because the prices of the materials differ, amounts used differ, equipment needs differ, additional materials are needed, such as an additional herbicide, an additional application step, either of the alternative or of some ancillary material is required, or there are additional land preparation or other costs. In practice, cost differences between methyl bromide and alternatives are generally small and can usually be ignored.

Quality difference in the yield, such as smaller, scarred, less sweet, or other differences in fruit quality would also be factors in assessing economic loss. In practice quality differences have not been reported in the available literature and so losses from his source cannot be incorporated into the analysis.

There has been extensive research on alternatives for solanaceous crops, and methyl bromide minimizing practices have been incorporated into pepper production systems where possible. However, the effectiveness of chemical and non-chemical alternatives designed to fully replace methyl bromide must still be characterized as preliminary. These alternatives have not been shown to be stand-alone replacements for methyl bromide, and no combination has been shown to provide effective, economical pest control. Methyl bromide is believed to be the only treatment currently available that consistently provides reliable control of nutsedge species and the disease complex affecting pepper production. (Locascio et al., 1997) Nematodes, especially root knot nematodes (*Meloidogyne* spp.), and fungal diseases (such as *Phytophthora* blight) are also of concern. Fungal pests are expected to become serious problems for pepper production if MB were not available for pre-plant fumigation.

The sandy soils of Florida are a contributing factor to the erratic performance suppressing nematodes and plant pathogens of the metam sodium + chloropicrin combination, the most promising alternative to methyl bromide currently available for use in Dade County (because of label restrictions for 1,3-D)[23]. Methyl bromide has higher vapor pressure than metam sodium, therefore can penetrate and diffuse throughout the soil more effectively than metam sodium.

Several climatic factors appeared to contribute to increases in plant pathogens, e.g., Southern stem blight, caused by the soil-borne fungus (*Sclerotium rolfsii*) across the production area, even with methyl bromide. Variations in rainfall and soil and air temperatures may predispose developing plants to diseases caused by plant-pathogenic fungi. Furthermore, in the fall, temperature and rainfall patterns favor high levels of nematode infestation.

Alternatives like 1,3-dichloropropene and metam sodium require a 21 to 28-day interval before planting, compared to 14 days for MB. This interval can cause delays/adjustments in production schedules that could lead to missing specific market windows, thus reducing profits on pepper crops (Kelley, 2003).

Weeds, particularly nutsedge, are the major pests of Florida peppers that drive the need for methyl bromide. There are no registered herbicides compatible with pepper production. Although s-metolachlor (Dual Magnum) and napropamide (Devrinol) were cited as herbicides with some potential to control nutsedges, the efficacy of these herbicides in sub-tropical Florida is inconsistent (Noling, 2003). When nutsedge pressure is moderate to severe, 1,3-D + chloropicrin is not technically feasible because it needs to be coupled with an effective herbicide to provide control for the entire growing season (U.S. EPA, 2002). Frank et al (1992) reported that weeds in pepper for 40 to 60 days could reduce yields by 10 to 50 percent. Stall and Morales-Payan reported that tomato must be nutsedge-free for 2 to10 weeks to keep yield reductions below 5 percent. There are no herbicides which control nutsedge in the crop row. Paraquat and glyphosate will suppress_emerged nutsedge, but cannot be used in the crop row because of potential crop injury (SE Pepper Consortium CUE 02-0041).

Diseases caused by soil-borne plant pathogenic fungi, (e.g., *Phytophthora* spp., *Verticillium* spp., *Pythium* spp. and *Rhizoctonia solani*) commonly reside in many production areas, since many

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pepper production areas are old tomato production fields. Fungicides such as chlorothalonil, and azoxystrobin are considered to be only prophylactic, and may not offer sufficient pest management. Resistance of *Phytophthora* spp to metalaxyl and mefanoxem (Ridomil and Ridomil Gold, respectively) has been reported in tomato crop areas, and most recently pepper (Lamour and Hausbeck 2003).

Nematodes, such as the root knot nematode species of *Meloidogyne* were third, following weeds and fungal pathogens, in order of causing yield and economic losses in Florida peppers. Pre-plant control of nematodes is very important because root feeding and damage may predispose the plant tissues to fungal pathogens or bacterial wilt which can lead to significant yield loss. Fumigant alternatives such as metam-sodium (Vapam, K-pam) have proven inconsistent. (Noling, 2003; CUE #03-0017).

In addition, labeling of 1,3-dichloropropene products restricts its use in key pepper growing areas of the U.S. where karst topography exists due to ground-water contamination concerns. In areas where 1,3-dichloropropene use is allowed, set back restrictions and 28-day waiting periods between application and planting cause delays/adjustments in production schedules that could lead to missing specific market windows, thus reducing profits on pepper crops. For example, peppers produced during the winter fetch a higher price than peppers produced during warmer months, and many growers rely on this price premium to maintain profitability.

Nutsedge management has proven to be difficult due to the perennial growth habit of nutsedge and tubers as primary means of propagation. Research suggests that metam sodium can, in some situations, provide effective pest management for certain diseases and weeds. However, even though there have been nearly 50 years experience with metam sodium, (which breaks down to methyl isothiocyanate) nutsedge control results have been unpredictable.

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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. The treatments at both locations included MB (67%) + chloropicrin (33%) chisel-injected at 390 kg/ha; metam-sodium (chisel-injected) at 300L/ha; metam-sodium drip-irrigated at 300L/ha; and 1,3-D + 17% chloropicrin chisel-injected at 327L/ha. 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. The yield of the 1,3-D treatment at Gainesville was 71% of the MB standard suggesting a 29% loss by not using MB (yield data for 1,3-D were not reported for Bradenton). In considering1,3 D results, one must keep in mind that this MB alternative cannot be used in areas where karst geology exists which is approximately 40% of the Florida pepper production area, including all of Dade country, a major pepper growing area.

Further, due to regulatory restrictions resulting from groundwater contamination concerns, 1,3-D + chloropicrin cannot be used in large portions of the southeastern United States due to the presence of karst geology. By law 1,3-D cannot be used anywhere in Dade county, Florida, where the majority of that region's peppers are grown. There is also a 28 day planting delay (vs. 14 days for MB) due to regulatory restrictions for 1,3-D + chloropicrin. In Florida particularly, growers are on a tight production schedule where buyers must place pepper transplants in fields at a certain time of the. Thus, if growers have only metam sodium for preplant pest control, they will be forced to fumigate earlier in their season, which in turn will force the fumigation schedule into rainy periods, an untenable situation since rain causes this and all other available fumigants to lose efficacy dramatically (Aerts, 2004).

Furthermore, trials of metam-sodium and 1,3 D + chloropicrin (and various combinations thereof) are based on small plot research trials conducted in the Southeastern United States on crops other than peppers. For fungi and nutsedge, no on-farm, large-scale trials have yet been done. Some researchers have also reported that these MB alternatives degrade more rapidly in areas where they are applied repeatedly due to enhanced metabolism by soil microbes (Dungan and Yates 2003, Gamliel et al. 2003). This may compromise long-term efficacy of these compounds and appears to need further scientific scrutiny.

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lower revenues to farmers, and later yields which resulted in further reduced revenues to farmers (missed market windows, shorter harvest periods, the inability to grow a second crop). The proportion of loss attributable to each component differs from sector to sector, and within sectors, depending on the local circumstances of the nomination. As an example, for tomatoes in both Michigan and the southeastern United States, approximately 70% to 75% of the loss is attributable to missing the high value market time and 25% to 30% of the loss is attributable to lower yield

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Southeastern US

Peppers are generally produced using mechanized practices that involve injection of methyl bromide to a depth of 20 – 25 cm. Weeds, especially nutsedge, are the most serious concern precipitating MB use in both transplant beds and the field, although nightshade and hard coated seeds are also problems. Nutsedge species grow even under adverse conditions, resist traditional and modern methods of weed control, and are endemic to large tracts of pepper producing area in the Southeastern United States. Herbicides are applied to the row middles between raised production beds to manage grass and broadleaf weeds - but there are no currently registered herbicides that control nutsedges near pepper plants. In addition to weeds, soil-borne fungal pathogens and plant-parasitic nematodes are endemic to the region and nearly all production areas have severe infestations, thereby necessitating annual treatment with a broad-spectrum soil fumigant.

There has been extensive research on alternatives for solanaceous crops, and methyl bromide minimizing practices have been incorporated into pepper production systems where possible. However, the effectiveness of chemical and non-chemical alternatives designed to fully replace methyl bromide must still be characterized as preliminary. These alternatives have not been shown to be stand-alone replacements for methyl bromide, and no combination has been shown to provide effective, economical pest control. Methyl bromide is believed to be the only treatment currently available that consistently provides reliable control of nutsedge species and the disease complex affecting pepper production. (Locascio et al., 1997) Nematodes, especially root knot nematodes (*Meloidogyne* spp.), and fungal diseases (such as *Phytophthora* blight) are

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Quality difference in the yield, such as smaller, scarred, less sweet, or other differences in fruit quality would also be factors in assessing economic loss. In practice quality differences have not been reported in the available literature and so losses from his source cannot be incorporated into the analysis.

also of concern. Fungal pests are expected to become serious problems for pepper production if MB were not available for pre-plant fumigation.

Alternatives like 1,3-dichloropropene and metam sodium require a 21 to 28-day interval before planting, compared to 14 days for MB. This interval can cause delays/adjustments in production schedules that could lead to missing specific market windows, thus reducing profits on pepper crops (Kelley, 2003).

Nutsedge management has proven to be difficult due to the perennial growth habit of nutsedge and tubers as primary means of propagation. There are no herbicides which control nutsedge in the crop row. Paraquat and glyphosate will suppress emerged nutsedge, but cannot be used in the crop row because of potential crop injury (SE Pepper Consortium CUE 02-0041.) Research suggests that metam sodium can, in some situations, provide effective pest management for certain diseases and weeds. However, even though there have been nearly 50 years experience with metam sodium, (which breaks down to methyl isothiocyanate) nutsedge control results have been unpredictable.

