# METHYL BROMIDE CRITICAL USE NOMINATION FOR PREPLANT SOIL USE FOR TOBACCO TRANSPLANT SEED BEDS

| FOR ADMINISTRATIVE PURPOSES ONLY:<br>**DATE RECEIVED BY OZONE SECRETARIAT:**<br>YEAR: CUN: |
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| **NOMINATING PARTY:** | The United States of America (U.S.) |
| **BRIEF DESCRIPTIVE TITLE OF NOMINATION:** | Methyl Bromide Critical Use Nomination for Preplant Soil Use for Tobacco Transplant Seed Beds |

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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.

X Yes ☐ No

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

List all paper and electronic documents submitted by the Nominating Party to the Ozone Secretariat

| 1. PAPER DOCUMENTS: Title of Paper Documents and Appendices | Number of Pages | Date Sent to Ozone Secretariat |
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| 2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: Title of Electronic Files | Size of File (kb) | Date Sent to Ozone Secretariat |
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## PART A: SUMMARY

### 1. NOMINATING PARTY:

The United States of America

### 2. DESCRIPTIVE TITLE OF NOMINATION:

Methyl Bromide Critical Use Nomination for Preplant Soil Use for Tobacco Transplant Seed Beds

### 3. CROP AND SUMMARY OF CROP SYSTEM

Tobacco is seeded into soil beds or cold frames and later transplanted to the production field when plants reach a height of five to seven inches. Seedling beds are located on well-drained sites that have been well cleared of weeds and trash. Sloping beds on southern exposure produce the strongest transplants. The seedling bed should be manured the previous fall, shallow-tilled, and planted to a cover crop if possible. This cover crop should be incorporated in early spring, well in advance of seeding.

Most farms have moved to floating transplant tray seedling production, however, not all farms have adopted transplant tray seedling production and others have returned to soil bed production after encountering serious disease losses in the float system. Fall seed bed fumigation with methyl bromide is recommended for better disease control, but is impractical due to the serious problem of recontamination of the beds with the long period between fumigation and seeding.

### 4. METHYL BROMIDE NOMINATED

**TABLE 4.1: METHYL BROMIDE NOMINATED**

| YEAR | NOMINATION AMOUNT (KG) | NOMINATION AREA (HA) |
|---|---|---|
| **2006** | **16,431** | **27** |

## 5. BRIEF SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE

Methyl bromide is still important for tobacco transplant seedbeds to ensure pathogen free crop production. Registered alternative fungicides are not effective against the full range of pathogens common for tobacco production. In addition, use of alternative fungicides during transplant production could potentially limit usefulness in field production due to fungicide resistance issues. Loss of methyl bromide would undermine integrated pest management strategies aimed at resistance management. The registered alternative soil fumigants have constraints that could jeopardize production. If used late season, after harvest, soil borne pathogens have very high potential to re-infect the treated area through the uncontrollable actions of wind, rain, and wildlife. Use of the same soil fumigants immediately prior to seeding is compromised by cold soil temperature. Due to the long aeration period required when using the alternative soil fumigants, early transplant dates are not possible (a critical tool in yield and disease management). Even under the best of conditions, spring use of alternatives will delay seeding date compared with methyl bromide by three weeks and almost insures a June transplanting date rather than a May transplanting date. Delayed seeding and transplanting results in crop exposure to higher disease pressure and drought conditions.

**TABLE A.1: EXECUTIVE SUMMARY**

| Region | | *Tobacco Transplant Beds* |
|---|---|---|
| **Amount of Nomination** | | |
| **2006** | **Kilograms** | 16,431 |
| | **Application Rate (kg/ha)** | 611 |
| | **Area (ha)** | 27 |
| **Amount of Applicant Request** | | |
| **2005** | **Kilograms** | 16,431 |
| | **Application Rate (kg/ha)** | 611 |
| | **Area (ha)** | 27 |
| **2006** | **Kilograms** | 16,431 |
| | **Application Rate (kg/ha)** | 611 |
| | **Area (ha)** | 27 |
| **Economics** | | |
| **Marginal Strategy** | | Metam Sodium |
| **Yield Loss (%)** | | 46 |
| **Loss per hectare (US$/ha)** | | 4,612 |
| **Loss per kg Methyl Bromide (US$/kg)** | | $1,371.62 |
| **Loss as % of Gross Revenue (%)** | | 45% |
| **Loss as % of Net Revenue (%)** | | 71% |

