METHYL BROMIDE CRITICAL USE RENOMINATION FOR PREPLANT SOIL USE (OPEN FIELD OR PROTECTED ENVIRONMENT)

NOMINATING PARTY:
The United States of America

NAME
USA CUN09 SOIL Nursery Stock - Fruit, Nut, and Rose Open Field

BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Nursery Stock - Fruit, Nut, and Rose in Open Fields or Protected Environments (Submitted in 2007 for 2009 Use Season)

CROP NAME (OPEN FIELD OR PROTECTED):
Nursery Stock - Fruit, Nut, and Rose in Open Fields or Protected Environments

QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION:

TABLE COVER SHEET: QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION

YEAR	NOMINATION AMOUNT (METRIC TONNES)*
2009	**45.282**

*This amount includes methyl bromide needed for research.

SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS

To meet certification requirements methyl bromide or 1,3-dichloropropene (1,3-D) are required where nematodes have been found historically. Where soil conditions and regulations allow, 1, 3-D is being used by nurseries of this sector that was until recently entirely reliant on MeBr. Also, a transition rate was applied based on the best estimate of yield losses and feasibility associated with likely methyl bromide alternatives that could be made by USG biologists and economists. In addition, a dosage rate of 150 kg/ha (for areas where disease pathogens were considered to be key pests) and 175 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested. Changes in the use pattern are reflected in the U.S. nomination for this sector.

Reports of ongoing research (e.g., Kabir et al., 2005) in California nurseries suggest that alternatives may be effective in some nurseries. Research trials in strawberry nurseries (a model for raspberries) indicated that methyl iodide with chloropicrin, chloropicrin followed by dazomet, and 1,3-D with chloropicrin followed by dazomet are potentially effective alternatives to MeBr. Transitioning to these alternatives will require addressing regulatory issues (e.g., methyl iodide is available for research use only; chloropicrin at high rates is restricted in California) and certification requirements. Consequently, while research indicates the possibility of effective alternatives for this industry, the U.S. nomination reflects the continued need for some methyl bromide for the 2009 use season.

REASONS WHY ALTERNATIVES TO METHYL BROMIDE ARE NOT TECHNICALLY AND ECONOMICALLY FEASIBLE

The requested amount of methyl bromide in the U.S. nomination includes those areas where 1,3-D would not meet the certification requirements or would be limited by township caps. Under California regulatory laws, nursery crops must be "free of especially injurious pests and disease symptoms" in order to qualify for a CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments (CDFA, 2001, 2003). If an approved fumigation is not used in the nursery, a nematode sampling procedure is imposed by CDFA, and if nematodes are found all nursery stock in an area should be destroyed resulting in a complete loss. methyl bromide meets the certification guidelines. Also, in certain soil conditions, 1,3-D meets certification guidelines; California township caps may limit the use of 1,3-D.

(Details on this page are requested under Decision Ex. I/4(7), for posting on the Ozone Secretariat website under Decision Ex. I/4(8).)

This form is to be used by holders of single-year exemptions to reapply for a subsequent year's exemption (for example, a Party holding a single-year exemption for 2005 and/or 2006 seeking further exemptions for 2007). It does not replace the format for requesting a critical-use exemption for the first time.

In assessing nominations submitted in this format, TEAP and MBTOC will also refer to the original nomination on which the Party's first-year exemption was approved, as well as any supplementary information provided by the Party in relation to that original nomination. As this earlier information is retained by MBTOC, a Party need not re-submit that earlier information.

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Following the requirements of Decision IX/6 paragraph (a)(1) The United States of America has determined that the specific use detailed in this Critical Use Nomination is critical because the lack of availability of methyl bromide for this use would result in a significant market disruption. ☐ Yes ☐ No

_____________________ _____________________ ____________

Signature Name Date

Title: ____________________________________

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LIST OF DOCUMENTS SENT TO THE OZONE SECRETARIAT IN OFFICIAL NOMINATION PACKAGE:

1. PAPER DOCUMENTS: **Title of paper documents and appendices**	**No. of pages**	**Date sent to Ozone Secretariat**
USA CUN09 SOIL Nursery Stock - Fruit, Nut, and Rose Open Field		
2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: ***Title of each electronic file (for naming convention see notes above)**	**No. of kilobytes**	**Date sent to Ozone Secretariat**
USA CUN09 SOIL Nursery Stock - Fruit, Nut, and Rose Open Field		

* Identical to paper documents

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Part A: INTRODUCTION
Renomination Part A: SUMMARY INFORMATION

1. (Renomination Form 1.) NOMINATING PARTY AND NAME:
The United States of America
USA01 CUN09 SOIL Nursery Stock - Fruit, Nut, and Rose in Open Fields or Protected Environments

2. (Renomination Form 2.) DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Nursery Stock - Fruit, Nut, and Rose in Open Fields or Protected Environments (Submitted in 2007 for 2009 Use Season)

3. CROP AND SUMMARY OF CROP SYSTEM (*e.g. open field (including tunnels added after treatment), permanent glasshouses (enclosed), open ended polyhouses, others (describe)***):**

This nomination is based on requests for critical use of methyl bromide by producers of nursery-grown raspberries, roses, and deciduous tree planting material. Nursery producers provide stock plants that are pest-free to allow the establishment of plantings that are of the highest initial quality. Nurseries provide plants used by commercial growers of fresh and processed raspberries, rose bushes, and such diverse fruit crops as: apricots, peaches, prunes, nectarines, cherries, plums, apples, pears, Asian pears, ornamental pears, as well as nut crops such as almonds, walnuts, pistachios, pecans, and chestnuts. Approximately 95% of the trees are fruiting varieties sold to commercial producers; the other 5% are ornamental types used for landscaping. Nurseries are concentrated in areas conducive to early plant growth. Deciduous trees are primarily produced in California in the Sacramento and San Joaquin valleys. Many of the large raspberry nurseries are located in the eastern San Joaquin valley and western Washington.

Raspberries. Raspberry nurseries in the western U.S. provide raspberry stock to most of the growers in North America. Dry climates and soils make these areas ideal for production of high quality plant stock. Although there are relatively few raspberry nurseries, they provide all of the stock used by commercial growers, and therefore, have a large impact on raspberry production overall. is used on approximately 200 hectares of field beds. There is a large return in the benefits of certified pest-free stock to numerous commercial growers throughout the continent. The raspberry nursery industry uses flat fumigation techniques similar to that of the strawberry industry. Raspberry nursery stock is grown using a two-year production cycle beginning with tissue culture and moving to foundation planting the first year. Winter dormant plants are replanted in commercial nurseries and harvested after one year.

Deciduous trees. Deciduous tree nurseries range from 15 to over 600 hectares in field beds. A typical operation in California ranges between 80 and 120 hectares. The climate and soil is ideal for fruit and nut tree nurseries (as well as for fruit and nut production). While some nurseries concentrate on specific tree crops, most nurseries grow and sell a variety of different trees. Nursery stock is grown on a cropping system that includes crop rotation or cover cropping between tree production cycles; therefore, not all of the nursery area is in tree production in a given year. The tree production cycle can be anywhere from a single year to several years depending on the type of tree crop being produced. Nursery production of trees takes from one to four years in the ground depending on the type being produced. Almonds take one year and walnuts take at least two years. Also, target tree size determines how long plants are grown in the nursery. The most common cycle is for the tree crop to be in the ground for either one or two years. A typical nursery cycle starts by digging the current tree crop (to be sold) then planting a cover crop for one or two years, followed by replanting with a tree crop. In order to prepare the ground for planting, the fields are disked, deep ripped, leveled, and then fumigated to meet certification standards set by the California Department of Food and Agriculture (CDFA, 2001, 2003). Methyl bromide is applied by shank and treated area is usually covered with a high barrier tarp. The fumigation is carried out around August and September, and planting begins in October, and may continue through January. The deciduous nurseries are subject to mandates set forth by the CDFA (2001, 2003) that trees must be pest free. The nomination is for the portion of tree nurseries in California that are in areas where alternatives are either unsuitable for meeting certification standards or subject to regulatory restrictions.

Roses. Nursery roses are grown in open field plots. A typical crop rotation for a two-year rose crop includes one year fallow, followed by one or two years of rotational crops, and then a two-year rose crop. The two-year rose crop cycle begins with land preparation (removing the cover crop, deep cultivation, and fumigation with methyl bromide), followed by planting the rootstock and T-bud grafting. In late winter of the first year, the rootstock tops are removed. The rose crop matures by the second autumn and is then harvested. This cycle varies depending on the type of rose crop being produced (e.g., two-year roses, one-year minis and patio trees, or 18-month mini bushes).

4. AMOUNT OF METHYL BROMIDE NOMINATED (*give quantity requested (metric tonnes) and years of nomination*):

(Renomination Form 3.) YEAR FOR WHICH EXEMPTION SOUGHT:

TABLE A 1: QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION

YEAR	NOMINATION AMOUNT (METRIC TONNES)*
2009	**45.282**

*This amount includes methyl bromide needed for research.

(Renomination Form 4.) SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS (*e.g. changes to requested exemption quantities, successful trialling or commercialisation of alternatives, etc.*)

To meet certification requirements methyl bromide or 1,3-D are required where nematodes have been found historically. Where soil conditions and regulations allow, 1,3-D is being used by nurseries of this sector that was until recently entirely reliant on MeBr. Changes in the use pattern are reflected in the U.S. nomination for this sector.

Reports of ongoing research (e.g., Kabir et al., 2005) in California nurseries suggest that alternatives may be effective in some nurseries. Research trials in strawberry nurseries (a model for raspberries) indicated that methyl iodide with chloropicrin, chloropicrin followed by dazomet, and 1,3-D with chloropicrin followed by dazomet are potentially effective alternatives to MeBr. Transitioning to these alternatives will require addressing regulatory issues (e.g., methyl iodide is available for research use only; chloropicrin at high rates is restricted in

California) and certification requirements. Consequently, while research indicates the possibility of effective alternatives for this industry, the U.S. nomination reflects the continued need for some methyl bromide for the 2009 use season.

5. (i) BRIEF SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE (e.*g. no registered pesticides or alternative processes for the particular circumstance, plantback period too long, lack of accessibility to glasshouse, unusual pests*):

Nurseries must provide stock that is pest-free in order to meet state mandated certification requirements for plant material (CDFA, 2001). Use of products with 1,3-D can provide an effective alternative to methyl bromide for nematode control where allowed by township cap regulation and where soil type and moisture are acceptable, (e.g., McKenry, 2000; Schneider et al., 2004). Moisture restrictions for 1,3-D may be more limiting than township caps. Nurseries with heavy soils or moisture greater than 12% (especially common in clay soils at depths of 1 to 1.5 meters) may not receive certification of nursery stock, because of failure to reduce populations of nematodes or pathogens. In these situations methyl bromide is critical.

A recent example of complications from contaminated nursery stock is a report by extension specialists in Florida (Noling, 2006). Florida purchases strawberry transplants from Canada. A severe outbreak of Golden Nematodes found on potatoes in Quebec province resulted in quarantine in August, 2006 by USDA of all plant material from Quebec province into the U.S. Subsequent negotiations resulted in protocols to attempt to prevent transmitting the pathogen to the U.S. so that Florida strawberry farmers could import and plant their crops. The quarantine by USDA initially affected 30 million bare-root strawberry transplants and 3 million plug plants destined for Florida farms, which could have reduced plantings in Florida by 20%. Ultimately the problem was resolved by strict certification requirements. The situation highlights the implications of potentially contaminated nursery stock and consequences for nurseries and farms within the U.S. The critical need for methyl bromide for all nurseries is reflected in the U.S. nomination for this sector for 2009.