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Further, due to regulatory restrictions resulting from groundwater contamination concerns, 1,3-D + chloropicrin cannot be used in large portions of the southeastern United States due to the presence of karst geology. There is also a 28 day planting delay (vs. 14 days for MB) due to regulatory restrictions for 1,3-D + chloropicrin. In many areas of the southeast growers are on a tight production schedule where buyers must place pepper transplants in fields at a certain time of the. Thus, if growers have only metam sodium for preplant pest control, they will be forced to fumigate earlier in their season, which in turn will force the fumigation schedule into rainy periods, an untenable situation since rain causes this and all other available fumigants to lose efficacy dramatically (Aerts, 2004).

Furthermore, trials of metam-sodium and 1,3 D + chloropicrin (and various combinations thereof) are based on small plot research trials conducted in the Southeastern United States on crops other than peppers. For fungi and nutsedge, no on-farm, large-scale trials have yet been done. Some researchers have also reported that these MB alternatives degrade more rapidly in areas where they are applied repeatedly due to enhanced metabolism by soil microbes (Dungan and Yates 2003, Gamliel et al. 2003). This may compromise long-term efficacy of these compounds and appears to need further scientific scrutiny.

For the Southeastern United States, including Florida and Georgia, metam-sodium and 1,3 D + chloropicrin are alternatives for nutsedges and nematodes, respectively, the key target pests in these regions. However, peppers treated with metam-sodium, the best available alternative, have an estimated 44 percent yield decrease compared to MB. 1,3 D + chloropicrin is infeasible because it cannot used on karst geology, and because there is a 28-day planting delay.

There is also evidence that the efficacy of 1,3-D and metam-sodium declines in areas where it is repeatedly applied due to enhanced degradation of methyl isothiocyanate, the active ingredient, by soil microbes (Ashley et al. 1963, Ou et al. 1995, Verhagen et al. 1996, Gamliel et al. 2003).

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peppers (1,3-D + chloropicrin and metam-sodium) are considered not technically feasible. This derives from regulatory restrictions and the magnitude of expected yield losses when they are used. MBTOC does not appear to have taken into account planting delays resulting from use of alternative pesticide treatments. These delays cause growers to lose all or part of a market window. In the case of peppers (in particular) missing the early part of the winter growing season causes hugely disproportionate losses in grower net revenues.

California

Urban encroachment and concomitant buffer zones, and local (township) caps restrict the use of the MB alternative 1,3 D (with or without chloropicrin). Essentially this prevents the use of this alternative on approximately 10 % of the pepper growing area in California, according to the applicant. The applicant is requesting MB only for this proportion of their total pepper acreage

Peppers are generally produced using mechanized practices that involve injection of methyl bromide to a depth of 20 – 25 cm. Weeds, especially nutsedge, are the most serious concern precipitating MB use in both transplant beds and the field, although nightshade and hard coated seeds are also problems Nutsedge species grow even under adverse conditions, resist traditional and modern methods of weed control, and are endemic to large tracts of pepper producing area in the Southeastern United States and coastal California. Herbicides are applied to the row middles between raised production beds to manage grass and broadleaf weeds - but there are no currently registered herbicides that control nutsedges near pepper plants. In addition to weeds, soil-borne fungal pathogens and plant-parasitic nematodes are endemic to the region and nearly all production areas have severe infestations, thereby necessitating annual treatment with a broad-spectrum soil fumigant.

There has been extensive research on alternatives for solanaceous crops, and methyl bromide minimizing practices have been incorporated into pepper production systems where possible. However, the effectiveness of chemical and non-chemical alternatives designed to fully replace methyl bromide must still be characterized as preliminary. These alternatives have not been shown to be stand-alone replacements for methyl bromide, and no combination has been shown to provide effective, economical pest control. Methyl bromide is believed to be the only treatment currently available that consistently provides reliable control of nutsedge species and the disease complex affecting pepper production. (Locascio et al., 1997 Nematodes, especially root knot nematodes (*Meloidogyne* spp.), and fungal diseases (such as *Phytophthora* blight) are also of concern. Fungal pests are expected to become serious problems for pepper production if MB were not available for pre-plant fumigation.

As far as EPA can ascertain, virtually none of the studies on key MB alternatives has focused on peppers in coastal California's growing conditions. One exception to this situation can be summarized first, although this study was ongoing at the time it was submitted to EPA. This study is a field trial, conducted in small plots in 2003 in Michigan by M.K. Hausbeck and B.D. Cortright of Michigan State University. The study focused on a number of vegetable crops, including bell peppers. As of July 31, 2003, results indicated that 1,3 D + 35 % chloropicrin treatments (shank-injected at 56.7 liters/ha) showed approximately 6 % plant loss (due to *P. capsici*) – less than the 7 % loss seen in the untreated control plots. Metam-sodium (drip-applied at 58.7 kg/ha) showed a 13 % loss. Methyl iodide with either 50 % or 33 % chloropicrin (shank-injected, at either 46.1 or 36.8 kg/ha, respectively) showed only 2 % plant loss. However, methyl iodide is not registered for this crop in the U.S. at present. It should also be noted that (1) since the trial had not yet ended, statistical analysis on these figures was not conducted, (2) plant loss figures are for all vegetable crops combined, and (3) these plots were being carefully monitored and managed with post-plant prophylactic foliar fungicides (e.g., chlorothalonil and myclobutanil) – an optimal management scheme that will require time to enable growers to adopt.

In studies with other vegetable crops, 1,3 D + chloropicrin has generally shown better control of fungi than metam-sodium formulations (though still not as good as control with MB). For example, in a study using a bell pepper/squash rotation in small plots - conducted in the much warmer conditions of Georgia and without *P. capsici* as a component of the pest complex - Webster et al. (2001) found significantly lower fungal populations with 1,3 D + 35 % chloropicrin (drip irrigated or chisel injected, 146 kg/ha of 1,3 D), as compared to the untreated control. However, MB (440 kg/ha, shank-injected) lowered fungal populations even more. Methyl iodide had no significant suppressive effect, as compared to the untreated control. In another study, conducted on tomatoes in Florida, Gilreath et al. (1994) found that metam-sodium treatments did not match MB in terms of plant vigor at the end of the season; *Fusarium* was one of several pests present.

Without methyl bromide, pepper producers in cool weather climates of Ventura and Santa Clara Counties would most likely use a mixture of 1,3-D and chloropicrin (Telone C-35) to manage the nematode and fungal pathogen populations prior to transplanting pepper. There is evidence from numerous small plot and large-scale trials to indicate that these MB alternatives, in combination, will control nematodes to the extent that MB does nematodes.(e.g. Eger 2000). However, EPA believes that there is no comparable set of research results to indicate that fungal pests, particularly *P. capsici*, will be controlled to a similar extent.

To wit, no large-plot studies have yet been performed to show commercial feasibility against fungal pests in coastal California peppers. Important regulatory constraints on 1,3 D and chloropicrin must also be kept in mind: township caps on the amounts used (which may affect the use rate and hence efficacy), mandatory 100 m buffers near inhabited structures – both of which will cause negative economic impacts that are likely to make the use of these MB alternatives infeasible for the near future. These planting restrictions may thus be important factors inhibiting widespread grower adoption of this MB alternative.

Currently unregistered alternatives, such as furfural and sodium azide, have shown good efficacy against the key pests involved. However, even if registration is pursued soon (and the EPA has no indications of any commercial venture planning to do so) these options will need more research on how to adapt them to commercial pepper production in California.

There are also no non-chemical alternatives that are currently viable for MB replacement for commercial pepper growers. In sum, while the potential exists for a combination of chemical and non-chemical alternatives to replace MB use in California pepper, this goal appears be at least a few years away.

USG does not agree that alternatives are available in California except where regulatory constraints (township caps dictating maximum use of 1.3-D) are binding. California peppers are similar to Michigan, in that the critical pest controlled by MB currently is *P. capsici*. The other important pest targeted by MB use in this region is the root knot nematode. California is requesting MB for less than 10 % of its pepper area, mainly along the coast. As in Michigan, climatological conditions in these coastal areas - primarily long periods of rainy, cloudy weather – exacerbate problems involving possible methyl bromide alternatives, particularly formulations of 1,3 D, which cannot be used when soils are very wet. Growers are also reporting lack of efficacy against both of these pests at the maximum label rates for this alternative. In addition, California has township caps that limit the amount of 1,3-D that can be used in a given area, as well as 100 meter buffer zones near inhabited structures. Urban encroachment is increasing dramatically in California coastal counties, making the buffer zone requirement more constraining. These factors are present in the 10% of California pepper area that need MB

Of the currently available MB alternatives, metam-sodium offers inconsistent control of nutsedges and nematodes, while 1,3-D + chloropicrin provides adequate control of nematodes (Locascio et al. 1997, Eger 2000, Noling et al. 2000). However, metam-sodium has yield losses of up to 44 % compared to MB where weed infestations are moderate to severe (Locascio et al. 1997). Metam-sodium also creates a planting delay as long as 21 days to avoid risk of phytotoxic injury to crops compared to a 14-day delay for MB.

Further, it is the opinion of some U.S. crop experts that metam sodium, in particular, is very inconsistent in its beneficial effects as a nematode control agent (Dr. S. Culpeper, University of Georgia, personal communication).

For California pests 1,3 D + chloropicrin is the only key alternative with efficacy comparable to MB. Regulatory restrictions due to human exposure concerns, combined with technical limitations, reduce its use. Key among these factors are a delay in planting as long as 30 days, due both to label restrictions and low soil temperatures, and mandatory 30 to 100 meter buffers for treated fields near inhabited structures.

MBTOC has suggested that shank-injected 1,3-D/Pic can be used in all areas that are not currently impacted by the township caps. In making this suggestion they are not accounting for both the technical and regulatory factors described above and the actual working of the township caps in California. The township cap is a maximum that can be applied *assuming that the method of application is deep shank injection.* For all other forms of injection an 'application factor' is applied. The purpose of this application factor is to reduce the amount of 1,3-D that can be applied to a given area, reducing exposure to the population to a level comparable to that experienced when deep shank injection is used.

Deep shank injection cannot be used to control pests in California pepper production. Unlike Florida, where the soils are sandy to a considerable depth, in California the soils are prepared for planting to a depth of 12- 18 inches[26]. The deep shank method injects 1,3-D below this level where the soil is not prepared and breaks into clumps. The soil must be re-tilled before planting

[26] This corresponds to 30-45 cm.

which risks introducing pathogens back into the planting zone. When shallow-shank injection is used, the higher application factors mean that a much smaller area can be injected.