**6. SUMMARIZE WHY KEY ALTERNATIVES ARE NOT FEASIBLE**:

Most of these are small farms without other economically, sustainable cropping options. Spring applications of dazomet and metam sodium are not acceptable for early transplanting dates due to long aeration periods. If spring applications of alternative fumigants are made, the seeding date may be shifted as far as April in most growing regions and as far as June in Kentucky. The later the crop is transplanted the greater risk from drought and diseases. Fall fumigation with most products gives better control of some pests, and would be desirable if not for the recontamination issue with pathogens that have rapid rates of reproduction (eg. black shank pathogen). Consequently, growers need to fumigate using methyl bromide within a week of seeding the bed to reduce the chance of recontamination. Spring weather in much of the production area during many seasons provides only short windows for soil conditions to favor fumigation and seeding. Therefore, the short interval between fumigation opportunity and seeding opportunity (2 days to a week) requires materials with a short fumigation-aeration period to fit into practical farming operations.

**7. (*i*) PROPORTION OF CROPS GROWN USING METHYL BROMIDE** *(if particular agricultural or political regions only use methyl bromide, provide local data as well as national figures):*

**TABLE 7.1: PROPORTION OF CROPS GROWN USING METHYL BROMIDE**

| REGION WHERE METHYL BROMIDE USE IS REQUESTED | TOTAL CROP AREA 2001 AND 2002 AVERAGE (HA)) | PROPORTION OF TOTAL CROP AREA TREATED WITH METHYL BROMIDE (%) |
|---|---|---|
| **Tobacco Transplant Beds** | Not available. | Not available because of overlapping use of field and tray grown transplants. |
| **NATIONAL TOTAL:** | Not available. | Not available. |

**7. (*ii*) IF ONLY 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.**

Methyl bromide is only used to eliminate pathogens in transplant seedbeds. A typical farm is 4 acres in size with only 0.06 acres of transplant beds treated with methyl bromide. Only seedbeds are fumigated to ensure healthy seedlings for transplant into production fields. Since 1990 the burley and dark tobacco industry has been transitioning transplant production from traditional ground beds to containerized production in a float system.

**7. (*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?**

Even if there were no restrictions on methyl bromide use, traditional plant beds use would have already completely disappeared and been replaced with containerized transplants if the increased disease potentials were not already a serious threat to the sustainability of that method of transplant production. Some growers that abandoned plant beds for the float system are returning to ground beds for all or a portion of the crop. The industry is still trying to sort this issue out, while under going serious economic pressures unrelated to the issue of fumigation and transplants. Therefore, if acceptable methods are developed to greatly reduce the greater disease potential of containerized transplants produced in the float system while maintaining the feasibility of the float system, the traditional ground beds should disappear as a production method.

## 8. Amount of Methyl Bromide Requested for Critical Use

**Tobacco Transplant Beds - Table 8.1: Amount of Methyl Bromide Requested for Critical Use**

| Region: | Tobacco Transplant Beds | |
|---|---|---|
| **Year of Exemption Request** | **2005** | **2006** |
| Kilograms of Methyl Bromide | 16,431 | 16,431 |
| Use: Flat Fumigation or Strip/Bed Treatment | Bed | Bed |
| **Formulation** *(ratio of methyl bromide/chloropicrin mixture)* to be used for the CUE | 98/2 | 98/2 |
| Total Area to be treated with the methyl bromide or methyl bromide/Chloropicrin formulation *($m^2$ or ha)* | 27 ha | 27 ha |
| Application rate* *(kg/ha)* for the **formulation** | 623 | 623 |
| Dosage rate* *($g/m^2$)* of **formulation** used to calculate requested kilograms of methyl bromide | 62.3 | 62.3 |
| Application Rate (KG/HA) for the **active ingredient** | 611 | 611 |
| Dosage rate* *(G/M2)* of **active ingredient** used to calculate requested kilograms of methyl bromide | 61.1 | 61.1 |

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

## 9. Summarize Assumptions Used to Calculate Methyl Bromide Quantity Nominated for Each Region:

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

- Only the acreage experiencing one or more of the following impacts were included in the nominated amount: moderate to heavy key pest pressure and cold soil temperatures in limited production regions.
- All other adjustments to the methyl bromide nominated amount (e.g., growth, regulatory impacts, etc.) did not apply to this sector.