TABLE A 2: EXECUTIVE SUMMARY*

Region		Western Raspberry Nursery	CA Rose Growers	CA Fruit and Nut Tree Growers	Sector Total or Average
EPA Preliminary Value	kgs	37,229	1,579	13,626	52,433
EPA Amount of All Adjustments	kgs	(8,658)	-	-	(8,658)
Most Likely Impact Value for Treated Area	kgs	28,571	1,579	13,626	43,776
	ha	143	6	43	192
	Rate	200	244	319	228
Sector Research Amount (kgs)		1,506	2009 Total US Sector Nomination		45,282

* *See Appendix A for a complete description of how the nominated amount was calculated.*

(ii) STATE WHETHER THE USE IS COVERED BY A CERTIFICATION STANDARD. (*Please provide a copy of the certification standard and give basis of standard (e.g. industry standard, federal legislation etc.). Is methyl bromide-based treatment required exclusively to meet the standard or are alternative treatments permitted? Is there a minimum use rate for methyl bromide? Provide data which shows that alternatives can or cannot achieve disease tolerances or other measures that form the basis of the certification standard).*

Nurseries providing plant stock of raspberry, tree fruits and nuts, and roses are covered by certification requirements as described in state (e.g., CDFA, 2001; CDFA, 2003) and federal regulations (USDA-APHIS, 2004). For example, "Section 3640, CCR, makes it mandatory that nursery stock for farm planting be commercially clean with respect to economically important nematodes" (CDFA, 2001, 2003). The regulations list methyl bromide and 1,3-D as appropriate fumigants for control of nematodes.

The requested amount of methyl bromide in the U.S. nomination includes those areas where 1,3-D would not meet the certification requirements or would be limited by township caps. Under California regulatory laws, nursery crops must be "free of especially injurious pests and disease symptoms" in order to qualify for a CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments (CDFA, 2001, 2003). If an approved fumigation is not used in the nursery, a nematode sampling procedure is imposed by CDFA, and if nematodes are found all nursery stock in an area should be destroyed resulting in a complete loss. methyl bromide meets the certification guidelines. Also, in certain soil conditions, 1,3-D meets certification guidelines; California township caps may limit the use of 1,3-D.

If nematodes are found and the nursery stock is not "free of especially injurious pests and disease symptoms", then a total loss is likely because the nursery stock: 1) Would not qualify for a CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments, 2) Would probably not be marketable, since resale for planting is severely restricted by the CDFA, 3) Should be destroyed to prevent further infestation.

6. SUMMARISE WHY KEY ALTERNATIVES ARE NOT FEASIBLE *(Summary should address why the two to three best identified alternatives are not suitable, < 200 words)***:**

Nurseries must provide stock that is pest-free in order to meet state mandated certification requirements for plant material (CDFA, 2001, 2003). Use of products with 1,3-D can provide an effective alternative to methyl bromide for nematode control where allowed by township cap regulation and where soil type and moisture are acceptable, (e.g., Schneider et al., 2004). Moisture restrictions for 1,3-D may be more limiting than township caps. Nurseries with heavy soils or moisture greater than 12% (especially common in clay soils at depths of 1 to 1.5 meters) may not receive certification of nursery stock, because of failure to reduce populations of nematodes or pathogens. In these situations methyl bromide is critical.

Key alternatives are combinations of 1,3-dichloropropene (1,3-D), chloropicrin, metam-sodium, and dazomet. These chemicals and other strategies, such as use of low permeability tarps, may reduce or replace MeBr. Regulations regarding certification requirements mandate certain treatments. In California, only methyl bromide and 1,3-D are listed as acceptable treatments for nematode-free stock.

Research (e.g., Kabir et al., 2005) has indicated potentially effective alternatives for strawberry nurseries, which should apply to raspberry nurseries. However, alternatives must be tested sufficiently for use in commercial operations.

7. (i) PROPORTION OF CROP GROWN USING METHYL BROMIDE *(provide local data as well as national figures. Crop should be defined carefully so that it refers specifically to that which uses or used methyl bromide. For instance processing tomato crops should be distinguished from round tomatoes destined for the fresh market)***:**

TABLE A 3. PROPORTION OF CROP GROWN USING METHYL BROMIDE.

REGION WHERE METHYL BROMIDE USE IS REQUESTED	TOTAL CROP AREA 2001/2003 (HA)	PROPORTION OF TOTAL CROP AREA TREATED WITH METHYL BROMIDE (%)
Western Raspberry Growers	Not available	Not available
California Deciduous Fruit and Nut Tree Growers	Not available	Not available
California Nursery Roses	Not available	Not available

(ii) IF PART OF THE CROP AREA IS TREATED WITH METHYL BROMIDE, INDICATE THE REASON WHY METHYL BROMIDE IS NOT USED IN THE OTHER AREA, AND IDENTIFY WHAT ALTERNATIVE STRATEGIES ARE USED TO CONTROL THE TARGET PATHOGENS AND WEEDS WITHOUT METHYL BROMIDE THERE.

Pest-free certification standards for nursery stock make complete transition to alternatives difficult. Regulatory restrictions on the best alternative, 1,3-D, can limit the use for a portion of nurseries of this sector. For example, the deciduous fruit and nut tree growers use 1,3-D as an alternative on approximately 35% of nursery land. These areas have less than 12% moisture (at 1.5 m) on light soils.

(iii) WOULD IT BE FEASIBLE TO EXPAND THE USE OF THESE METHODS TO COVER AT LEAST PART OF THE CROP THAT HAS REQUESTED USE OF METHYL BROMIDE? WHAT CHANGES WOULD BE NECESSARY TO ENABLE THIS?

Until protocols have been tested confirming research results of effective alternatives, commercial nurseries will not be able to risk plant stock. Certification requirements make transitioning to alternatives more time consuming since long-term field trials have to be conducted. Approximately 35% of nurseries currently use alternatives to MeBr.

8. AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE (*Duplicate table if a number of different methyl bromide formulations are being requested and/or the request is for more than one specified region*):

TABLE A 4. AMOUNT OF METHYL BROMIDE REQUESTED FOR CRITICAL USE.

REGION	Western Raspberry Growers	California Deciduous Fruit and Nut Tree Growers	California Nursery Roses
YEAR OF EXEMPTION REQUEST—2009			
QUANTITY OF METHYL BROMIDE NOMINATED (METRIC TONNES)	See Appendix A	See Appendix A	See Appendix A
TOTAL CROP AREA TO BE TREATED WITH THE METHYL BROMIDE OR METHYL BROMIDE/CHLOROPICRIN FORMULATION (HA) (NOTE: IGNORE REDUCTIONS FOR STRIP TREATMENT)	See Appendix A	See Appendix A	See Appendix A
METHYL BROMIDE USE: **BROADACRE OR STRIP/BED** TREATMENT?	Flat fumigation	Flat fumigation	Flat fumigation
PROPORTION OF BROADACRE AREA WHICH IS TREATED IN STRIPS; E.G. 0.54, 0.67	1.0	1.0	1.0
FORMULATION (RATIO OF METHYL BROMIDE/CHLOROPICRIN MIXTURE) TO BE USED FOR CALCULATION OF THE CUE E.G. 98:2, 50:50	67:33	75:25	98:2
APPLICATION RATE* (KG/HA) FOR THE FORMULATION	See Appendix A	See Appendix A	See Appendix A
DOSAGE RATE* (G/M^2) (I.E. ACTUAL RATE OF FORMULATION APPLIED TO THE AREA TREATED WITH METHYL BROMIDE/CHLOROPICRIN ONLY)	See Appendix A	See Appendix A	See Appendix A

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

9. SUMMARISE ASSUMPTIONS USED TO CALCULATE METHYL BROMIDE QUANTITY NOMINATED FOR EACH REGION *(include any available data on historical levels of use)*:

The amount of methyl bromide nominated by the U.S. was calculated as follows:

- The percent of regional hectares in the applicant's request was divided by the total area planted in that crop in the region covered by the request. Values greater than 100 percent are due to the inclusion of additional varieties in the applicant's request that were not included in the USDA National Agricultural Statistics Service surveys of the crop.
- Hectares counted in more than one application or rotated within one year of an application to a crop that also uses methyl bromide were subtracted. There was no double counting in this sector.
- Growth or increasing production (the amount of area requested by the applicant that is greater than that historically treated) was subtracted. The applicant that included growth in their request had the growth amount removed.
- Quarantine and pre-shipment (QPS) hectares is the area in the applicant's request subject to QPS treatments. Not applicable in this sector.
- Only the hectares affected by one or more of the following impacts were included in the nominated amount: moderate to heavy key pest pressure, regulatory impacts, karst geology, buffer zones, unsuitable terrain, and cold soil temperatures.

Renomination Form Part G: CHANGES TO QUANTITY OF METHYL BROMIDE REQUESTED

This section seeks information on any changes to the Party's requested exemption quantity.

(Renomination Form 16.) CHANGES IN USAGE REQUIREMENTS
Provide information on the nature of changes in usage requirements, including whether it is a change in dosage rates, the number of hectares or cubic metres to which the methyl bromide is to be applied, and/or any other relevant factors causing the changes.

A transition rate was applied based on the best estimate of yield losses and feasibility associated with likely methyl bromide alternatives that could be made by USG biologists and economists. In addition, a dosage rate of 150 kg/ha (for areas where disease pathogens were considered to be key pests) and 175 kg/ha (for areas where weeds were considered to be key pests) was used in calculating the amount of methyl bromide requested.

Certification requirements of these commodities restrict some transition to certain alternatives. Please also see Appendix A.

(Renomination Form 17.) RESULTANT CHANGES TO REQUESTED EXEMPTION QUANTITIES

QUANTITY REQUESTED FOR PREVIOUS NOMINATION YEAR:	51,102 kg
QUANTITY APPROVED BY PARTIES FOR PREVIOUS NOMINATION YEAR:	51,102 kg
QUANTITY REQUIRED FOR YEAR TO WHICH THIS REAPPLICATION REFERS:	45,282 kg

Part B: CROP CHARACTERISTICS AND METHYL BROMIDE USE

10. KEY DISEASES AND WEEDS FOR WHICH METHYL BROMIDE IS REQUESTED AND SPECIFIC REASON FOR THIS REQUEST IN EACH REGION (*List only those target weeds and pests for which methyl bromide is the only feasible alternative and for which CUE is being requested*):

TABLE B 1. KEY DISEASES AND WEEDS.