Dr. Legard[27] of the California Strawberry Commission has estimated the impact on maximum acreage treated if 1,3-D is (shallow) shank-injected into the soil rather than drip-applied a s a liquid. Using Telone C35® at 39-50 gallons per treated acre, 138.8 to 178.0 acres per township could be treated. When Inline® is used at 25 gallons per acre[28] 473.7 acres per township can be treated. In other words, the use of drip-applied 1,3-D results in 2.5 to 3 times as many treated acres. Shank injection of 1,3-D will greatly reduce the acreage treated[29].

The U.S. assessment that the alternatives are not technically and economically feasible rests on two kinds of losses[30]: changes in yields which result in a lesser amount harvested and therefore lower revenues to farmers, and later yields which resulted in further reduced revenues to farmers (missed market windows, shorter harvest periods, the inability to grow a second crop). The proportion of loss attributable to each component differs from sector to sector, and within sectors, depending on the local circumstances of the nomination. As an example, for tomatoes in both Michigan and the southeastern United States, approximately 70% to 75% of the loss is attributable to missing the high value market time and 25% to 30% of the loss is attributable to lower yield

There are currently few alternatives to methyl bromide for use in peppers. Furthermore, there are factors that limit existing alternatives' usability and efficacy from place to place. These include pest complex, climate, and regulatory restrictions. MBTOC does not appear to have taken into account planting delays resulting from use of alternative pesticide treatments. These delays cause growers to lose all or part of a market window. In the case of peppers (in particular) missing the early part of the winter growing season causes hugely disproportionate losses in grower net revenues.

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[27] Daniel Legard, PhD, personal communication. January 9, 2005.

[28] The common use rate on strawberries in California

[29] The main concern associated with broadcast fumigation with telone C35 is related to the telone township cap. There are different emission ratios used for the different application methods that adjusts the amount of telone applied to the township cap. The lbs used are "adjusted" by the following factors (1x for deep shank, 1.1x for drip applied, 1.8x for shallow shank). Hopefully, most growers would use deep shank where possible for broadcast telone applications. However, broadcast applications still involve treating approximately 40% more acreage than drip (2 row bed and slightly lower for 3 and 4 row beds, which are becoming more popular in the North). The net result of both changes is to reduce the maximum treatable area to between 30-40% of the area that can be treated using drip applied 1,3-D.

[30] From a theoretical perspective there are additional losses that should be included: differences in costs between methyl bromide and the alternatives and changes in yield quality. Cost differences between methyl bromide and the alternatives can occur because the prices of the materials differ, amounts used differ, equipment needs differ, additional materials are needed, such as an additional herbicide, an additional application step, either of the alternative or of some ancillary material is required, or there are additional land preparation or other costs. In practice, cost differences between methyl bromide and alternatives are generally small and can usually be ignored.

Quality difference in the yield, such as smaller, scarred, less sweet, or other differences in fruit quality would also be factors in assessing economic loss. In practice quality differences have not been reported in the available literature and so losses from his source cannot be incorporated into the analysis.

c. rate reduction to 200kg/ha under treated strips

MBTOC has also reduced the amount recommended for peppers stating: "A further adjustment was applied to reduce the dosage to the guideline level of 200kg/ha under the strips." When this issue was discussed with MBTOC members during the 16th MOP, U.S. experts agreed to clarify whether the reported rates were in fact the rates used under the strips (as the U.S. believed) or whether they were the average for an acre as MBTOC believed[31]. The U. S. has verified that the application rates provided in the quantitative assessment (the Methyl Bromide Usage Numerical Index, or BUNI) are in fact the rates under the strips. The number of acres reported is the "treated acres". A strip application that results in two thirds of an acre being fumigated while one-third is untreated is reported as two thirds of an acre, not as an acre.

Technical and Economic Assessment of MBTOC/TEAP Report.
We have not been provided by MBTOC with information on their technical assessment of the performance of alternatives, ortheir economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of higher yield losses, longer plant back intervals, the economic feasibility if key market windows are missed, and the economic impact of a 20% transition to alternatives including estimates of management costs for more intensive programs and how the impact of less reliable alternatives is calculated. The sources of estimates of the extent of pest pressure should describe the rationale for using other estimates, a complete description of the questions, species being surveyed and quantitative levels used.

U.S. 2006 nomination
The USG is reiterating its request for an additional 691.683 metric tons of methyl bromide for use in field grown peppers for a total amount in this sector of 1,498.530 which includes a research amount of 2.844 metric tons.

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[31] If the rates were an average per acre, as MBTOC believed, given that in strip treatments approximately one-third of the acre is left untreated, the rates applied would, in some cases, exceed the MBTOC recommended dosage of 200kg/ha.

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7. SMOKEHOUSE HAMS

Overview of the U.S. Nomination

The U.S. has requested 135.742 metric tons of methyl bromide for use on uncooked (dry cured or 'country') hams for 2006. MBTOC was unable to make a recommendation for this sector.

Currently there are no viable alternatives to methyl bromide for the dried meat industry: phosphine does not control mites (a major pest affecting this sector) and heat would alter the product. In U.S. pork processing plants that produce dry-cured pork products there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- Pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to MB, making these alternatives technically and/or economically infeasible. Phosphine, alone or in combination with carbon dioxide does not control mites, a major pest on cured hams.
- Geographic distribution of the facilities: Facilities included in this nomination are located in the southern U.S. where mild temperatures and high relative humidity result in key pest pressures that are moderate to severe. These ambient conditions require that pests be killed because they will only reinfest the facility after fumigation.
- Age and type of facility: older food processing facilities, especially those constructed of wood, experience more frequent and severe pest infestations that must be controlled by fumigation. In the U.S. it is usual for dry-cured processed pork to be produced in traditional facilities. These facilities are usually constructed of wood and many are decades old, if not older. Many newer facilities are constructed using the older facilities as models.
- Constraints of the alternatives: some types of commodities (e.g., those containing high levels of fats and oils) prevent the use of heat as an alternative because of its effect on the final product (e.g., rancidity). All of the pork products are relatively high fat products so rancidity would be a problem. In addition, using heat will alter the character of the final product, producing, for example, a cooked pork product rather than a dry-cured pork product with the attendant flavor differences.
- Transition to newly available alternatives: Sulfuryl fluoride recently received a Federal registration for certain commodities and structures, such as cereal mills. At present, pork and pork products are not included among the legal uses of sulfuryl fluoride, so this chemical is not an option for these facilities.
- Delay in plant operations: e.g., the use of some alternatives can add a delay to production by requiring additional time to complete the fumigation process. Production delays can result in significant economic impacts to the processors.

It is common for producers of cured pork products to experience pest pressure from insects such as the ham skipper, the red legged ham beetle, dermestid beetles, and mites. These insects infest and feed on meat as it cures and ages. Environmental conditions (temperature and humidity) in and around the facility strongly influence the level of pest pressure. Under favorable ambient conditions, such as those seen in silo curing, pest pressure increases and a regular fumigation schedule is recommended. In the U.S., the Food and Drug Administration (FDA) regulates the maximum levels of live or dead insects or insect parts that may be present in stored food products. Food commodities that exceed maximum limits allowed are considered adulterated by FDA and thus unfit for human consumption. There are currently no alternatives registered for use on hams in the U.S. that would provide the same level of pest control.

The specific name and physical address of each facility was not requested in the forms filled out by the applicants in the United States. However, general location information for the following facilities is known:

- Kentucky (Cadiz, Greenville)
- Missouri (California)
- North Carolina (Boone, Goldsboro, Smithfield, Wayne County)
- Virginia (Surry)
- Tennessee (Various locations)
- South Carolina (Various locations).

In order to address this concern, USG has requested location information from the post-harvest sector participants. The forms have begun to come in from the applicants and are currently under review. When the analysis is complete it will be forwarded to MBTOC.

It has been difficult to determine the amount of methyl bromide used historically in this sector. Some data have been supplied by applicants[32]:

METHYL BROMIDE CONSUMPTION FOR THE PAST 5 YEARS AND THE AMOUNT REQUIRED IN THE YEAR(S) NOMINATED

	Historical Use						Requested Use	
For each year specify:	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2005**	**2006**
Amount of MB (kg)	1,159	1,309	1,291	972	1,659	1,528	170,350	170,350
Volume Treated 1000 m^3	50	53	52	41	48	43	7,087	7,087
Formulation of MB	Information not provided						Information not provided	
Dosage Rate (kg/1000 m^3)	31	30	32	29	38	35	25	25
Actual (A) or Estimate (E)	Information not provided						Information not provided	

There are currently no alternatives to methyl Bromide in Ham fumigation. Phosphine, alone and in combination with carbon dioxide, does not control mites, a major pest in cured pork products. Additionally, according to the phosphine label, the state of North Carolina has further restricted the use of this alternative. According to state regulations, phosphine may only be used to control rats and mice, but not insects.

[32] Data for only one company. Given the small share of the market for dry-cured pork products represented by the reporting company, these data cannot be taken as representative.

In the U.S., the Food and Drug Administration (FDA) regulates the maximum levels of live or dead insects or insect parts that may be present in stored food products. Food commodities that exceed maximum limits allowed are considered adulterated by FDA and thus unfit for human consumption and cannot be sold. The law is part of the Federal Food, Drug, and Cosmetic Act and available on the World Wide Web at: http://www.cfsan.fda.gov/~dms/dalbook.html). Another source for the Food, Drug, and Cosmetics Act can be found at: http://www.fda.gov/opacom/laws/fdcact/fdcact4.htm

Meat Inspections are through the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA). Under authority of the Federal Meat, Poultry and Egg Products Inspection Acts, FSIS inspects and monitors all meat, poultry and egg products sold in interstate and foreign commerce to ensure compliance with mandatory U.S. food safety standards and inspection legislation.
http://www.fsis.usda.gov/regulations_&_policies/federal_inspection_programs/index.asp

Establishments have the option to apply for Federal or State inspection. Under the agreement, a State's program must enforce requirements "at least equal to" those imposed under the Federal Meat and Poultry Products Inspection Acts. However, product produced under State inspection is limited to intrastate commerce. FSIS provides up to 50% of the State's operating funds, as well as training and other assistance.
http://www.fsis.usda.gov/regulations_&_policies/state_inspection_programs/index.asp

Technical and Economic Assessment of MBTOC/TEAP Report
We have not been provided by MBTOC with information on their technical assessment of the performance of alternatives, or their economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of higher yield losses, longer plant back intervals, the economic feasibility if key market windows are missed, and the economic impact of a 20% transition to alternatives including estimates of management costs for more intensive programs and how the impact of less reliable alternatives is calculated. The sources of estimates of the extent of pest pressure should describe the rationale for using other estimates, a description of the questions, species being surveyed and quantitative levels used.

U.S. 2006 nomination
In responding to MBTOC concerns USG has developed some information suggesting that less methyl bromide is needed in this sector than previously thought. Accordingly, USG is submitting an amended request for this sector of 40.854 metric tons of methyl bromide, a reduction to less than 1/3 of the previously requested amount.

Citations

Bell, C.H. 2000. Fumigation in the 21st Century. Crop Protection, 19:563-69.

8. FIELD GROWN STRAWBERRIES

Overview of the U.S. Nomination

The U.S. is requesting 1,918.4 metric tons of methyl bromide for use on field grown strawberries in California (1,452.732 metric tons), Florida (310.997 metric tons), and the southeastern U.S. (152.294 metric tons).

The U.S. nomination is only for those areas where the alternatives are not suitable. In U.S. strawberry fruit production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in strawberry fruit production.
- geographic distribution of key target pests: i.e., some alternatives may be comparable to methyl bromide as long as key pests occur at low pressure, and in such cases the U.S. is only nominating a CUE for strawberry fruit where the key pest pressure is moderate to high such as nutsedge in the Southeastern US.
- regulatory constraints: e.g., telone use is limited in California due to townships caps and in Florida due to the presence of karst geology.
- delay in planting and harvesting: e.g., the plant-back interval for telone+chloropicrin is two weeks longer than methyl bromide+chloropicrin. Delays in planting and harvesting result in users missing key market windows, and adversely affect revenues through lower prices.
- unsuitable topography: e.g., alternatives that must be applied with drip irrigation may not be suitable in areas with rolling or sloped topography due to uneven distribution of the fumigant.

Overview of MBTOC's prior recommendations

MBTOC recommended that 1,520.803 metric tons of methyl bromide be allocated to this use as follows: Florida, 224.142 metric tons, the southeastern U.S. 134.476 metric tons, and California 1162.186 metric tons.

MBTOC reasons that the amount calculated by the USG was predicated on a 1X township cap but that the 'Ornamental' portion of the U.S. nomination indicates that a greater availability of 1,3-D is expected for 2006. MBTOC further argues that there are available substitutes for methyl bromide and cites "Porter, in press", to justify a 20% reduction in the nominated amount. MBTOC states that Pic EC® or metam and pic are 'technically suitable' for Florida and the southeastern US. MBTOC also states that reduced dosage is appropriate because the treated portion of the beds can be held to 200kg/ha and because dosages can be reduced when higher density films (including VIF) are used, citing Fennimore et al 2005 and Gilreath et al 2003.

U.S. Response to MBTOC's prior recommendations
The U.S. nomination for strawberry field grown strawberry fruit is a critical need for an amount of methyl bromide in areas with moderate to severe pest pressure, because currently there are no feasible alternatives and farmers would face severe economic hardships in the absence of methyl bromide. Where there is moderate to severe pest pressure, the suggested alternatives for strawberry fruit production fail to provide the necessary degree of pest control or their use is not easily adoptable due to state-imposed restrictions. The nomination also notes that applying alternatives is further complicated when plant-back restrictions prevent farmers from meeting marketing windows (e.g., winter or early spring) when strawberry sale prices are as much as 100% higher than during the rest of the year (see Market Window Information). The nomination notes significant progress in adopting emission reduction technologies and changing formulations and application rates to reduce methyl bromide dosage rates to some of the lowest in the world, and that further trials are being conducted to evaluate new alternatives, and to test ways of overcoming constraints in further lowering methyl bromide formulations and adopting even more impermeable barriers.

Despite use of many alternatives, many of which have already been incorporated into standard strawberry production systems, methyl bromide is believed to be the only currently available treatment that consistently provides reliable control of nutsedge species, nematodes and the disease complex affecting strawberry production. Only acreage with moderate to high pest pressure is included in this nomination.

a. Township caps

MBTOC indicates their understanding that the nomination was based on 1X township caps. In fact, a weighted average of expected probability of 1X and 2X cap was used in developing the U.S. request, so the MBTOC assumption on this issue is incorrect[33]. MBTOC reasons that the availability of 1,3,-D for strawberry production will be greater than the 1X township cap but this is by no means certain (see footnote below). MBTOC cites the 'Ornamentals' section of the nomination to bolster their assertion. The 'Ornamentals' section was in error, and the USG thanks MBTOC for noting this discrepancy (which has now been corrected).

b. Alternatives are technically and economically feasible so a 20% reduction for phase-in of alternatives such as 1,3-D/Pic or metam sodium was used: alternatives can be used in areas where 1,3-D is not appropriate

MBTOC appears to disagree with the U.S. assessments of yield loss.

[33] In practice, the weights applied were 1/3 of the 2X cap and 2/3 of the 1X cap. In the current judgment of USG experts this places too much likelihood on an increased township cap. In repeated conversations with State of California pesticide regulators, USG has been given no indication that the township caps would be raised beyond the temporary increase in the cap except as negotiated in individual agreements. In order to be eligible for an increased cap amount under these agreements, a township must have an unused (banked) amount available to increase the cap. As the program currently stands, only townships with banked amounts can increase their use of 1,3-D above the 1X cap. As townships exceed the 1X cap they lose their ability to increase the caps by depleting their 'banked' amount.

The U.S. assessments of yield loss were developed from technically appropriate studies relevant to the specific circumstances of the U.S. situation. Technically appropriate studies are those which:

- Included an untreated control for comparison purposes
- Included information on the (key) pests present in the treated area
- Give estimates of yield changes (differences)
- Include methyl bromide as a standard

The U.S. nomination was restricted to those situations where 'key' pest pressure was moderate to severe[34] and where these pests could not be controlled by alternatives and, therefore, would result in yield loss.

MBTOC used what they describe, interchangeably as a "meta analysis" or an 'average'. The procedure MBTOC used was not a meta analysis in the sense thata meta analysis includes only studies which are similar enough from a statistical standpoint that they can be combined and analyzed as if they comprised one study, and the studies need to be identified, appraised and summarized according to an explicit and reproducible methodology that is designed to answer a specific research question. In this case, the appropriate research question would be the performance of alternatives to methyl bromide under the conditions of the U.S. nomination (i.e. with moderate to severe pressure from key pests). The null hypothesis would be that alternatives work as well as methyl bromide in the circumstances of the U.S. nomination. The U.S. nomination is specifically for the use of methyl bromide where key pests (pests not adequately controlled by alternatives to methyl bromide) are present at moderate to severe levels and/or soil, climate, terrain, or regulatory conditions are such that alternatives to methyl bromide either cannot be used or result in significant economic losses when used. These economic losses must be of sufficient magnitude that they render the alternative "not economically feasible".

Although it is difficult to be certain how the MBTOC analysis was conducted and what it includes because it has not been reviewed and published and was not provided to the U.S. experts to evaluate[35], U.S. experts were able to make some educated guesses about the analysis[36]. The analysis for strawberry fruit is described in a paper is listed as being "in press" as conference proceedings with a date after the MBTOC recommendations on the U.S. nomination were tendered.

A version of the paper was presented by Dr. Ian Porter at the Methyl Bromide Alternatives Organization meeting in San Diego, November 2003 and the subject of considerable controversy

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[34] In the judgment of U.S. experts pressure was such that yield losses of the magnitude of those used in the economic assessment would be sustained.

[35] The U.S. requested two of the authors of the paper for references so that the studies included could be evaluated against the circumstances of the U.S. nomination, but to date the references have not been provided.

[36] Some of this material with references had been previously presented at the Methyl Bromide Alternatives Organization 2003 meeting (San Diego). At that time U.S. experts expressed their view that many if not most of the studies were not an appropriate application of the information.

and questioning among participants. Dr. Porter's paper included a number of papers which U.S. experts believe are not representative of the specific conditions included in the U.S. nomination in determining the usefulness of alternatives because the research was carried out under conditions of no pest pressure[37]. If no pests are present any alternative, or indeed not using any pesticide at all, will all work equally well. By including situations where there is no pest pressure one in effect adds (many) "0" to the equation[38] describing the differences in yield between crops grown using methyl bromide and those grown using an alternative. This has the effect of lowering the average difference between yields using methyl bromide and yields using an alternative. If a sufficient number of "0" are added, the result will be to (falsely) eliminate the yield differences between methyl bromide and the alternative treatments.

In other studies, pests were present but they were not the same pests that were present in all of the U.S. circumstances. Taking the case of the southeastern U.S., for example, weeds, diseases, fungi, and nematodes all infest the crops. Some of these pests can be controlled with alternatives, but some of the weeds, in particular nutsedges (nut grasses), nightshades, and some hard seed coated weeds, cannot. Situations without weeds will show small or no yield losses when alternatives are used while the true situation when (key) weeds are present is that there are large yield losses[39]. Including these factors has the effect of adding "0" yield difference as many times as there are papers.

If the issue had been to average all results, describing an "average" worldwide situation, the procedure would be correct. However, The U.S. submitted requests for continued methyl bromide use only for situations with sufficiently high pest pressure (not average), which cannot be controlled by alternatives to methyl bromide.

The U.S. disagrees with the MBTOC assessment of yield loss in the specific circumstances of the U.S. nomination.

Market Windows

As to the component of economic loss that is a consequence of market timing, we believe that MBTOC has not accounted for losses arising from market windows.

Experts are familiar with the occurrence of high prices for fresh produce early in the season, prices which decline as the produce becomes abundant (and more familiar) later in the season.

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[37] For example, some trials are used for residue tests. These tests are likely to be carried out in conditions of little or no pest pressure in order to have enough harvested fruit to to test for residue. The Porter paper does not indicate which of the studies that were used (but not cited) were for the purposes of examining pesticide residues.