REGION WHERE METHYL BROMIDE USE IS REQUESTED	KEY DISEASE(S) AND WEED(S) TO SPECIES AND, IF KNOWN, TO LEVEL OF RACE	SPECIFIC REASONS WHY METHYL BROMIDE NEEDED (E.G. EFFECTIVE HERBICIDE AVAILABLE, BUT NOT REGISTERED FOR THIS CROP; MANDATORY REQUIREMENT TO MEET CERTIFICATION FOR DISEASE TOLERANCE; NO HOST RESISTANCE FOR A SPECIFIC RACE)
Western Raspberry Growers	Primarily pathogens: *Phytophthora fragariae* var. *Rubi* (root rot), *Verticillium* spp. (wilt), others including *Pythium* spp., *Rhizoctonia* spp.	To meet certification requirements for sale of nursery stock.
California Deciduous Fruit and Nut Tree Growers	**Nuts:** Nematodes—*Pratylenchus vulnus* (root lesion), *Meloidogyne* spp. (root knot), *Helicotylenchus dihystera* (spiral), *Xiphinema americanum* (dagger). **Stone Fruit:** Nematodes—*Helicotylenchus dihystera* (spiral), *Tylenchus mexicanus* (Tylenchus), *Tylenchorhynchus* spp. (stunt), *Trichodorus* spp. (stubby root)	Nurseries providing stock for orchards are required to provide the stock that is pest-free (and particularly nematode-free). 1,3-D is an effective nematicide, but its use is restricted in California. Compounds producing methyl isothiocyanate (MITC) have been tested as possible alternatives (e.g., metam-sodium and dazomet) but nematode control was not sufficient to meet certification requirements. The goal in the orchard nursery industry is 99.9% control when sampled within 30-60 days after treatment, so certification can be met when stock is harvested 18 months later (McKenry, 2000). Generally, less than 98% control in the 30-60 day sampling period will yield unacceptable stock plants. Field moisture is a carefully monitored factor. A site (e.g., walnut nursery in Davis, California) with silty clay loam over sandy loam or clay loam has moisture differential with the lighter textured soils holding more moisture (>12%), which can impede distribution of an alternative such as 1,3-D (McKenry, 2000) and make it ineffective. In California deciduous tree nurseries, approximately 30% have silt or clay loam soils requiring methyl bromide. The remaining 70% have sand or sandy loam soils. Approximately one half of these areas have a critical need for methyl bromide due to moisture requirements. According to the applicant, approximately 65% of nursery soils in California have a critical need for methyl bromide. Township caps for 1,3-D may further limit the use of the best alternative.
California Nursery Roses	Root knot nematode (*Meloidogyne hapla*); lesion nematode (*Pratylencus penetrans*); pin nematode (*Paratylenchus hamatus*); *Verticillium dahlia*; *Pythium* spp.; *Agrobacterium tumefaciens*; weeds (including *Cyperus* spp.)	California regulations state that nursery stock must be commercially clean with respect to established pests of general distribution. County agricultural officials may certify a crop based on the completion of a prescribed fumigation regime, such as the use of methyl bromide (CDFA, 2001).

11. (i) CHARACTERISTICS OF CROPPING SYSTEM AND CLIMATE *(Place major attention on the key characteristics that affect the uptake of alternatives)***:**

TABLE B 2. CHARACTERISTICS OF CROP SYSTEM AND CLIMATE

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED		
	RASPBERRIES	FRUIT & NUTS	ROSES*
CROP TYPE, E.G. TRANSPLANTS, BULBS, TREES OR CUTTINGS	Raspberry cane stock	Nursery tree stock	Transplant production
ANNUAL OR PERENNIAL CROP (STATE NUMBER OF YEARS BETWEEN REPLANTING)	Perennial (2-3 years)	Perennial (1 to 2 years in nursery)	Perennial (see below)

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED		
	RASPBERRIES	FRUIT & NUTS	ROSES*
‵YPICAL CROP ROTATION (IF ANY) AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION (IF ANY)	1 year in foundation nursery, 1 year in commercial nursery. The raspberry nursery industry utilizes flat fumigation techniques similar to that of the strawberry industry. Raspberry nursery stock are grown using a two year production cycle beginning with tissue culture and moving to foundation nurseries the first year. Winter dormant plants are replanted in commercial nurseries and harvested after one year	The tree production cycle can be anywhere from 1 year to several years depending on the type of tree crop. Nursery production of trees takes from 1-4 years. Almonds take one year, walnuts take at least two years. Also, desired tree size determines how long it is grown in the nursery. A typical cycle is for the tree crop to be in the ground for either 1 or 2 years. A typical nursery cycle starts by digging the current tree crop (to be sold) then planting a cover crop for 1 or 2 years, followed by replanting with a tree crop. Fields are disked, deep ripped, leveled, and then fumigated to meet certification standards set by the California Department of Food and Agriculture (CDFA, 2001). A shank is used to apply a fumigation of 75% methyl bromide and 25% chloropicrin, typically at a rate of 340 kg per hectare. The treated area is covered with a high barrier tarp. The fumigation is carried out around August and September, and planting begins in October, and may continue through January. The deciduous nurseries are subject to mandates set forth by the CDFA, that trees must be pest-free.	Typically, crop rotation for a two-year rose crop includes one-year fallow, followed by one or two years of rotational crops, and then a two-year rose crop. This rotation varies depending on the type of rose crop being produced (i.e., two-year roses, one-year minis and patio trees, or an 18-month mini bush).
SOIL TYPES: (SAND LOAM, CLAY, ETC.)	Typically light or medium	Mostly sandy loam (also sandy clay loam, sandy loam, silt loam, clay loam); light soils (20%), medium (50%), heavy (30%)	Medium soil with 0 to 2% organic matter.

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED		
	RASPBERRIES	FRUIT & NUTS	ROSES*
TYPICAL DATES OF PLANTING AND HARVEST	Planting: May Harvest: Oct-Nov	Planting: Oct-Jan Harvest: following year or two (varies w/crop)	Planting: Nov-Dec Harvest: Dec (following year)
TYPICAL DATES OF METHYL BROMIDE FUMIGATION	March-April	Aug-Sept	August
FREQUENCY OF METHYL BROMIDE FUMIGATION (E.G. EVERY TWO YEARS)	Once in 2-3 years	Typically once in 3-4 years, depending on crop	Once every 4 to 5 years (a typical grower fumigates and plants approximately 20-25% of the production area each year).
TYPICAL SOIL TEMPERATURE RANGE DURING METHYL BROMIDE FUMIGATION (E.G. 15-20°C)	Various	Various	52-56
CLIMATIC ZONE (E.G. TEMPERATE, TROPICAL)	USDA zones 8a, 9a, 9b	USDA zones 8a, 9a, 9b, 10a, 10b	USDA zone 9a (primarily in the San Joaquin Valley – 55% to 65% of U.S. rose plant production is located around Wasco, Kern County, CA)
ANNUAL AND SEASONAL RAINFALL (MM)	Various	Various	Various
RANGE IN AVERAGE TEMPERATURE VARIATIONS IN MID WINTER AND MID SUMMER (E.G. MIN/MAX °C) (E.G. JAN 5-15°C, JULY 10-30°C	Various	Various	Various
OTHER RELEVANT FACTORS:	Ten hectares of plants in a foundation nursery will provide for 100 hectares of a commercial nursery. A commercial nursery produces enough plants to provide 1200 hectares of commercial fields	Nursery stock is inspected by county agricultural commissioners through the California Department of Food and Agriculture (CDFA). Stock must be "found free of especially injurious pests and disease symptoms" to qualify for the CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments (CDFA, 2001). 1,3-D is a legally acceptable treatment where township restrictions and physical limitations (e.g., moisture greater than 12% in many soils reduces efficacy of 1,3-D) do not prevent its	The perennial nature of the crop requires pest control to a depth of 1.5 meters. Certification requires commercially clean stock. In tree nursery production, there must be 99.9% nematode control in the first 30 to 60 days to meet this requirement (McKenry, 2000).

CHARACTERISTICS	REGION WHERE METHYL BROMIDE IS REQUESTED		
	RASPBERRIES	FRUIT & NUTS	ROSES*
		use.	

*The planting and fumigation schedule are for 1 year roses. According to the consortium, 2-year roses are planted from Nov-Jan on ground fumigated the previous summer. In Jan and Feb of the 2nd year, tops are cut to force out the grafted variety. The finished crop is harvested from Nov-Jan, two years after planting. The ground is followed by a 1 or 2 year rotational crop before roses are planted again.

(ii) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11.(i) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?

Soil structure and texture can impact transition to alternatives (e.g., metam-sodium does not consistently dissipate in heavy soils due to low vapour pressure). Delay in planting due to plantback restrictions can occur with some alternatives (1,3-D) due to longer fumigation time required under tarp. Regulatory restrictions can impact use of 1,3-D and chloropicrin.

Soil moisture content of greater than 12% reduces efficacy of 1,3-D and is not an acceptable treatment to comply with certification standards. Soils that are dry are unusual at 1.5 meters (the depth required to be nematode-free) (CDFA, 2001) especially with moderate to heavy subsoils. Approximately 65% of nurseries require methyl bromide to meet certification requirements (especially in wet years). Areas with light soils and dry conditions generally have good results from 1,3-D (where township caps allow its use) and combinations with chloropicrin and/or metam-sodium.

12. HISTORIC PATTERN OF USE OF METHYL BROMIDE, AND/OR MIXTURES CONTAINING METHYL BROMIDE, FOR WHICH AN EXEMPTION IS REQUESTED

(*Add separate table for each major region specified in Question 8*):

TABLE B 3A. WESTERN RASPBERRY GROWERS -: HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	111	103	131	151	134	130
RATIO OF FLAT FUMIGATION* METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Flat	Flat	Flat	Flat	Flat	Flat
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	26,937	24,188	30,570	37,680	34,937	31,840
FORMULATIONS OF METHYL BROMIDE	67:33 or 57:43	67:33 or 57:43	67:33 or 57:43	67:33 or 57:43	67:33 or 57:43	67:33 or 57:43
METHOD BY WHICH METHYL BROMIDE APPLIED)	Shank injected, with tarp	Shank injected, with tarp	Shank injected, with tarp	Shank injected, with tarp	Shank injected, with tarp	Shank injected, with tarp
APPLICATION RATE OF ACTIVE INGREDIENT (kg/ha)*	242	235	234	249	260	247
ACTUAL DOSAGE RATE OF ACTIVE *(g/m^2)**	25.8	24.2	23.5	23.4	25.2	24.7

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

TABLE B 3B. CALIFORNIA DECIDUOUS FRUIT AND NUT TREE GROWERS. - HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	639	633	651	630	442	521
RATIO OF FLAT FUMIGATION* METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Flat	Flat	Flat	Flat	Flat	Flat
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)*	207,755	194,965	208,391	201,309	141,111	170,488
FORMULATIONS OF METHYL BROMIDE	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED)	Shank injected with tarp	Shank injected with tarp	Shank injected with tarp	Shank injected with tarp	Shank injected with tarp	Shank injected with tarp
APPLICATION RATE OF ACTIVE INGREDIENT (kg/ha)*	325	308	320	319	319	326
ACTUAL DOSAGE RATE OF ACTIVE *(g/m^2)**	32.5	30.8	32.0	31.9	31.9	32.6

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

TABLE B3C. CALIFORNIA NURSERY ROSES - HISTORIC PATTERN OF USE OF METHYL BROMIDE

FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY:	2000	2001	2002	2003	2004	2005
AREA TREATED *(hectares)*	609	647	584	576	459	470
RATIO OF FLAT FUMIGATION* METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED	Flat	Flat	Flat	Flat	Flat	Flat
AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kg)*	217,588	219,938	196,496	161,479	144,286	157,992
FORMULATIONS OF METHYL BROMIDE *(methyl bromide /chloropicrin)*	98:2	98:2	98:2	98:2	98:2	98:2
METHOD BY WHICH METHYL BROMIDE APPLIED	Shanked 25 cm and tarped	Shanked 25 cm and tarped	Shanked 25 cm and tarped	Shanked 25 cm and tarped	Shanked 25 cm and tarped	Shanked 25 cm and tarped
APPLICATION RATE OF ACTIVE INGREDIENT **(kg/ha)***	357	340	336	280	315	336
ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *(g/m^2)**	35.7	34.0	33.6	28.0	31.5	33.6

** For Flat Fumigation treatment application rate and dosage rate may be the same.*

Part C: TECHNICAL VALIDATION
Renomination Form Part D: REGISTRATION OF ALTERNATIVES

13. REASON FOR ALTERNATIVES NOT BEING FEASIBLE (*Provide detailed information on a minimum of the best two or three alternatives as identified and evaluated by the Party, and summary response data where available for other alternatives (for assistance on potential alternatives refer to MBTOC Assessment reports, available at http://www.unep.org/ozone/teap/MBTOC , other published literature on methyl bromide alternatives and Ozone Secretariat alternatives when available)*:

TABLE C 1. REASONS FOR ALTERNATIVES NOT BEING FEASIBLE.