[38] The actual procedure was to add in yields expressed as a percentage of (anticipated) yield using methyl bromide. How this yield was estimated is puzzling as many of the studies did not include a methyl bromide control. Because there was no indication of pest pressure in many instances, many of the entries indicated yields of approximately 100%, obviating the differences between methyl bromide and the alternatives.

[39] So, for example, studies conducted in California, where there is less pressure for weeds will not give an accurate picture of the situation in the southeastern U.S. where nutsedge, nightshades, and hard seed-coated weeds are a major problem.

The U.S. has provided marketing data documenting the existence of these market windows and their effects on the revenue and profits earned by farmers. Farmers tell us that nearly all of their net revenue (approximately 90%) above cost is earned during the short period of high prices. For some crops, 75% of the economic loss is due to missing a market window rather than through smaller crops, lower fruit quality, or higher costs.

Many of the alternatives will cause farmers to miss the market window. For some alternatives, for example, the "plant-back" interval is 2-4 weeks longer, relative to methyl bromide plant back times. Requiring a longer interval before a crop can be planted will delay the harvesting, causing a farmer to miss a market window. Some alternatives also require a different bed preparation, which will also delay the planting time. The strawberry crop in California is one example of this situation.

> The main issue for drip applied fumigants is that the entire field and irrigation equipment must be set up before you can apply the fumigants. Growers here have told me that this requires at least an additional 2-3 weeks longer than with broadcast fumigation. The extension of this time is not a serious problem on fields with short day cultivars like Camarosa, however, it is an important problem on fields with day-neutral cultivars like Diamonte (a majority of the acreage in the Watsonville / Salinas area).
>
> On ranches crowing predominantly day-neutral (long day) cultivars the production season overlaps with the next crops planting season, so fields of day-neutral cultivars are typically rotated with vegetable crops (i.e. half the ranch is planted in strawberry and the other half is rotated out each year). The normal cycle is strawberry (September 04 – November 05) followed by two vegetable crops (November 05 – September 06) then back to strawberry (September 06 – November 07). The value of the October / November fruit harvests from the day-neutral cultivars is so high that growers cannot shorten the length of their season (not economically possible since this is when most ranches break even and make their profit). The need for an additional 2-3 weeks to prepare a field for drip fumigation forces strawberry growers to take back the land from the rotation vegetable growers 2-3 weeks earlier. Normally, vegetable growers can produce two crops between the strawberry rotations. However, the shortening of the season by 2-3 weeks would cause result in only one vegetable crop on 80% of the land instead of two. Land sublease rates to vegetable growers are approximately $1000 for one crop and $1800 for two (the land leases for $2200 for full year). Therefore, strawberry growers would need to absorb the $800 increase in rent on 80% of their crop acreage due to the loss of one of the two vegetable crops.
>
> A second issue with the transition to drip applied fumigants is the need to setup the entire irrigation system before they fumigate. In the traditional production system (i.e. broadcast fumigation), growers migrate most of their irrigation headers and other main line pipes over from the previous season's crop to the new after the end of that season (in November/December/January). However, with drip applied fumigants growers will need two sets of this equipment, an increased cost that is difficult for many growers to absorb. It is difficult to get firm prices on this but I have an estimate of $500 / acre for the additional equipment. Another related issue is that growers cannot use drip applied fumigants on land that has not had strawberries on it before due to a similar issue. The main valves and pipes for the irrigation system need to be setup for strawberry, and this can't be done while another crop is in the ground, and there is insufficient time put this equipment in and setup for drip applied

fumigation. Growers in this situation will have to use broadcast fumigation for the first year on new non-strawberry ground.[40]

Losses result not only from missing market windows but also from the inability to plant other crops in rotation with strawberries, losing the revenue from these crops

USG experts have examined a "Porter paper in press"[41] and have a number of concerns with the applying the results of this paper in the context of the specific circumstances of the U.S. nomination. Although it has a 'publication date" of one year later than the San Diego presentation, we find that our concerns on this issue remain the same. The studies used in the meta analysis are not listed and no indication is given of the criteria used to include or exclude a study from the analysis.

A specific requirement of the Montreal Protocol findings is that they be made "in the circumstances of the nomination". There is no indication that MBTOC considered the specific circumstances of the U.S. nomination (which are that methyl bromide is requested only for situations where regulatory concerns preclude use of an alternative or where there are 'key' pests present at moderate to severe levels, or where terrain conditions (temperature, topography) result in no alternative being technically and economically feasible). MBTOC has not cited research findings to support their contention that alternatives are both technically and economically feasible. The U.S. has relied upon and presented specific results in the circumstances of the nomination to support our request.

California

At moderate to severe pest pressure only MB can effectively control the target pests found in California. Uses of alternatives are limited by regulatory restrictions such as the township caps on the amount of 1,3-D 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 202 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without compromising pest management.

Florida

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 geography). Finally, there are other areas where regulatory restrictions such as mandatory buffers around inhabited structures make alternatives infeasible. 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 202 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without

[40] Daniel Legard, PhD, personal communication, January 3, 2005.
[41] Porter,I., S. Mattner, R. Mann, R. Gounder, J. Banks, and P. Fraser. 1994. Strawberry Fruit Production and results from trials in Different Geographic Regions. A Presentation to the Methyl Bromide Alternatives Conference, Lisbon, September 1994.

compromising pest management.

Southeastern U.S.

At moderate to severe pest pressure only MB can effectively control the target pests found in the southeastern U.S. In addition, the use of alternatives are limited in some areas because the soil overlays a vulnerable water table (karst geography). Finally, there are other areas where regulatory restrictions such as mandatory buffers around inhabited structures make alternatives infeasible. 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 202 kg/ha are below the threshold in the MBTOC 2002 Report, making further reduction difficult to achieve without compromising pest management.

A requirement for obtaining a critical use exemption for methyl bromide under the Montreal Protocol is that there are no alternatives that are both technically and economically feasible. In making its assessment, MBTOC has ignored the issue of economic feasibility. Presented below are economic considerations for each of the regions applying for a critical use exemption.

TABLE 1: COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER 3-YEAR PERIOD

ALTERNATIVE	YIELD*	COST IN YEAR 1 *(US$/ha)*	COST IN YEAR 2 *(US$/ha)*	COST IN YEAR 3 *(US$/ha)*
Methyl Bromide	100	1,248	1,248	1,248
Chloropicrin+ metam sodium	73	964	964	964
1,3-d chloropicrin	86	1,416	1,416	1,416
Metam Sodium	70	849	849	849

** As percentage of typical or 3-year average yield, compared to methyl bromide.*

TABLE 2: YEAR 1 GROSS AND NET REVENUE

Year 1		
ALTERNATIVES *(as shown in question 21)*	GROSS REVENUE FOR LAST REPORTED YEAR *(US$/ha)*	NET REVENUE FOR LAST REPORTED YEAR *(US$/ha)*
Methyl Bromide	$29,818	$5484
Chloropicrin+ metam sodium	$20,679	$-1,716
1,3-d chloropicrin	$24,362	$702
Metam Sodium	$19,829	$-2,396

TABLE 3: YEAR 2 GROSS AND NET REVENUE

Year 2		
ALTERNATIVES *(as shown in question 21)*	GROSS REVENUE FOR LAST REPORTED YEAR *(US$/ha)*	NET REVENUE FOR LAST REPORTED YEAR *(US$/ha)*
Methyl Bromide	$29,818	$5484
Chloropicrin+ metam sodium	$20,679	$-1,716
1,3-d chloropicrin	$24,362	$702
Metam Sodium	$19,829	$-2,396

TABLE 4: YEAR 3 GROSS AND NET REVENUE

Year 3		
Alternatives *(as shown in question 21)*	**Gross revenue for last reported year** *(US$/ha)*	**Net Revenue for last reported year** *(US$/ha)*
Methyl Bromide	$29,818	$5484
Chloropicrin+ metam sodium	$20,679	$-1,716
1,3-d chloropicrin	$24,362	$702
Metam Sodium	$19,829	$-2,396

CALIFORNIA - TABLE 5: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

CALIFORNIA	METHYL BROMIDE	ALTERNATIVE PIC+MS	ALTERNATIVE 1,3-D+PIC	ALTERNATIVE MS
YIELD LOSS (%)	0	27%	14%	30%
YIELD PER HECTARE (FRESH)	48,438	35,359	41,639	33,906
* PRICE PER UNIT (US$)	$1.71	$1.62	$1.62	$1.62
= GROSS REVENUE PER HECTARE (US$)	$73,683	51,099	60,173	48,999
- OPERATING COSTS PER HECTARE (US$)	$60,131	55,339	58,438	54,921
= NET REVENUE PER HECTARE (US$)	$13,552	(4,240)	(1,735)	(5,922)
LOSS MEASURES				
1. LOSS PER HECTARE (US$)	$0	17,792	11,817	19,474
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	88.19	58.57	96.52
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	24%	16%	26%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	131%	87%	144%

FLORIDA - TABLE 6: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

FLORIDA	METHYL BROMIDE	ALTERNATIVE 1,3-D+PIC
YIELD LOSS (%)	0	25
YIELD PER HECTARE	3,138	2,353
* PRICE PER UNIT (US$)	23.10	23.10
= GROSS REVENUE PER HECTARE (US$)	72,511	54,360
- OPERATING COSTS PER HECTARE (US$)	44,459	40,795
= NET REVENUE PER HECTARE (US$)	28,012	13,565
LOSS MEASURES		
1. LOSS PER HECTARE (US$)	$0	14,447
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	77.72
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	20%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	52%

EASTERN UNITED STATES - TABLE 7: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

EASTERN UNITED STATES	METHYL BROMIDE	ALTERNATIVE PIC+MS	ALTERNATIVE 1,3-D+PIC	ALTERNATIVE MS
YIELD LOSS (%)	0%	27%	14%	30%
YIELD PER HECTARE	22,417	16,364	19,270	15,692
* PRICE PER UNIT (US$)	2.59	2.59	2.59	2.59
= GROSS REVENUE PER HECTARE (US$)	51,892	37,881	44,608	36,324
- OPERATING COSTS PER HECTARE (US$)	29,623	30,555	31,658	30,270
= NET REVENUE PER HECTARE (US$)	22,269	7,327	12,950	6,054
LOSS MEASURES				
1. LOSS PER HECTARE (US$)	$0	14,942	9,319	16,215
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	99.49	62.05	107.96
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	29%	18%	31%
4. LOSS AS A PERCENTAGE OF NET REVENUE (%)	0%	67%	42%	73%

Summary of Economic Feasibility

The economic analysis evaluated methyl bromide alternative control scenarios for strawberry production of fruit in Southeastern states, Florida, and California by comparing the economic outcomes of methyl bromide oriented production systems to those using alternatives.