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
CHEMICAL ALTERNATIVES		
Chloropicrin	Restrictions of chloropicrin used alone. Not sufficiently effective to meet standards for pest-free nursery stock. Reduction in formulation of methyl bromide with chloropicrin to 45:55 may be achieved by 2011, if tarp technology is successfully implemented and regulations do not prevent its use..	Not alone
1,3-dichloropropene (1,3-D)	For nematodes as key pests, areas with moisture restrictions (e.g., >12% at 1-1.5 meters) (McKenry, 2000, 2001) or township caps would not be able to meet standards for pest-free nursery stock; nurseries with no such restrictions should be able to use 1,3-D as an alternative for control of nematodes. Township caps are in place for 1,3-D. California rose growers are located within two townships in one county, and rose growers compete for the use of 1,3-D with growers of almonds, carrots, and other crops (Trout, 2001). Buffer zones reduce the amount of land that can be treated with 1,3-D.	Yes
Metam-sodium	Not listed as acceptable for certification; may be an acceptable treatment for weed problems where conditions are amenable. Some research indicates that a certification problems occur because metam-sodium did not move deep enough into the soil (at the 1.2 to 1.5 meter depth metam sodium did not control the nematodes) (Schneider et al, 2002a; McKenry, 1999).	Not listed as effective for certification standards
Dazomet	As with metam-sodium, would not meet standards for nursery. The use of dazomet in combination with 1,3-D was examined in a study submitted by the applicant. The study showed that although weed populations were suppressed, nematode populations were not controlled, causing stock to be commercially unacceptable. When dazomet was used in combination with 1,3-D, nematode populations were 15 times greater when compared to that of a dual application of 1,3-D.	Not listed as effective for certification standards
NON CHEMICAL ALTERNATIVES		

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Containerized production	A field is planted with tissue culture plugs. The wide, flat planting beds allow these plants to grow laterally in all directions and to produce long straight roots. The nursery is watered using overhead irrigation, this creates optimal growing conditions over the entire surface area of the beds. At the end of the growing season when plants are dormant they are mowed to about 20 cm long. The canes are chopped into small pieces and later they are incorporated into the soil to increase the organic matter. Then the beds are "lifted" and shaken, this removes soil from the plants and makes it easier to pick the plants up and place them in a box for transfer to the trimming operation. This system is efficient because the crews can move up each row with a mower, then the lifter followed by several workers who transfer the plants into the bin for movement to the trimming operation (Maybe add a sentence such as: Containerized production would change this efficient harvesting system and require different equipment.). Plants are produced with long straight roots, which are trimmed from the canes. The trimmed roots provide the root planting material used by the growers. Generally, container-grown plants produce shorter or curved roots. New canes are produced from adventitious root buds, it is likely that any reduction in surface area would reduce the number and/or quality (size, strength) of these new adventitious canes. Nursery managers have observed that when raspberries are grown in pots, the south, or hot, side of the pot has a reduced or absent root system, which reduces yield and increases water demands. Some of the largest nurseries are located in the eastern San Joaquin Valley of California where temperatures can reach over 40º C in the summer. Roots are not as large or healthy as what is produced in field systems.	Not feasible for most of industry
Virtually Impermeable Film (VIF)	May have a role in reducing methyl bromide use rates while maintaining efficacy due to reduced emissions (Guillino et al., 2002; Martin, 2003). Ongoing studies may help assess value of VIF with methyl bromide and chemical alternatives (VIF use is restricted in California).	May become more economical as technology develops; regulatory restrictions will have to be revised.

NAME OF ALTERNATIVE	TECHNICAL AND REGULATORY* REASONS FOR THE ALTERNATIVE NOT BEING FEASIBLE OR AVAILABLE	IS THE ALTERNATIVE CONSIDERED COST EFFECTIVE?
Biofumigation, solarization, steam heat, biological control, cover crops/mulches, crop rotation, flooding and water management, grafting/resistant rootstocks, organic amendments, sanitation, and resistant cultivars	Some of these alternatives are important components of an IPM system and are currently employed by the industry. These practices include field sanitation to reduce inoculum, crop rotation to reduce hosts, and attempts to breed resistance to pathogens. However, these alternatives will not meet requirements of CDFA for nursery stock certification either individually or in combinations. Use of flooding is not practical because of the topographic features of many production areas and requirements for excessive water use. The use of steam also requires large quantities of water and is slow and expensive to perform, which would impact planting and production intervals for this industry. Use of solarization is not practical due to the depth of heating required to eliminate propagules; environmental constraints at high altitude nurseries, including high winds, are of concern.	Not feasible without additional treatments to meet certification requirements
COMBINATIONS OF ALTERNATIVES		
(1,3-D) + chloropicrin	In areas with moisture restrictions (e.g., >12% at 1-1.5 meters) (or under township caps) would not be able to meet standards for pest-free nursery stock; nurseries with no such restrictions should be able to use 1,3-D as an alternative	Where soil conditions and township caps allow use
(1,3-D) + chloropicrin + metam-sodium or dazomet	In areas with moisture restrictions (e.g., >12% at 1-1.5 meters) (or under township caps) would not be able to meet standards for pest-free nursery stock; nurseries with no such restrictions should be able to use 1,3-D as an alternative Metam-sodium may be helpful where weeds are problems.	Where soil conditions and township caps allow use

14. LIST AND DISCUSS WHY REGISTERED PESTICIDES AND HERBICIDES ARE CONSIDERED NOT EFFECTIVE AS TECHNICAL ALTERNATIVES TO METHYL BROMIDE (*Provide information on a minimum of two best alternatives and summary response data where available for other alternatives)*:

Nurseries must produce pest-free plant stock to their respective growers. Quality of stock plants may have a greater place in the requirements of the nursery managers than quantity since there can be an exponential increase in pest pressure when infested nursery stock is transferred to production fields. Therefore, the threshold for nurseries to manage pest problems is higher than might be for field production and critical need for effective pest management tools is paramount. Because locations of nurseries vary and soil, climate, and water situations are variable, alternatives such as 1,3-D, may be acceptable substitutes for methyl bromide under some conditions. Results of meta-analyses (Larson and Shaw, 2000; Shaw and Larson, 1999) of numerous research studies indicate that for the nurseries unable to use 1,3-D, other alternatives are not sufficiently effective to meet their production needs. The industry has indicated that by 2011, they can use a reduced formulation of methyl bromide (45:55) with chloropicrin if low permeable films can be successfully used and if permits are available for higher rates of chloropicrin.

15. STATE RELATIVE EFFECTIVENESS OF RELEVANT ALTERNATIVES COMPARED TO METHYL BROMIDE FOR THE SPECIFIC KEY TARGET PESTS AND WEEDS FOR WHICH IT IS BEING REQUESTED (*Use the same regions as in Section 10 and provide a separate table for each target pest or disease for which methyl bromide is considered critical. Provide information in relation to a minimum of the best two or three alternatives.*)

Some studies reported for the raspberry nursery region were based on strawberry research, a crop with similar pest problems to raspberry, and because of the large size of the industry, a greater resource for research data.

TABLE C 2. WESTERN RASPBERRY NURSERY GROWERS --FRUIT YIELD (GRAMS PER PLANT) OF STRAWBERRY* AT WATSONVILLE, CA IN 2002.

Nursery treatment (high elevation, MacDoel, CA)	Field treatment (Watsonville)	Marketable fruit yield (g/plant)	Unmarketable fruit yield (g/plant)	Total fruit yield (g/plant)
control	Pic	1301.7	535.6	1837.3
methyl bromide/Pic	Pic	1235.8	550.9	1786.6
MI/Pic	Pic	1278.2	525.0	1803.3
Chloropicrin followed by dazomet	Pic	1388.4	575.1	1963.4
Telone C35 followed by dazomet	Pic	1346.4	553.3	1899.7
control	methyl bromide/Pic	1520.3	600.1	2120.4
methyl bromide/Pic	methyl bromide/Pic	1474.0	596.3	2070.3
MI/Pic	methyl bromide/Pic	1526.8	625.0	2151.8
Chloropicrinfollowed by dazomet	methyl bromide/Pic	1634.5	640.6	2275.1
Telone C35 followed by dazomet	methyl bromide/Pic	1434.1	634.0	2068.1
ANOVA		------------------------P values----------------------		
Nursery		0.04*	0.24	0.07
Field		<0.0001*	<0.0001*	<0.0001*
Nursery (field)		0.47	0.74	0.73
		* indicates significance		

Footnote: The ‘nursery’ column indicates the treatment of nursery plants grown in 2001; the ‘field’ column indicates the fumigation treatment in the field.]
* Studies reported were based on strawberry research, a crop with similar pest problems to raspberry, and because of the large size of the industry, a greater resource for research data.

Source: Kabir, Z., Fennimore, S., Martin, F., Ajwa, H., Duniway, J., Browne, G., Winterbottom, C., Westerdahl, B., Goodhue, R., Guerrero, L., Haar, M. 2003. Alternative[s] Fumigants for the Control of Soil Pests: Strawberry as a Model System. Methyl Bromide Alternatives Conference (2003). www.mbao.org. Similar results of ongoing studies were published by Kabir et al. (2005).

Key to Abbreviations: For **nursery treatments**: **control**= no fumigation; **methyl bromide/chloropicrin (methyl bromide/Pic)** = 57:43, 450 kg/ha; **methyl iodide/chloropicrin (MI/Pic)** = 50:50, 392 kg/ha; **1,3-D/chloropicrin (Telone C35)** (300 liters/ha) followed by **dazomet (280 kg/ha)**; **chloropicrin (Pic)** (336 kg/ha) followed by **dazomet** (280 kg/ha).

For **field treatments**: **control**= no fumigation; **methyl bromide/Pic**, 67:33 (392 kg/ha); **Chloropicrin** (224 kg/ha).

TABLE C 3. WESTERN RASPBERRY NURSERY GROWERS--FRUIT YIELD (GRAMS PER PLANT) OF STRAWBERRY* AT WATSONVILLE, CA IN 2003.

Nursery treatment (high elevation, MacDoel, CA)	Field treatment (Watsonville)	Marketable fruit yield (g/plant)	Unmarketable fruit yield (g/plant)	Total fruit yield (g/plant)
control	Pic	1270.2	1092.5	2362.7
methyl bromide/Pic	Pic	1244.2	1070.5	2314.7
MI/Pic	Pic	1153.7	992.9	2146.6
Chloropicrin followed by dazomet	Pic	1324.6	1059.4	2384.0
Telone C35 followed by dazomet	Pic	1220.2	1069.7	2289.9
control	methyl bromide/Pic	1177.2	1216.1	2393.3
methyl bromide/Pic	methyl bromide/Pic	1132.2	1179.8	2311.9
MI/Pic	methyl bromide/Pic	1050.8	1106.2	2157.0
Chloropicrinfollowed by dazomet	methyl bromide/Pic	1166.9	1249.2	2416.0
Telone C35 followed by dazomet	methyl bromide/Pic	1111.0	1176.9	2287.9
ANOVA		------------------------P values---------------------		
Nursery		0.001*	0.003*	0.0001*
Field		<0.0001*	<0.0001*	0.70
Nursery (field)		0.92	0.60	0.99
		* indicates statistical significance		

Footnote: The 'nursery' column indicates the treatment of nursery plants grown in 2002; the 'field' column indicates the fumigation treatment in the field.
* Studies reported were based on strawberry research, a crop with similar pest problems to raspberry, and because of the large size of the industry, a greater resource for research data.

Source: Kabir, Z., Fennimore, S., Martin, F., Ajwa, H., Duniway, J., Browne, G., Winterbottom, C., Westerdahl, B., Goodhue, R., Guerrero, L., Haar, M. 2003. Alternative[s] Fumigants for the Control of Soil Pests: Strawberry as a Model System. Methyl Bromide Alternatives Conference (2003). www.mbao.org. Similar results of ongoing studies were published by Kabir et al. (2005).

Key to Abbreviations: For **nursery treatments**: **control**= no fumigation; **methyl bromide/chloropicrin (methyl bromide/Pic)** = 57:43, 450 kg/ha; **methyl iodide/chloropicrin (MI/Pic)** = 50:50, 392 kg/ha; **1,3-D/chloropicrin (Telone C35)** (300 liters/ha) followed by **dazomet (280 kg/ha)**; **chloropicrin (Pic)** (336 kg/ha) followed by **dazomet** (280 kg/ha).

For **field treatments**: **control**= no fumigation; methyl **bromide/Pic**, 67:33 (392 kg/ha); Chloropicrin (224 kg/ha).

This strawberry yield research study was conducted at three strawberry runner nurseries. Plants were grown for three years at two high elevation nurseries (HEN) or for two years at a low elevation nursery (LEN). Plants were then placed in two different field locations (Watsonville and Oxnard) for marketable yield assessments. Plants received various fumigation treatments at both nursery and field locations (results from two trials, conducted in 2002 and 2003, are presented in Tables 15.1 and 15.2, above).

Pests were not identified and only yields were evaluated. In the 2002 test, "…fruit yield was significantly greater under the on-site methyl bromide/chloropicrin treatment than in chloropicrin treatment alone" (Table 15.1). The fumigants used at the nursery had "…positive carryover effects on marketable fruit yield when the treatment was chloropicrin [followed by] Basamid".

The results at the Watsonville location for the 2003 test showed "…marketable fruit yield was increased (9%) in on-site chloropicrin treatments compared to methyl bromide/chloropicrin treatments. In contrast, non-marketable fruit yield was significantly greater (4%) under methyl bromide/chloropicrin than under chloropicrin (Table 15.2). The authors again noted that the nursery treatments had significant carryover effects on the fruit yield. They "…suggest that application of chloropicrin [followed by] Basamid [dazomet] at the HEN increased runner plant production, which eventually improved fruit yield with chloropicrin in the fruiting field. Chloropicrin could be a viable alternative to methyl bromide/chloropicrin". No interaction was found between the fumigations at the nursery and field, therefore, the effects were considered additive.

TABLE C 4. WESTERN RASPBERRY NURSERY GROWERS.: EFFECTIVENESS OF ALTERNATIVES – YIELD (STRAWBERRY TRIALS)

KEY PEST: DISEASES	AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS				
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES		DISEASE (% OR RATING)	# OF TRIALS	ACTUAL YIELDS* (T/HA)	CITATION
[1] methyl bromide (263 kg/ha) + chloropicrin (129 kg/ha) [2] chloropicrin (140 kg/ha) [3] no fumigation		No pests identified	12 reps	Runners/mother plant (strawberry) [1] 18.0a [2] 15.7b [3] 7.9c	Larson and Shaw, 2000
[1] methyl bromide (314 kg/ha) + chloropicrin (78 kg/ha) [2] chloropicrin (191 kg/ha) [3] chloropicrin (303 kg/ha) [4] no fumigation		No pests identified	4 reps	Runners/mother plant (strawberry) [1] 29.7a [2] 27.0a [3] 29.7a [4] 11.2b	Larson and Shaw, 2000
[1] methyl bromide (263 kg/ha) + chloropicrin (129 kg/ha) [2] chloropicrin (157 kg/ha) [3] chloropicrin (314 kg/ha) [4] no fumigation		No pests identified	24 reps	Runners/mother plant (strawberry) [1] 18.8a [2] 16.7b [3] 18.9a [4] 10.3c	Larson and Shaw, 2000
[1] methyl bromide (263 kg/ha) + chloropicrin (129 kg/ha) [tarped, noble plow] [2] chloropicrin (168 kg/ha) [3] chloropicrin (336 kg/ha) [4] 1,3-D (134 kg/ha) + chloropicrin (314 kg/ha) [5] 1,3-D (361 kg/ha) + chloropicrin (155 kg/ha) [6] no fumigation		No pests identified	12 reps (methyl bromide trt, 11 reps)	Runners/mother plant (strawberry) [1] 39.2a [2] 28.6bc [3] 33.8abc [4] 35.8ab [5] 33.0bc [6] 15.8d	Larson and Shaw, 2000

* Some studies reported were based on strawberry research, a crop with similar pest problems to raspberry, and because of the large size of the industry, a greater resource for research data.

TABLE C 5. CALIFORNIA DECIDUOUS FRUIT & NUT TREE GROWERS.: EFFECTIVENESS OF ALTERNATIVES – NEMATODES

KEY PEST: NEMATODES			
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	**# OF TRIALS**	**DISEASE (% OR RATING)**	**CITATION**
[1] untreated [2] methyl bromide (568 kg/ha) [Tarped] [3] 1,3-D (272 kg/ha) + chloropicrin (155 kg/ha) [Telone 35, Untarped] [4] 1,3-D (312 kg/ha) + chloropicrin (177 kg/ha) [Telone 35, Tarped] [5] chloropicrin (400 kg/ha) [Untarped] [6] chloropicrin (455 kg/ha) [Tarped]	Mean of 6 reps. in vine, tree, berry field nursery trial	**Rootknot nematode population/cc soil sampled at 120-150 cm depth** [1] 21.3a [2] 0b [3] 0b [4] 2.2b [5] 0b [6] 0b	Schneider et al., 2002b
[1] untreated [2] methyl bromide (285 kg/ha) [Tarped, Fall] [3] methyl bromide (285 kg/ha) [Tarped, Spring] [4] metam-sodium (425 kg/ha injected + 329 kg/ha overlay rotovate) [Tarped] [5] metam-sodium (425 kg/ha injected + 329 kg/ha overlay rotovate) [Untarped]	4 reps, trial Malin, Oregon, 2001; loamy sand; moisture 2% at surface, 19% at 1 meter)	**Percent control of citrus nematode (bioindicator) compared to untreated:** [2] 93% (some survival at 80 cm depth) [3] 93% (some survival at 80 cm depth) [4] 81% (survival at 65-80 cm depth) [5] 73% % (survival below 5 cm depth)	Westerdahl et al., 2002
[1] untreated [2] methyl bromide (455 kg/ha) [shank, Tarped] [3 1,3-D (445 kg/ha) [drip Telone II EC; Tarped]	4 reps, artificially inoculated soils with rootknot and citrus nematodes to depths of 30 cm, 90 cm, and 150 cm	**Percent control of citrus and rootknot nematodes compared to untreated:** [2] 100% (at all depths) [3] significant nematode populations at 150 cm; control at 30 cm was "excellent"	Schneider et al., 2003a

California Rose Growers:

Perennial Crop Nurseries—Performance of Methyl Bromide Alternatives in the Field (Schneider et al, 2004). "Rootknot nematode was found in the roots of plants grown in the untreated plots and in plots treated with MIDAS [methyl iodide , 30% and chloropicrin, 70% @ 448 kg/ha drip applied], untarped Telone C35, chloropicrin [224 kg/ha, split application], metam sodium, and Iota [bacterial suspension]. Treatments resulting in nematode infested roots are not acceptable for certified nursery use. The largest plants were in plots treated with methyl bromide or tarped Telone C35".

Evaluation of Alternatives to Methyl Bromide for Roses (Schneider et al, 2002a; Schneider et al, 2003b). Preliminary data from a study by the Agricultural Research Service, USDA were submitted. Nematodes were sampled in 250 cc soil at the following depths: 0-0.3 meters, 0.3-0.6 meters, 0.6-0.9 meters, 0.9-1.2 meters, and 1.2-1.5 meters. Stunt nematode (*Tylenchorhynchus spp.*) was predominantly found at the site, but populations of root knot nematode (*Meloidogyne spp.*) and stubby root nematode (*Paratrichodorus spp.*) were also present at low levels. The only alternatives that provided control to the lowest depth (1.2 to 1.5 meters) were methyl bromide and methyl iodide drip applications, although these results were not statistically different from many of the other alternatives. The following year, additional data were collected, including weed ratings. methyl bromide had the best weed rating of all the alternatives. Additional data, including summer/fall nematode and fungal populations in the soil and plant quality at harvest, are yet to be collected. The results are shown in Tables 16.3 and 16.4.

Jackson and Perkins Fumigant Tests, 2003. Preliminary data submitted by Jackson and Perkins Operation, Inc. showed yield losses of 2–8% for metam-sodium (Vapam HL, 701 L/ha), yield losses of 5% for 1,3-D (Telone II, 309 L/ha), and for methyl bromide (336 kg/ha) yield gains of up to 10% to yield losses of 6% The data submitted gave yields compared to historic yields for numerous rose varieties. The first year results indicated that there was no nematode pressure in the trials. There was no statistical analysis on the results.

Other studies submitted were conducted on orchard and vineyard crops. Some the results are included in the tables below. These studies demonstrate that the alternatives do not provide the same level of nematode control as methyl bromide to the depth required.

TABLE C 6. CALIFORNIA NURSERY ROSES –EFFECTIVENESS OF ALTERNATIVES – NEMATODES

KEY PEST: NEMATODES	AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS		
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	# OF REPLICATIONS	TOTAL # NEMATODES AT A DEPTH ACROSS ALL REPLICATES (The results have been added across the 4 replicates – there is no statistical analysis on these results).	
		DEPTH	# OF NEMATODES
methyl bromide + CP (75/25) 535 lb/ac (599 kg/ha), tarped	4	0-1 feet (0-0.3 meters) 1-2 feet (0.3-0.6 meters) 2-3 feet (0.6-0.9 meters) 3-4 feet (0.9-1.2 meters) 4-5 feet (1.2-1.5 meters)	0 0 0 2 15
Dual application Telone C-35 @ 65 gpa (608 L/ha) or approx. 650 lb/acre (728 kg/ha)	4	0-1 feet (0-0.3 meters) 1-2 feet (0.3-0.6 meters) 2-3 feet (0.6-0.9 meters) 3-4 feet (0.9-1.2 meters) 4-5 feet (1.2-1.5 meters)	2 1 0 2 47
1,3-D (330 lb/ac (370 kg/ha)) then metam sodium drench (110 lb/ac (123 kg/ha))	4	0-1 feet (0-0.3 meters) 1-2 feet (0.3-0.6 meters) 2-3 feet (0.6-0.9 meters) 3-4 feet (0.9-1.2 meters) 4-5 feet (1.2-1.5 meters)	5 0 1 40 103
1,3-D (330 lb/ac (370 kg/ha)) then Basamid drench (200 lb/ac (224 kg/ha))	4	0-1 feet (0-0.3 meters) 1-2 feet (0.3-0.6 meters) 2-3 feet (0.6-0.9 meters) 3-4 feet (0.9-1.2 meters) 4-5 feet (1.2-1.5 meters)	0 0 0 2 16
Non-treated check	4	0-1 feet (0-0.3 meters) 1-2 feet (0.3-0.6 meters) 2-3 feet (0.6-0.9 meters) 3-4 feet (0.9-1.2 meters) 4-5 feet (1.2-1.5 meters)	98 455 416 836 216

McKenry, 2000 (this study was conducted on tree nurseries).