The economic factors that most influence the feasibility of methyl bromide alternatives for fresh market strawberry 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.

The economic reviewers analyzed crop budgets for pre-plant sectors to determine the likely economic impact if methyl bromide were unavailable. Various measures were used to quantify the impacts, including the following:

(1) **Loss per Hectare.** For crops, this measure is closely tied to income. It is relatively easy to measure, but may be difficult to interpret in isolation.

(2) **Loss per Kilogram of Methyl Bromide**. This measure indicates the nominal marginal value of methyl bromide to crop production.

(3) **Loss as a Percentage of Gross Revenue.** This measure has the advantage that gross revenues are usually easy to measure, at least over some unit, *e.g.*, a hectare of land or a storage operation. However, high value commodities or crops may provide high revenues but may also

entail high costs. Losses of even a small percentage of gross revenues could have important impacts on the profitability of the activity.

(4) **Loss as a Percentage of Net Operating Revenue**. We define net cash revenues as gross revenues minus operating costs. This is a very good indicator as to the direct losses of income that may be suffered by the owners or operators of an enterprise. However, operating costs can often be difficult to measure and verify.

(5) **Operating Profit Margin**. We define operating profit margin as net operating revenue divided by gross revenue per hectare. This measure would provide the best indication of the total impact of the loss of methyl bromide to an enterprise. Again, operating costs may be difficult to measure and fixed costs even more difficult, therefore, fixed costs were not included in the analysis.

These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide users, strawberry farmers in this case. Because producers (suppliers) represent an integral part of any definition of a market, we interpret the threshold of significant market disruption to be met if there is a significant impact on commodity suppliers using methyl bromide. The economic measures provide the basis for making that determination.

Several methodological approaches will help interpret the findings. Economic estimates were first calculated in pounds and acres and then converted to kilograms and hectares. Costs for alternatives are based on market prices for the control products multiplied by the number of pounds of active ingredient that would be applied. Baseline costs were based on the average number of annual applications necessary to treat strawberry fields with methyl bromide.

Net revenue is calculated as gross revenue minus operating costs. This is a good measure as to the direct losses of income that may be suffered by the users. It should be noted that net revenue does not represent net income to the users. Net income, which indicates profitability of an operation of an enterprise, is gross revenue minus the sum of operating and fixed costs. Net income should be smaller than the net revenue measured in this study. Fixed costs were not included because they are difficult to measure and verify.

Loss per hectare measures the value of methyl bromide based on changes in operating costs and/or changes in yield. Loss expressed as a percentage of the gross revenue is based on the ratio of the revenue loss to the gross revenue. Likewise, for the loss as a percentage of net revenue. The profit margin percentage is the ratio of net revenue to gross revenue per hectare. The values to estimate gross revenue and the operating costs for each alternative were derived for three alternative fumigation scenarios for the Eastern States and California, relative to methyl bromide: 1) metam sodium + chloropicrin; 2) 1,3-d + chloropicrin; and 3) metam sodium. Yield loss estimates were based on data from the CUE's and EPA data, as well as expert opinion.

For Florida, three scenarios were compared to the methyl bromide baseline: 1) 1,3-D plus chloropicrin; 2) Iodomethane; and 3) Iodomethane + chloropicrin. Because Iodomethane **is not registered**, it is not considered a feasible alternative but the analysis is provided for comparative purposes.

Florida

In 2002, Florida had 2,792 hectares (6,900 acres) or 100% of harvested area treated with an average of 75 kilograms (166 pounds) of methyl bromide per hectare (acre). The closest chemical alternative to methyl bromide is 1,3-D plus chloropicrin (as Telone C-35). However, US-EPA estimates that approximately 40% of Florida's strawberry growing areas overlay Karst geology, which prohibits the use of 1,3-D because of the potential for groundwater contamination. The use of 1,3-D also requires a 30 m buffer around inhabited structures. This would reduce the strawberry producing acreage by about 10%. Nematodes and nutsedge are key pests in Florida strawberry controlled with methyl bromide. Chloropicrin is not as effective in controlling weeds as methyl bromide. Using chloropicrin adds to production costs through increased labor costs for weeding and harvesting.

The least-loss scenario for Florida in the absence of methyl bromide is for growers to use 1,3-d plus chloropicrin. Under that scenario, yield loss would be approximately 27%, not including increases in labor costs for hand weeding, drip irrigation costs, or changes in market prices due to later harvests missing early market price-premiums. A delay in planting occurs due to the longer plant-back interval for 1,3-d, which means delayed harvesting. According to U.S. Department of Agriculture data, market prices for Florida strawberries decline approximately 18% between December and January. Yield and price impacts together make up impacts on gross revenues.

Under Alternative 1 (1,3-d plus chloropicrin), the yield loss was estimated to be 25% with operating costs in U.S. dollars per hectare of $40,795. The estimated net revenue was $13,565 per hectare. The estimated loss per hectare is estimated to be $14. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $77.72 per kilogram. If growers miss the December market window, a loss of approximately one month's revenue would reduce grower gross revenues by about 22% in addition to the yield loss of 25%.

The following alternatives are presented for comparative purposes only as the products are not registered. Under alternative 2 (Iodomethane), the yield loss was estimated to be 14%. Operating costs in U.S. dollars per hectare are $40,795. The estimated net revenue was $21,538 per hectare. The loss per hectare is estimated to be $6,474. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $34.83 per kilogram.

Under alternative 3 (Iodomethane + chloropicrin), the yield loss was estimated to be 30%. Operating costs in U.S. dollars per hectare are $40,795. The estimated net revenue was $9,963 per hectare. The loss per hectare is estimated to be $18,049. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $97.11 per kilogram.

California

In California, 1,3-D plus chloropicrin would also be the primary replacement for methyl bromide. California restricts total use of 1,3-D, at the local level (township cap). Approximately 63% of California's strawberry areas are fumigated with methyl bromide, and 31% are fumigated with alternatives. Approximately 15% of the strawberry areas are on hillsides with slopes severe enough to make drip irrigation impractical.

Increased production preparation time would delay planting in the southern region of California and reduce the harvest period in the northern region, leading to decreases in the prices farmers receive. Ground preparation between crops takes 30 days longer using 1,3-D and chloropicrin because of the time required to prepare drip irrigation. According to U.S. Department of Agriculture data, market prices for strawberries California decline 5% between January and February. If using the alternatives delay the harvest period, US-EPA estimates there will be a market price decline in addition to a yield loss. The following paragraphs illustrate the estimated losses with three alternatives for California.

Alternative 1 (chloropicrin+metam sodium), yield loss was estimated to be 27%, and gross revenues are expected to decline 24%. The estimated net revenue is estimated to decline more than 131%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $88.19 per kilogram.

Under alternative 2 (1,3-D plus chloropicrin), the yield loss was estimated to be 14% and prices by 05%, if growers miss key market windows. Gross revenue is expected to decline 16%. The net revenue is expected to decline by more than 87%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $58.57 per kilogram.

Under alternative 3 (metam sodium), the yield loss was estimated to be 30%, and the gross revenue loss was estimated to by 26%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $96.52 per kilogram.

Southeastern United States:
Under Alternative 1 (chloropicrin+metam sodium), yield loss was estimated to be 27%, with gross revenues decline 29%, and a loss in estimated net revenue of 67%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $99.49 per kilogram.

Under alternative 2 (1,3-D + chloropicrin), the yield loss was estimated to be 14%, with gross revenues declining 18%, and net revenues expected to decline by 42%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $62.05 per kilogram.

Under alternative 3 (Metam Sodium), the yield loss was estimated to be 30%, with gross revenues declining 31%, and net revenues expected to decline by 73%. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $107.96 per kilogram.

Note: Market price data was not available for the Eastern United States but it is assumed that the net effect of shifting from methyl bromide to any of the alternatives would result in additional revenue reductions due fluctuations in market price due to changes in production and harvesting times.

It should be noted that the applicants do not consider any alternative to be feasible and that these estimates are an attempt to measure potential impacts.

c. use of methyl bromide can be reduced because soil pests can be controlled with a use rate of 200kg/ha and because use of higher density films (including VIF) will allow pest control at lower dosages.

In making this assertion MBTOC has relied on the work cited in two papers, Fennimore et al, 2003 and Gilreath et al, 2003. Fennimore was contacted to determine whether, in his opinion, his work could be appropriately used to support lower application rates. His reply, reproduced below, indicates that he is very uncomfortable with this interpretation of his results[42].

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[42] From: Steven Fennimore [mailto:safennimore@ucdavis.edu]
Sent: Fri Jan 07 16:24:43 2005
To: Dan Legard
Cc: jmduniway@ucdavis.edu; haajwa@ucdavis.edu
Subject: MBTOC VIF stance

Hi Dan
I am a bit disturbed to learn from you that the some in MBTOC may have come to the conclusion that VIF will allow reduced rates of methyl bromide. While I stand behind my research that indicates clearly that the weed control efficacy of drip-applied chloropicrin and Inline are improved under VIF compared to standard film, these fumigants are used to control many other pests besides weeds. For example, results do not necessarily suggest that VIF improves phytopthora cactorum control. Our research results presented at MBAO are preliminary and we are currently preparing peer reviewed publications. When those are written we will have a more clear understanding of the potential benefits and limitations of VIF than we have now. I do believe that VIF offers real potential benefits, however I caution anyone to make policy decisions about VIF based on my preliminary results presented at MBAO

Steve Fennimore
Extension Specialist
University of California, Davis
1636 East Alisal St
Salinas, CA 93905
831-755-2896

Technical and Economic Assessment of MBTOC/TEAP Report.

We have not been provided by MBTOC with information on their technical assessment of the performance of alternatives, ortheir economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of higher yield losses, longer plant back intervals, the economic feasibility if key market windows are missed, and the economic impact of a 20% transition to alternatives including estimates of management costs for more intensive programs and how the impact of less reliable alternatives is calculated. The sources of estimates of the extent of pest pressure should describe the rationale for using other estimates, a complete description of the questions, species being surveyed and quantitative levels used.

U.S. 2006 nomination

In summary, the USG disagrees with MBTOC's recommendation that the U.S. request can be reduced and reiterates its request for an additional 397.597 metric tons of methyl bromide for a total of 1,918.4 metric tons of methyl bromide.

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9. FIELD GROWN TOMATOES

Overview of the U.S. nomination

The U.S. is requesting 2,844.985 metric tons of methyl bromide for use on field-grown tomatoes in the following areas: Michigan (10.746 metric tons), California (102.058 metric tons), and the southeastern U.S. Florida and Georgia as well as other states in the southeast (2, 726.68 metric tons) with a small additional amount (5.501 metric tons) for research purposes.

Currently registered alternatives to methyl bromide do not consistently provide effective control of nutsedge weed species and more time is needed to evaluate relationship between fumigant alternatives, various mulches, and herbicide systems under different growing conditions.

The U.S. nomination is only for those areas where the alternatives are not suitable. In U.S. tomato production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- pest control efficacy of alternatives: the efficacy of alternatives may not be comparable to methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in tomato production.
- geographic distribution of key target pests: i.e., some alternatives may be comparable to methyl bromide as long as key pests occur at low pressure, and in such cases the U.S. is only nominating a CUE for tomato where the key pest pressure is moderate to high such as nutsedge in the Southeastern US.
- regulatory constraints: e.g., telone use is limited in California due to townships caps and in Florida due to the presence of karst geology.
- delay in planting and harvesting: e.g., the plant-back interval for telone+chloropicrin is two weeks longer than methyl bromide+chloropicrin, and in Michigan an additional delay would occur because soil temperature must be higher to fumigate with alternatives. Delays in planting and harvesting result in users missing key market windows, and adversely affect revenues through lower prices.
- unsuitable topography: e.g., alternatives that must be applied with drip irrigation may not be suitable in areas with rolling or sloped topography due to uneven distribution of the fumigant.

Overview of MBTOC's prior Recommendation

MBTOC has recommended a total of 2,217.433 metric tons of methyl bromide distributed as follows: Michigan (10.746metric tons), the southeastern U.S. (2,197.5 metric tons) and California (9.185 metric tons). The research amount was approved.

MBTOC suggests that California can use shank injected 1,3-D/pic and avoid the problems that drip applied poses on the hilly terrain that forms the basis for the California request. MBTOC asserts that only 9% of the California terrain is precluded from this option due to binding township caps. In the case of the southeastern states, MBTOC has indicated their view that alternatives are technically and economically feasible and applies a 20% phasein factor. MBTOC further states that the dosage can be reduced for a maximum applied rate of 200kg/ha for the treated areas and may be further reduced if high density films, including VIF are used.

California

MBTOC has suggested that shank-injected 1,3-D/Pic can be used in all areas that are not currently impacted by the township caps. In making this suggestion they are ignoring both the technical and regulatory factors described above and the actual working of the township caps in California. The township cap is a maximum that can be applied *assuming that the method of application is deep shank injection.* For all other forms of injection an 'application factor' is applied. The purpose of this application factor is to reduce the amount of 1,3-D that can be applied to a given area, reducing exposure to the population to a level comparable to that experienced when deep shank injection is used.

Deep shank injection cannot be used to control pests in California tomato production. Unlike Florida, where the soils are sandy to a considerable depth, in California the soils are prepared for planting to a depth of 12- 18 inches[43]. The deep shank method injects 1,3-D below this level where the soil is not prepared and breaks into clumps. The soil must be re-tilled before planting which risks introducing pathogens back into the planting zone. When shallow-shank injection is used, the higher application factors mean that a much smaller area can be injected.

Dr. Legard[44] of the California Strawberry Commission has estimated the impact on maximum acreage treated if 1,3-D is (shallow) shank-injected into the soil rather than drip-applied a s a liquid. Using Telone C35® at 39-50 gallons per treated acre, 138.8 to 178.0 acres per township could be treated. When Inline® is used at 25 gallons per acre[45] 473.7 acres per township can be treated. In other words, the use of drip-applied 1,3-D results in 2.5 to 3 times as many treated acres. Shank injection of 1,3-D will greatly reduce the acreage treated[46].

The U.S. assessment that the alternatives are not technically and economically feasible rests on two kinds of losses[47]: changes in yields which result in a lesser amount harvested and therefore

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[43] This corresponds to 30-45 cm.

[44] Daniel Legard, PhD, personal communication. January 9, 2005.

[45] The common use rate on strawberries in California

[46] The main concern associated with broadcast fumigation with telone C35 is related to the telone township cap. There are different emission ratios used for the different application methods that adjusts the amount of telone applied to the township cap. The lbs used are "adjusted" by the following factors (1x for deep shank, 1.1x for drip applied, 1.8x for shallow shank). Hopefully, most growers would use deep shank where possible for broadcast telone applications. However, broadcast applications still involve treating approximately 40% more acreage than drip (2 row bed and slightly lower for 3 and 4 row beds, which are becoming more popular in the North).

[47] From a theoretical perspective there are additional losses that should be included: differences in costs between methyl bromide and the alternatives and changes in yield quality. Cost differences between methyl bromide and the alternatives can occur because the prices of the materials differ, amounts used differ, equipment needs differ, additional materials are needed, such as an additional herbicide, an additional application step, either of the alternative or of some ancillary material is required, or there are additional land preparation or other costs. In practice, cost differences between methyl bromide and alternatives are generally small and can usually be ignored.

Quality difference in the yield, such as smaller, scarred, less sweet, or other differences in fruit quality would also be factors in assessing economic loss. In practice quality differences have not been reported in the available literature and so losses from his source cannot be incorporated into the analysis.

lower revenues to farmers, and later yields which resulted in further reduced revenues to farmers (missed market windows, shorter harvest periods, the inability to grow a second crop). The proportion of loss attributable to each component differs from sector to sector, and within sectors, depending on the local circumstances of the nomination. As an example, for tomatoes in both Michigan and the southeastern United States, approximately 70% to 75% of the loss is attributable to missing the high value market time and 25% to 30% of the loss is attributable to lower yield

Southeastern United States

MBTOC has asserted that for the southeastern United States alternatives are technically and economically feasible. Using this assertion as a basis they recommend a 20% reduction for phase-in of alternatives such as 1,3D/Pic or metam sodium with or without Pic.

MBTOC disagrees with the U.S. assessments of yield loss.

The U.S. assessments of yield loss were developed from technically appropriate studies for the specific circumstances of the U.S. situation. Technically appropriate studies are those which:

- Included an untreated control for comparison purposes on pest levels
- Included methyl bromide as a treatment standard
- Included information on the (key) pests present in the treated area
- Give estimates of yield changes (differences)

The U.S. nomination was restricted to those situations where the presence and prevalence of pests ('key' pests) that could not be controlled by alternatives to methyl bromide was moderate to severe[48] and would result in yield loss.

As we understand it from discussions at MOP-16, MBTOC used what they describe, interchangeably as a "meta analysis" or an 'average'. The procedure MBTOC used was not a meta analysis in that a meta analysis includes only studies which are similar enough from a statistical standpoint that they can be combined and analyzed as if they comprised one study, and the studies need to be identified, appraised and summarized according to an explicit and reproducible methodology that is designed to answer a specific research question. In this case, the appropriate research question would be the performance of alternatives to methyl bromide under the conditions of the U.S. nomination (i.e. with moderate to severe pressure from key pests). The null hypothesis would be that alternatives work as well as methyl bromide in the conditions of the U.S. nomination. The U.S. nomination is specifically for the use of methyl bromide where key pests (pests not adequately controlled by alternatives to methyl bromide) are present at moderate to severe levels and/or soil, climate, terrain, or regulatory conditions are such that alternatives to methyl bromide either cannot be used or result in significant economic losses when used. These economic losses must be of sufficient magnitude that they render the alternative "not economically feasible" which presents a serious problem in applying the meta analysis. Our understanding is that this analysis includes some studies conducted under

[48] In the judgment of U.S. experts pressure was such that yield losses of the magnitude of those used in the economic assessment would be sustained.

circumstances that are not similar to the limited conditions included in the U.S. nomination, such as the presence of moderate to severe pest pressure.

Although it is difficult to be certain how the MBTOC analysis was conducted and what it includes because it has not been reviewed and published and was not provided to the U.S. experts to evaluate[49], we are able to make some educated guesses about the analysis[50]. The analysis for strawberry fruit is described in a paper is listed as being "in press" as conference proceedings with a date after the MBTOC recommendations on the U.S. nomination were tendered.

A version of the paper was presented by Dr. Ian Porter at the Methyl Bromide Alternatives Organization meeting in San Diego, November 2003 and was the subject of some controversy and concern among a number of participants. Dr. Porter's paper included a number of papers which U.S. experts believe are not appropriate for use in determining the usefulness of alternatives because the research was carried out under conditions of no pest pressure, and are therefore not relevant to the specific circumstances of our nomination[51]. If no pests are present any alternative, or indeed not using any pesticide at all, will all work equally well. By including situations where there is no pest pressure one in effect adds (many) "100" to the equation[52] describing the differences in yield between crops grown using methyl bromide and those grown using an alternative. This has the effect of lowering the average difference between yields using methyl bromide and yields using an alternative. If a sufficient number of "100" are added, the result will be to (falsely) eliminate the yield differences between methyl bromide and the alternatives.

In other papers, pests were present but they were not the pests present in the all of the U.S. circumstances. Taking the case of the southeastern US, for example, weeds, diseases, fungi, and nematodes all afflict the crops. Some of these pests can be controlled with alternatives, but some of the weeds, in particular nutsedges (nut grasses), nightshades, and some hard seed coated weeds, cannot. Situations without weeds will show small or no yield losses when alternatives are used while the true situation when (key) weeds are present is that there are relatively large yield losses. Including these factors again has the effect of adding "100" yield difference as many times as there are papers.