TABLE C 7. CALIFORNIA NURSERY ROSES –EFFECTIVENESS OF ALTERNATIVES – PHYTOPHTHORA

KEY PEST: PHYTOPHTHORA CITRICOLA	AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS		
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	# OF REPLICATIONS	TOTAL NUMBER OF COLONIES FORMED OUT OF 10 INOCULUM PIECES PLATED AT CERTAIN DEPTHS ACROSS ALL REPLICATES (*max # is 40 – 4 reps x10 pieces. No statistical analysis on these results)*	
		DEPTH	# OF COLONIES
methyl bromide + CP (75/25) 535 lb/ac (599 kg/ha), tarped	4	0.5 feet (0.2 meters) 2.0 feet (0.6 meters) 4.0 feet (1.2 meters)	0 10 40
Dual application Telone C-35 @ 65 gpa (608 L/ha) or approx. 650 lb/acre (728 kg/ha)	4	0.5 feet (0.2 meters) 2.0 feet (0.6 meters) 4.0 feet (1.2 meters)	0 0 20
1,3-D (330 lb/ac (370 kg/ha)) then metam sodium drench (110 lb/ac (123 kg/ha))	4	0.5 feet (0.2 meters) 2.0 feet (0.6 meters) 4.0 feet (1.2 meters)	5 20 38
1,3-D (330 lb/ac (370 kg/ha)) then Basamid drench (200 lb/ac (224 kg/ha))	4	0.5 feet (0.2 meters) 2.0 feet (0.6 meters) 4.0 feet (1.2 meters)	0 0 40
Non-treated check	4	0.5 feet (0.2 meters) 2.0 feet (0.6 meters) 4.0 feet (1.2 meters)	37 30 30

McKenry, 2000 (This study was conducted on tree nurseries).

TABLE C 8. CALIFORNIA NURSERY ROSES –EFFECTIVENESS OF ALTERNATIVES – STUNT NEMATODE

KEY PEST: STUNT NEMATODE	Disease (% or rating) Mean of 6 replications			
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	# OF REPS	0 – 0.3 METERS (0-12 INCHES)	0.6-0.9 METERS (24-36 INCHES)	1.2 – 1.5 METERS (48-60 INCHES)
Untreated	6	1.0 b*	29.8 a	5.8 ab
Methyl bromide – 350 lb/acre (392 kg/ha), tarped – noble plow	6	0.0 b	0.0 b	0.0 c
30% Iodomethane 70% Chloropicrin – 400 lb/acre (448 kg/ha), tarped – noble plow	6	0.0 b	0.0 b	0.4 bc
Telone C35 – 48 gal/acre (449 L/ha) – noble plow	6	0.0 b	0.9 b	6.2 ab
Telone C35 – 48 gal/acre (449 L/ha); untarped – telone rig	6	0.0 b	0.3 b	3.5 abc
Inline – 50 gal/acre (468 L/ha), drip	6	0.0 b	0.3 b	2.4 abc
Telone EC – 35 gal/acre (327 L/ha), drip	6	0.0 b	0.9 b	6.9 ab
Chloropicrin – 200 lb/acre (224 kg/ha), drip	6	0.0 b	3.0 b	13.3 a
Chloropicrin – 400 lb/acre (448 kg/ha), drip	6	0.0 b	1.4 b	4.8 abc
Chloropicrin – 200 + 200 lb/acre (224 + 224 kg/ha), drip	6	0.0 b	0.0 b	4.2 abc
30% Iodomethane 70% - 400 lb/acre (448 kg/ha), drip	6	0.0 b	0.0 b	0.0 c
50% Iodomethane 50% Chloropicrin – 300 lb/acre (336 kg/ha), drip	6	0.2 b	0.0 b	0.0c
Metam sodium – 75 gal/acre (701 L/ha) (42% a.i.), drip	6	0.2 b	0.0 b	10.0 a
Iota (a bacterial suspension from FUSION 360, Turlock, CA)	6	5.5 a	47.8 a	7.9 ab

Schneider et al, 2002b

* Statistical analysis conducted on log transformed (ln (n+1)) data. Data presented are the antilogs of the means. Stunt Nematode Populations per 250cc soil sampled at planting in a commercial rose trial. Results at other depths (12-24 inches (0.3-0.6 meters) and 36-48 inches (0.9-1.2 meters) are also available in the study.

TABLE C 9. CALIFORNIA NURSERY ROSES –EFFECTIVENESS OF ALTERNATIVES – ROOT KNOT NEMATODE

KEY PEST: ROOT KNOT NEMATODE	ROOT KNOT NEMTAODE POPULATIONS PER 100 CC SOIL SAMPLED AT PLANTING IN A COMMERCIAL ROSE TRIAL MARCH 2003		
METHYL BROMIDE FORMULATIONS AND ALTERNATIVES	# OF REPS	DISEASE (% OR RATING) # OF NEMATODES (SOIL SAMPLED TO A DEPTH OF 0.6 METERS (24 INCHES)	
		MEAN	RANGE
Untreated	6	18.0 a	0-805
Methyl bromide – 350 lb/acre (392 kg/ha), tarped – noble plow	6	0 c	0-0
30% Iodomethane 70% Chloropicrin – 400 lb/acre (448 kg/ha), tarped – noble plow	6	0 c	0-0
Telone C35 – 48 gal/acre (449 L/ha) – noble plow	6	0.8 bc	0-32
Telone C35 – 48 gal/acre (449 L/ha); untarped – telone rig	6	6.4 ab	0-354
Inline – 50 gal/acre (468 L/ha), drip	6	0 c	0-0
Telone EC – 35 gal/acre (327 L/ha), drip	6	0 c	0-0
Chloropicrin – 200 lb/acre (224 kg/ha), drip	6	0 c	0-0
Chloropicrin – 400 lb/acre (448 kg/ha), drip	6	0 c	0-0
Chloropicrin – 200 + 200 lb/acre (224 + 224 kg/ha), drip	6	0 c	0-0
30% Iodomethane 70% - 400 lb/acre (448 kg/ha), drip	6	0 c	0-0
50% Iodomethane 50% Chloropicrin – 300 lb/acre (336 kg/ha), drip	6	0 c	0-0
Metam sodium – 75 gal/acre (701 L/ha) (42% a.i.), drip	6	0.5 bc	0-12
Iota (a bacterial suspension from FUSION 360, Turlock, CA)	6	10.8 a	0-213

Schneider et al, 2003b
Statistical analyses conducted on log transformed (log (n+1)) data. Data presented are antilogs of the means, as well as the range of values. Means followed by the same letter are not significantly different at the *P*=0.05 level.

16. ARE THERE ANY OTHER POTENTIAL ALTERNATIVES UNDER DEVELOPMENT THAT THE PARTY IS AWARE OF WHICH ARE BEING CONSIDERED TO REPLACE METHYL BROMIDE? (*If so, please specify*):

There are a number of possibilities, including both chemical and non-chemical alternatives, which are being investigated for use as possible methyl bromide replacements. These range from iodo-methane, which has some potential to become a drop-in replacement for methyl bromide in pre-plant uses, to radio waves which may one day be used to sterilize the soil.

Until a chemical is registered, and only after efficacy against key pests is demonstrated in repeated trials at commercial scales, does the USG consider that a chemical or technology is a bona fide replacement for methyl bromide.

Advances in film technology of low permeable and colored films are proceeding. Protocols of the already identified alternatives (1,3-D, chloropicrin, dazomet, and metam-sodium) are being developed, primarily to identify the most effective combination or sequence of applications (e.g., chloropicrin followed by dazomet—see Kabir, et al., 2005). Iodomethane is not likely to be available for the 2009 use season in the U.S.

Raspberry nurseries have spent $100,000 on research, including $20,000 on screening resistance for *Phytophthora* and *Verticillium*, and over $60,000 over the last decade studying various alternatives in the large Watsonville, California area. . There are regulatory limitations to the use of 1,3-D, yet growers must meet certification requirements. In addition, 1,3-D does not control *Verticillium dahilae*, *Pythium* spp., which are pests of raspberry and roses nurseries. Studies are also ongoing to discover how application methods can improve efficacy of chemical alternatives such as 1,3-D and metam-sodium, and mixes of chemicals. Moisture constraints, both too much and too little, can reduce efficacy of effective chemicals such as 1,3-D, especially when soil textures are not optimal for their physical chemistry.

Currently, approximately 35% of the fruit and nut nurseries are able to use alternatives to MeBr. Research for methyl bromide alternatives has been conducted by the nursery industry since at least 1990, initially to find alternatives to 1,3-D, whose registration had been cancelled (Martin, 2003). Upon reinstatement in 1994, studies began to examine 1,3-D formulations that could provide acceptable nematode control under conditions (especially critical moisture conditions) common to commercial nursery sites that would meet certification requirements and reduce or replace the use of methyl bromide (Martin, 2003; McKenry, 2000). Successful treatment with 1,3-D depends on enough surface moisture to allow penetration into the soil, but less than 12% moisture.

Studies with emulsifiable formulations of 1,3-D and chloropicrin , such as Inline, may improve efficacy by removing technical limitations of shank injected 1,3-D. However, township caps, effective rates, buffer zones, and limitations due to physical characteristics of soils are still important issues to successful nursery production.

17. (i) ARE THERE TECHNOLOGIES BEING USED TO PRODUCE THE CROP WITHOUT METHYL BROMIDE? *(e.g. soilless systems, plug plants, containerised plants. State proportion of crop already grown in such systems nationally and if any constraints exist to adoption of these systems to replace methyl bromide use. State whether such technologies could replace a proportion of proposed methyl bromide use):*

Under some conditions (where soils are appropriate and regulations do not prohibit use) alternative chemicals are used and research is ongoing to increase efficacy, as has been described above. The raspberry industry has indicated that by 2011, they can use a reduced formulation of methyl bromide (45:55) with chloropicrin if low permeable films can be successfully used and if permits are available for higher rates of chloropicrin.

The deciduous tree nurseries use a double application of 1,3-D where moisture is less than 12% on light soils. This is allowed by California certification regulations, except where township restrictions apply or where plantback restrictions prevent the planting of a rotational crop.

(ii) IF SOILLESS SYSTEMS ARE CONSIDERED FEASIBLE, STATE PROPORTION OF CROP BEING PRODUCED IN SOILLESS SYSTEMS WITHIN REGION APPLYING FOR THE NOMINATION AND NATIONALLY:

Because of the large root size for these commodities, the grafting requirements, and the large volume of production, soilless systems are not considered feasible.

(iii) WHY ARE SOILESS SYSTEMS NOT A SUITABLE ALTERNATIVE TO PRODUCE THE CROP IN THE NOMINATION?

Containerized or soilless systems that use "plug plants" is not feasible for these nursery growers because virtually all production is by grafting onto resistant rootstock, not by the use of cuttings. Bareroot shipments of roses are usually in temperature controlled trucks of approximately 20,000 roses per truck. Container roses ship at approximately 2,000 roses per truck, resulting in a significant economic burden. Substrate production in CA is not acceptable for two reasons. One, roses are a deep rooted crop. Rose rootstock is grown for 18 months (called 1-year by the market) or 2 years resulting in root systems of 1 m. The containers do not allow full development of the root systems, which then reduces the vigor of the plant. Second, production in CA is not feasible based on the scale of production. Research will have to be conducted to determine the commercial feasibility of a change of this scale to soilless culture.