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[49] The US Government requested references from two of the authors of the paper to allow us to better understand the analysis, but this information has not yet been provided

[50] Some of this material with references had been previously presented at the Methyl Bromide Alternatives Organization 2003 meeting (San Diego). At that time U.S. experts expressed their view that many if not most of the studies were not an appropriate application of the information.

[51] For example, some trials are used for residue tests. These tests are likely to be carried out in conditions of little or no pest pressure in order to have enough harvested fruit to test for residue. The Porter paper does not indicate which of the studies used (but not cited) where for the purposes of examining pesticide residues.

[52] The actual procedure was to add in yields expressed as a percentage of (anticipated) yield using methyl bromide. How this yield was estimated is puzzling as many of the studies did not include a methyl bromide control. Because there was no indication of pest pressure in many instances, many of the entries indicated yields of approximately 100%, obviating the differences between methyl bromide and the alternatives.

If the issue had been to average all papers, describing some "average" worldwide situation, the procedure followed in this approach would be appropriate. However, The U.S. submitted requests for continued methyl bromide use only instances of sufficiently high pest pressure (not average) for pests which cannot be controlled by alternatives to methyl bromide.

In the case of crops other than strawberries, the basis for MBTOC's suggestion of no differences in yields between methyl bromide treatments and treatments with the alternatives is more difficult to assess. MBTOC representatives at MOP-16 indicated that their "expert judgment" was the basis for the finding that alternatives were technically and economically feasible. It is impossible to determine from this statement whether the conditions used by the experts to make their findings are similar to the particular conditions of the U.S. nomination. Given what we already know about the applicability of the meta analysis for strawberries to the U.S. circumstances, it seems likely that MBTOC is not using experience accrued in situations similar to those prevailing in the portions of the U.S. for which methyl bromide is requested, but rather relying on more generalized experience to make these judgments for which no data or references have been provided.

The U.S. disagrees with the MBTOC assessment of yield loss in the specific circumstances of the U.S. nomination.

Turning now to the component of economic loss that is a consequence of market timing we find that MBTOC has completely ignored losses arising from market windows.

Experts are familiar with high prices for fresh produce early in the season, prices which decline as the produce becomes abundant (and more familiar) later in the season. The U.S. has provided marketing data documenting the existence of these market windows and their effects on the revenue and profits earned by farmers. Anecdotally, farmers tell us that virtually al of their net revenue (approximately 90%) above cost is earned during the short period of high prices. For some crops, 75% of the economic loss is due to missing a market window rather than through smaller crops, lower fruit quality, or higher costs.

Many of the alternatives will cause farmers to miss the market window. In conditions of cold soil temperatures, such as in Michigan and coastal California, where the growing season is short, alternatives cannot be used until the soil temperatures reach at least 40 F. This temperature is reached 3-4 weeks into the growing season, delaying planting and consequently harvesting for that time. Because the Michigan growing season is already short due to the cold temperatures, even apart from missing the market window, delaying planting will result in a smaller harvestable amount. In other situations the "plant-back" interval is longer, by 2-4 weeks, relative to the methyl bromide plant back times. Requiring a longer interval before a crop can be planted will delay the harvesting, again causing a farmer to miss a market window. Some alternatives also require a different bed preparation, which will also delay the planting time. The strawberry crop in California is one example of this situation.

It is difficult to determine the basis MBTOC used in determining that alternatives for methyl bromide are both technically and economically feasible in tomato production. USG technical experts asked MBTOC to explain the basis for their decision[53] and were told that in some cases a meta analysis served as the basis, and in other cases the basis was experience. When asked for references, USG experts were directed to "the Porter paper in press". USG experts have examined a "Porter paper in press"[54] and have a number of concerns over its applicability to the specific circumstances of the U.S. CUE. Although it has a publication date of one year later than the San Diego presentation, we find that our concerns over its applicability have not been resolved. The studies used in the meta analysis are not listed and no indication is given of the criteria used to include or exclude a study from the analysis.

There is no indication that MBTOC considered the specific circumstances of the U.S. nomination (which are that methyl bromide is requested only for situations where regulatory concerns preclude use of an alternative or where there are 'key' pests present at moderate to severe levels, or where terrain conditions (temperature, topography) result in no alternative being technically and economically feasible). MBTOC has not cited research findings supporting their contention that alternatives are both technically and economically feasible; the U.S. has presented extensive results in the circumstances of the nomination to support our position.

We conclude that, at present, no economically feasible alternatives to MeBr exist for use in Southeastern U.S. tomato production. Two factors have proven most important in our conclusion. These are yield loss and missed market windows, which are discussed individually below.

1. Yield Loss - Expected yield losses of somewhat over 6%[55] are anticipated throughout southeastern U.S. tomato production.

2. Missed Market Windows - We agree with Southeastern US's assertion that growers will likely receive significantly lower prices for their produce if they switch to 1,3-D + chloropicrin. This is due to changes in the harvest schedule caused by the above described soil temperature complications and extended plant back intervals when using these alternatives.

Our analysis of this effect is based on the fact that prices farmers receive for their tomatoes vary widely over the course of the growing season. Driving these fluctuations are the forces of supply and demand. Early in the growing season, when relatively few tomatoes are harvested, the supply is at is lowest and the market price is at its highest. As harvested quantities increase, the

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[53] MBTOC suggests that alternatives were both technically and economically feasible for the pre-plant sectors of field grown peppers, strawberries, and tomatoes. The same assertions were made for portions of other countries' nominations as well.

[54] Porter,I., S. Mattner, R. Mann, R. Gounder, J. Banks, and P. Fraser. 1994. Strawberry Fruit Production and results from trials in Different Geographic Regions. A Presentation to the Methyl Bromide Alternatives Conference, Lisbon, September 1994.

[55] The submitted data showed that using the above best alternative the growers are expected to suffer 6.2% yield losses (Chellemi, Botts and Noling. 2001). A combination of 1,3-D + chloropicrin + pebulate appeared to be the best alternative in controlling key pests in tomato fields. Since pebulate is no longer available then the growers will need to substitute another herbicides such as halosulfuron, rimsulfuron or trifloxysulfuron to control nutsedge weeds. These herbicides, however, have significant limitations. In addition, losses will be higher in areas of Karst geology, where 1,3-D may not be used.

price declines. In order to maximize their revenues, tomato growers manage their production systems with the goal of harvesting the largest possible quantity of tomatoes when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of tomato operations.

To describe these conditions in Southeastern U.S. tomato production, we used weekly tomato sales data from the U.S. Department of Agriculture for the previous three years to gauge the impact of early season price fluctuations on gross revenues. Though data availability is limiting, we assume that if tomato growers adjust the timing of their production system, as required when using 1,3-D + Chloropicrin, that they will, over the course of the growing season, accumulate gross revenues reduced by approximately 15%. We reduced the season average price by 15% in our analysis of the alternatives to reflect this. Based on currently available information, we believe this reduction in gross revenues serves as a reasonable indicator of the typical effect of planting delays resulting when MeBr alternatives are used in Southeastern US.

MBTOC has suggested that rates can be reduced to a maximum level of 200kg/ha

MBTOC has also reduced the amount recommended for tomatoes stating: "A further adjustment was applied to reduce the dosage to the guideline level of 200kg/ha under the strips." When this issue was discussed with MBTOC members during the 16th MOP, U.S. experts agreed to clarify whether the reported rates were in fact the rates used under the strips (as the U.S. believed) or whether they were the average for an acre as MBTOC believed[56]. The U. S. has verified that the application rates provided in the quantitative assessment (the Methyl Bromide Usage Numerical Index, or BUNI) are in fact the rates under the strips. The number of acres reported is the "treated acres", so that a strip application results in two thirds of an acre being fumigated while one-third is the untreated is reported as two thirds of an acre.

They have further suggested that rates can be reduced still further if higher density tarps, including VIF, are used. One of the papers cited in support of this proposal is Fennimore et el, 2003. Fennimore was contacted to determine whether, in his opinion, his work could be appropriately used to support lower application rates. His reply, reproduced below, indicates that he is very uncomfortable with this interpretation of his results[57].

[56] If the rates were an average per acre, as MBTOC believed, given that in strip treatments approximately one-third of the acre is left untreated, the rates applied would, in some cases, exceed the MBTOC recommended dosage of 200kg/ha.

[57] From: Steven Fennimore [mailto:safennimore@ucdavis.edu]
Sent: Fri Jan 07 16:24:43 2005
To: Dan Legard
Cc: jmduniway@ucdavis.edu; haajwa@ucdavis.edu
Subject: MBTOC VIF stance

Hi Dan
I am a bit disturbed to learn from you that the some in MBTOC may have come to the conclusion that VIF will allow reduced rates of methyl bromide. While I stand behind my research that indicates clearly that the weed control efficacy of drip-applied chloropicrin and Inline are improved under VIF compared to standard film, these fumigants are used to

Technical and Economic Assessment of MBTOC/TEAP Report.
We have not been provided by MBTOC with information on their technical assessment of the performance of alternatives, ortheir economic assessment on the impact of converting to alternatives. To support the MBTOC's recommended change in the U.S. request citations of the research references and economic assessments that led to the MBTOC conclusions are needed so we can understand the justification. The technical references should describe the species tested, pest numbers, concentrations, times, and commodity volumes. Economic references should describe the costs of converting from methyl bromide to alternatives, the impact of higher yield losses, longer plant back intervals, the economic feasibility if key market windows are missed, and the economic impact of a 20% transition to alternatives including estimates of management costs for more intensive programs and how the impact of less reliable alternatives is calculated. The sources of estimates of the extent of pest pressure should describe the rationale for using other estimates, a complete description of the questions, species being surveyed and quantitative levels used.

U.S. 2006 nomination
In summary, the USG does not agree with MBTOC's contention that the U.S. request can be reduced and reiterates it request for an additional 622.053 metric tons of methyl bromide for a total of 2,844.985 metric tons of methyl bromide.

Citations

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control many other pests besides weeds. For example, results do not necessarily suggest that VIF improves phytopthora cactorum control. Our research results presented at MBAO are preliminary and we are currently preparing peer reviewed publications. When those are written we will have a more clear understanding of the potential benefits and limitations of VIF than we have now. I do believe that VIF offers real potential benefits, however I caution anyone to make policy decisions about VIF based on my preliminary results presented at MBAO

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