Progress in registration of a product will often be beyond the control of an individual exemption holder as the registration process may be undertaken by the manufacturer or supplier of the product. The speed with which registration applications are processed also can falls outside the exemption holder's control, resting with the nominating Party. Consequently, this section requests the nominating Party to report on any efforts it has taken to assist the registration process, but noting that the scope for expediting registration will vary from Party to Party.

(Renomination Form 11.) PROGRESS IN REGISTRATION

Where the original nomination identified that an alternative's registration was pending, but it was anticipated that one would be subsequently registered, provide information on progress with its registration. Where applicable, include any efforts by the Party to "fast track" or otherwise assist the registration of the alternative.

USG endeavors to identify methyl bromide alternatives in order to move them forward in the registration queue. However USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant. Please also see table below.

TABLE C 10. REGISTRATION STATUS OF METHYL IODIDE.

NAME OF ALTERNATIVE	Present Registration Status	REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)	DATE OF POSSIBLE FUTURE REGISTRATION:
Methyl Iodide	Not registered for use in U.S. Research label has been granted for small plots (approximately 1 ha). Formulation being considered is 50:50 (chloropicrin). Risk assessment for chloropicrin will have to be finalized prior to registration of methyl iodide. Registration will have to be pursued for these nurseries.	Yes	Unknown

(Renomination Form 12.) DELAYS IN REGISTRATION

Where significant delays or obstacles have been encountered to the anticipated registration of an alternative, the exemption holder should identify the scope for any new/alternative efforts that could be undertaken to maintain the momentum of transition efforts, and identify a time frame for undertaking such efforts.

USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant. Please see table above for additional detail.

(Renomination Form 13.) DEREGISTRATION OF ALTERNATIVES

Describe new regulatory constraints that limit the availability of alternatives. For example, changes in buffer zones, new township caps, new safety requirements (affecting costs and feasibility), and new environmental restrictions such as to protect ground water or other natural resources. Where a potential alternative identified in the original nomination's transition plan has subsequently been deregistered, the nominating Party would report the deregistration, including reasons for it. The nominating Party would also report on the deregistration's impact (if any) on the exemption holder's transition plan and on the proposed new or alternative efforts that will be undertaken by the exemption holder to maintain the momentum of transition efforts.

Six fumigants are undergoing a review of risks and benefits at present. A likely outcome of this review will be the imposition of additional restriction on the use of some or all of these chemicals. This process will not lead to proposed restrictions until 2008, at which point the process to modify labels will start. This process can take several years to complete. It is not possible to forecast the outcome of the soil fumigant analysis at this time.

An additional complication in forecasting changes in the registration of alternatives is that under the US federal system individual states may impose restrictions above those imposed at the Federal level. Examples of these additional restrictions include the township caps on Telone® in California and the "SLN" (Special Local Needs) restrictions on the same chemical in 31 Florida counties.

In addition, the California Department of Pesticide Regulation (DPR) may impose use restrictions and water seal requirements on all soil fumigants to reduce their contributions to volatile organic compounds as part of the efforts to meet the Federal Clean Air Standards for ground level ozone. DPR plans to finalize regulations in the next 2-3 months to meet a deadline imposed by a lawsuit concerning compliance with the 1994 pesticide component of the State Implementation Plan (SIP) on ozone. They are also in the process of devising what measures will be included in the next SIP (for June, 2007) to meet the new lower ozone standards.

Part D: EMISSION CONTROL
Renomination Form Part E: IMPLEMENTATION OF MBTOC/TEAP RECOMMENDATIONS

18. TECHNIQUES THAT HAVE AND WILL BE USED TO MINIMISE METHYL BROMIDE USE AND EMISSIONS IN THE PARTICULAR USE (*State % adoption or describe change*):

TABLE D 1. TECHNIQUES TO MINIMISE METHYL BROMIDE USE AND EMISSIONS.

TECHNIQUE OR STEP TAKEN	LOW PERMEABILITY BARRIER FILMS	METHYL BROMIDE DOSAGE REDUCTION	INCREASED % CHLOROPICRIN IN METHYL BROMIDE FORMULATION	DEEP INJECTION	LESS FREQUENT APPLICATION
WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?	Currently, many growers use HDPE tarps; other films are restricted in California. Metalized films are being studied	Most nurseries have reduced methyl bromide amounts to lower rate formulations. Between 1997 and 2001, the U.S. has achieved a 36% reduction in use rates.	May be feasible for some pests, if regulations allow a higher percentage of chloropicrin; some nurseries are using higher amounts of chloropicrin	Deep injections of methyl bromide are currently being used to provide the deep-rooted plant optimal pest-free environment	For certification of nursery stock, fumigation must occur prior to every planting
WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?	Research is underway to develop use in commercial production systems	Research is underway to develop use of a 50% methyl bromide formulation, especially for pathogen control, where allowed.	May be feasible for some pests, if regulations allow a higher percentage of chloropicrin	Deep injections of methyl bromide are currently being used to provide the deep-rooted plant optimal pest-free environment	For certification of nursery stock, fumigation must occur prior to every planting
OTHER MEASURES (PLEASE DESCRIBE)	Combination of methods using two or three chemicals and effective tarps (low permeability and/or various colors) and IPM methods are being studied to develop the most effective regimes for pest management. However, certification requirements may dictate treatment.				

19. IF METHYL BROMIDE EMISSION REDUCTION TECHNIQUES ARE NOT BEING USED, OR ARE NOT PLANNED FOR THE CIRCUMSTANCES OF THE NOMINATION, STATE REASONS:

Techniques to minimize emission include the use of low-permeability films, the application of water seals, and the "top dressing" application of fertilizer. In California, however, there is a performance standard for films that require a minimum level of permeability to methyl bromide to protect workers so low barrier films cannot be used with methyl bromide.

The application of water seals is dependent on the availability of adequate supplies of water and a lack of restrictions on water use as well as irrigation systems that will allow the application of sufficient quantities of water to effect the seal.

The Methyl Bromide Technical Options Committee and the Technology and Economic Assessment Panel may recommended that a Party explore and, where appropriate, implement alternative systems for deployment of alternatives or reduction of methyl bromide emissions.

Where the exemptions granted by a previous Meeting of the Parties included conditions (for example, where the Parties approved a reduced quantity for a nomination), the exemption holder should report on progress in exploring or implementing recommendations.

Information on any trialling or other exploration of particular alternatives identified in TEAP recommendations should be addressed in Part C.

(Renomination Form 14.) USE/EMISSION MINIMISATION MEASURES

Where a condition requested the testing of an alternative or adoption of an emission or use minimisation measure, information is needed on the status of efforts to implement the recommendation. Information should also be provided on any resultant decrease in the exemption quantity arising if the recommendations have been successfully implemented. Information is required on what actions are being, or will be, undertaken to address any delays or obstacles that have prevented implementation.

In accordance with the criteria of the critical use exemption, each party is required to describe ways in which it strives to minimize use and emissions of methyl bromide. The use of methyl bromide in the United States is minimized in several ways. First, because of its toxicity, methyl bromide has, for the last 40 years, been regulated as a restricted use pesticide in the United States. As a consequence, methyl bromide can only be used by certified applicators who are trained at handling these hazardous pesticides. In practice, this means that methyl bromide is applied by a limited number of very experienced applicators with the knowledge and expertise to minimize dosage to the lowest level possible to achieve the needed results. In keeping with both local requirements to avoid “drift” of methyl bromide into inhabited areas, as well as to preserve methyl bromide and keep related emissions to the lowest level possible, methyl bromide application for tomatoes is most often machine injected into soil to specific depths.

As methyl bromide has become more scarce, users in the United States have, where possible, experimented with different mixes of methyl bromide and chloropicrin. Specifically, in the early 1990s, methyl bromide was typically sold and used in methyl bromide mixtures made up of 98% methyl bromide and 2% chloropicrin, with the chloropicrin being included solely to give the chemical a smell enabling those in the area to be alerted if there was a risk. However, with the outset of very significant controls on methyl bromide, users have been experimenting with significant increases in the level of chloropicrin and reductions in the level of methyl bromide. While these new mixtures have generally been effective at controlling target pests, at low to moderate levels of infestation, it must be stressed that the long term efficacy of these mixtures is unknown.

Tarpaulin (high density polyethylene) is also used to minimize use and emissions of methyl bromide. In addition, cultural practices are utilized by tomato growers.

Reduced methyl bromide concentrations in mixtures, cultural practices, and the extensive use of tarpaulins to cover land treated with methyl bromide has resulted in reduced emissions and an application rate that we believe is among the lowest in the world for the uses described in this nomination.

USDA has several grant programs that support research into overcoming obstacles that have prevented the implementation of methyl bromide alternatives. In addition, USEPA and USDA jointly fund an annual meeting on methyl bromide alternatives. At this year's meeting (held in November in Orlando, Florida) sessions were to assess and prioritize research needs and to develop a use/emission minimization agenda for methyl bromide alternatives research.

Additional, specific, measures are provided in Table D 1 above.

Part E: ECONOMIC ASSESSMENT

20. (Renomination Form 15.) ECONOMIC INFEASIBILITY OF ALTERNATIVES – METHODOLOGY *(MBTOC will assess economic infeasibility based on the methodology submitted by the nominating Party. Partial budget analysis showing per hectare gross and net returns for methyl bromide and the next best alternatives is a widely accepted approach. Analysis should be supported by discussions identifying what costs and revenues change and why. The following measures may be useful descriptors of the economic outcome using methyl bromide or alternatives. Parties may identify additional measures. Regardless of the measures used by the methodology, it is important to state why the Party has concluded that a particular level of the measure demonstrates a lack of economic feasibility):*

The following measures or indicators may be used as a guide for providing such a description:

- (a) The purchase cost per kilogram of methyl bromide and of the alternative;
- (b) Gross and net revenue with and without methyl bromide, and with the next best alternative;
- (c) Percentage change in gross revenues if alternatives are used;
- (d) Absolute losses per hectare relative to methyl bromide if alternatives are used;
- (e) Losses per kilogram of methyl bromide requested if alternatives are used;
- (f) Losses as a percentage of net cash revenue if alternatives are used;
- (g) Percentage change in profit margin if alternatives are used.

An economic analysis was not done because the alternatives are not technically feasible, particularly for certification needs and so no economic analysis were done.

Certification requirements. The requested amount of methyl bromide in the U.S. nomination includes those areas where 1,3-D would not meet the certification requirements or would be limited by township caps. Under California regulatory laws, nursery crops must be "free of especially injurious pests and disease symptoms" in order to qualify for a CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments (CDFA, 2001). If an approved fumigation is not used in the nursery, a nematode sampling procedure is imposed by CDFA, and if nematodes are found all nursery stock in an area should be destroyed resulting in a complete loss. methyl bromide meets the certification guidelines. Also, in certain soil conditions, 1,3-D meets certification guidelines; California township caps may limit the use of 1,3-D.

If nematodes are found and the nursery stock is not "free of especially injurious pests and disease symptoms", then a total loss is likely because the nursery stock:

- Would not qualify for a CDFA Nursery Stock Certificate for Interstate and Intrastate Shipments,
- Would probably not be marketable, since resale for planting is severely restricted by the CDFA.
- Should be destroyed to prevent further infestation.

Yield loss. It is likely that yield losses would also occur where soil conditions are not ideal, but little data are available. The yield loss could be 100% if the nursery stock cannot be certified as pest-free.

Reduced pesticide use. An effective fumigation results in a growth response that allows an initial growth spurt. This growth response helps maintain a healthy plant, which is able to better handle the stress induced by pathogens and pests. A healthier plant consequently requires a fewer number of pesticide sprays during the season.

Beyond the nursery. Healthier plants and trees provide benefits beyond the nursery in terms of higher yields of fruit and nuts and reduced infestations. One hectare of nursery stock provides these benefits to many hectares producing fruits and nuts.

Part F: NATIONAL MANAGEMENT STRATEGY FOR PHASE-OUT OF THIS NOMINATED CRITICAL USE
Renomination Form Part B: TRANSITION PLANS

Provision of a National Management Strategy for Phase-out of Methyl Bromide is a requirement under Decision Ex. I/4(3) for nominations after 2005. The time schedule for this Plan is different than for CUNs. Parties may wish to submit Section 21 separately to the nomination.

21. DESCRIBE MANAGEMENT STRATEGIES THAT ARE IN PLACE OR PROPOSED TO PHASE OUT THE USE OF METHYL BROMIDE FOR THE NOMINATED CRITICAL USE, INCLUDING:

1. *Measures to avoid any increase in methyl bromide consumption except for unforeseen circumstances;*
2. *Measures to encourage the use of alternatives through the use of expedited procedures, where possible, to develop, register and deploy technically and economically feasible alternatives;*
3. *Provision of information on the potential market penetration of newly deployed alternatives and alternatives which may be used in the near future, to bring forward the time when it is estimated that methyl bromide consumption for the nominated use can be reduced and/or ultimately eliminated;*
4. *Promotion of the implementation of measures which ensure that any emissions of methyl bromide are minimized;*
5. *Actions to show how the management strategy will be implemented to promote the phase-out of uses of methyl bromide as soon as technically and economically feasible alternatives are available, in particular describing the steps which the Party is taking in regard to subparagraph (b) (iii) of paragraph 1 of Decision IX/6 in respect of research programmes in non-Article 5 Parties and the adoption of alternatives by Article 5 Parties.*

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

Renomination Form Part C: TRANSITION ACTIONS

Responses should be consistent with information set out in the applicant's previously-approved nominations regarding their transition plans, and provide an update of progress in the implementation of those plans.

In developing recommendations on exemption nominations submitted in 2003 and 2004, the Technology and Economic Assessment Panel in some cases recommended that a Party should explore the use of particular alternatives not identified in a nomination' transition plans. Where the Party has subsequently taken steps to explore use of those alternatives, information should also be provided in this section on those steps taken.

Questions 5 - 9 should be completed where applicable to the nomination. Where a question is not applicable to the nomination, write "N/A".

(Renomination Form 6.) TRIALS OF ALTERNATIVES
Where available, attach copies of trial reports. Where possible, trials should be comparative, showing performance of alternative(s) against a methyl bromide-based standard.

See Section 15 above for selected trial results and citations.

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

(ii) OUTCOMES OF TRIALS: (*Include any available data on outcomes from trials that are still underway. Where applicable, complete the table included at Appendix I identifying comparative disease ratings and yields with the use of methyl bromide formulations and alternatives*.)

See Section 15 above for selected trial results and citations.

(iii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES: *(For example, provide advice on any reductions to the required quantity resulting from successful results of trials.)*

During the preparation of this nomination the USG has accounted for all identifiable means to reduce the request. Specifically, approximately 15 million kilograms of methyl bromide were requested by methyl bromide users across all sectors. USG carefully scrutinized requests and made subtractions to ensure that no growth, double counting, inappropriate use rates on a treated hectare basis was incorporated into the final request. Use when the requestor qualified under some other provision (QPS, for example) was also removed and appropriate transition given yields obtained by alternatives and the associated cost differentials were factored in. As a result of all these changes, the USG is requesting roughly 1/3 of that amount.

The USG feels that no additional reduction in methyl bromide quantities is necessary, given the significant adjustments described above. See Appendix A.

(iv) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES IN CONDUCTING OR FINALISING TRIALS:

The USG has the ability to authorize Experimental Use Permits (EUPs) for large scale field trials for methyl bromide alternatives, as has been done for methyl iodide. A recent change has been to allow the EUP for methyl iodide without the previously required destruction of the crop, thus encouraging more growers to participate in field trials. As with other activities connected with registration of a pesticide, the USG has no legal authority either to compel a registrant to seek an EUP or to require growers to participate.

As noted in our previous nomination, the USG provides a great deal of funding and other support for agricultural research, and in particular, for research into alternatives for methyl bromide. This support takes the form of direct research conducted by the Agricultural Research Service (ARS) of USDA, through grants by ARS and CSREES, by IR-4, the national USDA-funded project that facilitates research needed to support registration of pesticides for specialty crop vegetables, fruits and ornamentals, through funding of conferences such as MBAO, and through the land grant university system.

(Renomination Form 7.) TECHNOLOGY TRANSFER, SCALE-UP, REGULATORY APPROVAL FOR ALTERNATIVES

The USDA maintains an extensive technology transfer system, the Agricultural Extension Service. This Service is comprised of researchers at land grant universities and county extension agents in addition to private pest management consultants. In addition to these sources of assistance for technology transfer, there are trade organizations and grower groups, some of which are purely voluntary but most with some element of institutional compulsion, that exist to conduct research, provide marketing assistance, and to disseminate "best practices". The California Strawberry Commission is one example of such a grower group.

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

See above.

(ii) OUTCOMES ACHIEVED TO DATE FROM TECHNOLOGY TRANSFER, SCALE-UP, REGULATORY APPROVAL:

See Table 11.

(iii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES: (*For example, provide advice on any reductions to the required quantity resulting from successful progress in technology transfer, scale-up, and/or regulatory approval.*)

The USG feels that no additional change in methyl bromide quantity requested is necessary. The U.S. nomination for this sector reflects the commitment by this sector and the U.S. to reduce methyl bromide use to only the most critical needs. See Appendix A.

(iv) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

See above.

Ongoing field trials require results to be validated for commercial application. Therefore, some period of time after publication of field trials is needed for commercial testing and implementation.

USG endeavors to identify methyl bromide alternatives to move them forward in the registration queue. However USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant.

(Renomination Form 8.) COMMERCIAL SCALE-UP/DEPLOYMENT, MARKET PENETRATION OF ALTERNATIVES

(i) DESCRIPTION AND IMPLEMENTATION STATUS:

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

(ii) IMPACT ON CRITICAL USE NOMINATION/REQUIRED QUANTITIES: (*For example, provide advice on any reductions to the required quantity resulting from successful commercial scale-up/deployment and/or market penetration.*)

The USG feels that no additional change in methyl bromide quantity requested is necessary. The U.S. nomination for this sector reflects the commitment by this sector and the U.S. to reduce methyl bromide use to only the most critical needs. See Appendix A.

(iii) ACTIONS TO ADDRESS ANY DELAYS/OBSTACLES:

USG endeavors to identify methyl bromide alternatives to move them forward in the registration queue. However USG has no legal authority to compel registrations; it can only act on registrations requested by private entities. The timely submission of data to support a registration decision is at the sole discretion of the registrant.

The USDA maintains an extensive technology transfer system, the Agricultural Extension Service. This Service is comprised of researchers at land grant universities and county extension agents in addition to private pest management consultants. In addition to these sources of assistance for technology transfer, there are trade organizations and grower groups, some of which are purely voluntary but most with some element of institutional compulsion, that exist to conduct research, provide marketing assistance, and to disseminate “best practices”. The California Strawberry Commission is one example of such a grower group.

(Renomination Form 9.) CHANGES TO TRANSITION PROGRAM

If the transition program outlined in the Party’s original nomination has been changed, provide information on the nature of those changes and the reasons for them. Where the changes are significant, attach a full description of the revised transition program.

See Appendix A.

(Renomination Form 10.) OTHER BROADER TRANSITION ACTIVITIES

Provide information in this section on any other transitional activities that are not addressed elsewhere. This section provides a nominating Party with the opportunity to report, where applicable, on any additional activities which it may have undertaken to encourage a transition, but need not be restricted to the circumstances and activities of the individual nomination.

Without prescribing specific activities that a nominating Party should address, and noting that individual Parties are best placed to identify the most appropriate approach to achieve a swift transition in their own circumstances, such activities could include market incentives, financial support to exemption holders, labelling, product prohibitions, public awareness and information campaigns, etc.

These issues are discussed in the US Management Plan for Methyl Bromide, submitted previously.

Part G: CITATIONS

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Appendix A: Methyl Bromide Usage Newer Numerical Index Extracted (BUNNIE)

2009 Methyl Bromide Usage Newer Numerical Index - BUNNIE						Nursery Stock	
December 18, 2006	Region		Western Raspberry Nursery	CA Rose Growers	CA Fruit and Nut Tree Growers	Sector Total or Average	Notes
Dichotomous Variables	Strip or Bed Treatment?		No	No	No		
	Currently Use Alternatives?		No	No	Yes		
	Tarps / Deep Injection Used?		Tarp	Tarp	Tarp		
	Pest-free Cert Requirements?		Yes	Yes	Yes		
Other Issues	Frequency of Treatment (x/ yr)		1x/ 3-4 years	1x/ 4 years	1x/ 3 years		*
	QPS Removed?		Yes	Yes	Yes		
Most Likely Combined Impacts (%)	Florida Telone Restrictions (%)		0%	0%	0%		
	100 ft Buffer Zones (%)		0%	0%	0%		
	Key Pest Distribution (%)		100%	100%	100%		
	Regulatory Issues (%)		0%	24%	13%		
	Unsuitable Terrain (%)		0%	0%	0%		
	Cold Soil Temperature (%)		0%	0%	0%		
	Total Combined Impacts (%)		**100%**	**100%**	**100%**		
Most Likely Baseline Transition	(%) Able to Transition		0%	0%	0%		
	Minimum # of Years Required		0	0	0		
	(%) Able to Transition / Year		**0%**	**0%**	**0%**		
EPA Adjusted Use Rate (kg/ha)			**200**	**244**	**319**		
EPA Adjusted Strip Dosage Rate (g/m2)			20.0	24.4	31.9		
2009 Requested Usage	*Amount - Pounds*	Pounds	*82,075*	*3,480*	*30,041*	*115,596*	
	Area - Acres		*350*	*16*	*102*	*468*	
	Rate (lb/A)		*234.50*	*217.50*	*294.52*	*247*	
	Amount - Kilograms	Metric	**37,229**	**1,579**	**13,626**	**52,433**	
	Treated Area - Hectares		142	6	41	189	
	Rate (kg/ha)		263	244	330	277	
EPA Preliminary Value		**kgs**	**37,229**	**1,579**	**13,626**	**52,433**	
EPA Baseline Adjusted Value has been adjusted for:			MBTOC Adjustments, QPS, Double Counting, Growth, Use Rate/Strip Treatment, Miscellaneous, and Combined Impacts				
EPA Baseline Adjusted Value		kgs	28,571	1,579	13,626	43,776	
EPA Transition Amount		kgs	-	-	-	-	
EPA Amount of All Adjustments		kgs	**(8,658)**	**-**	**-**	**(8,658)**	
Most Likely Impact Value for Treated Area		kgs	**28,571**	**1,579**	**13,626**	**43,776**	
		ha	**143**	**6**	**43**	**192**	
		Rate	**200**	**244**	**319**	**228**	
Sector Research Amount (kgs)			**1,506**	**2009 Total US Sector Nomination**		**45,282**	

1 Pound = 0.453592 kgs 1 Acre = 0.404686 ha