**TABLE A.2: 2005 SECTOR NOMINATION***

| 2005 (Sector) Nomination | | Tobacco Transplant Beds |
|---|---|---|
| **Applicant Request for 2005** | Requested Hectares (ha) | 27 |
| | Requested Application Rate (kg/ha) | 611 |
| | Requested Kilograms (kg) | 16,431 |

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

**TABLE A.3: 2006 SECTOR NOMINATION***

| 2006 (Sector) Nomination | | Tobacco Transplant Beds |
|---|---|---|
| **Applicant Request for 2006** | Requested Hectares (ha) | 27 |
| | Requested Application Rate (kg/ha) | 611 |
| | Requested Kilograms (kg) | 16,431 |
| **CUE Nominated for 2006** | Nominated Hectares (ha) | 27 |
| | Nominated Application Rate (kg/ha) | 611 |
| | Nominated Kilograms (kg) | 16,431 |

| | | |
|---|---|---|
| **2006 Sector Nomination Totals** | Overall Reduction (%) | 0% |
| | **Total 2006 U.S. Sector Nominated Kilograms (kg)** | 16,431 |

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

## TOBACCO TRANSPLANT BEDS - PART B: CROP CHARACTERISTICS AND METHYL BROMIDE USE

## TOBACCO TRANSPLANT BEDS - 10. KEY DISEASES AND WEEDS FOR WHICH METHYL BROMIDE IS REQUESTED AND SPECIFIC REASONS FOR THIS REQUEST

**TOBACCO TRANSPLANT BEDS - TABLE 10.1: KEY DISEASES AND WEEDS AND REASON FOR METHYL BROMIDE REQUEST**

| REGION WHERE METHYL BROMIDE USE IS REQUESTED | KEY DISEASE(S) AND WEED(S) TO GENUS AND, IF KNOWN, TO SPECIES LEVEL | SPECIFIC REASONS WHY METHYL BROMIDE IS NEEDED |
|---|---|---|
| Tobacco Transplant Beds | *Phytophthora parasitica nicotianae*<br>*Pythium spp.*<br><br>*Rhizoctonia spp.* | No effective fungicides registered* |

*Mefenoxam-containing fungicides which were used in seedbeds for many years to aid in *Phytophthora* and *Pythium* control were removed from the labels in recent years due to resistance issues.

## TOBACCO TRANSPLANT BEDS - 11. (*i*) CHARACTERISTICS OF CROPPING SYSTEM AND CLIMATE

**TOBACCO TRANSPLANT BEDS - TABLE 11.1: CHARACTERISTICS OF CROPPING SYSTEM**

| CHARACTERISTICS | TOBACCO TRANSPLANT BEDS |
|---|---|
| **CROP TYPE:** *(e.g. transplants, bulbs, trees or cuttings)* | Transplant production |
| **ANNUAL OR PERENNIAL CROP:** *(# of years between replanting)* | Annual (1 year) |
| **TYPICAL CROP ROTATION** *(if any)* **AND USE OF METHYL BROMIDE FOR OTHER CROPS IN THE ROTATION:** *(if any)* | Not Applicable |
| **SOIL TYPES:** *(Sand, loam, clay, etc.)* | Medium organic sandy loam |
| **FREQUENCY OF METHYL BROMIDE FUMIGATION:** *(e.g. every two years)* | Yearly |
| **OTHER RELEVANT FACTORS:** | Growers normally prepare the bed site only a few days prior to fumigating, plant within a week, and harvest transplants 6-12 weeks later, depending upon growing conditions. This is done to reduce the risk of contaminating the seedbed due to a relatively long interval between fumigation and seeding. |

**TOBACCO TRANSPLANT BEDS - TABLE 11.2 CHARACTERISTICS OF CLIMATE AND CROP SCHEDULE**

| | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC | JAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLIMATIC ZONE | USDA plant hardiness zone 5a-8b. | | | | | | | | | | | |
| RAINFALL *(mm)* | 60.7 | 34.8 | 192.5 | 134.1 | 109.0 | 68.7 | 44.7 | 74.2 | 138.2 | 165.6 | 126.7 | 103.6 |
| OUTSIDE TEMP. *(℃)* | 3.2 | 3.2 | 6.9 | 14.3 | 16.2 | 23.6 | 26.2 | 25.6 | 22.3 | 13.3 | 5.9 | 2.0 |
| FUMIGATION SCHEDULE | X | | | | | | | | | | | |
| PLANTING SCHEDULE | X | X | X | | | | | | | | | |

*Kentucky data provided as representative of the growing region

**TOBACCO TRANSPLANT BEDS – 11. (*ii*) INDICATE IF ANY OF THE ABOVE CHARACTERISTICS IN 11. (*i*) PREVENT THE UPTAKE OF ANY RELEVANT ALTERNATIVES?**

The cold temperatures during February through April constrain the use of metam sodium and dazomet as soil fumigants. Cold soil temperature prevents early transplanting dates due to the long aeration period required for full activity and to avoid major phytotoxicity issues with residual fumigant. Spring application of metam sodium and dazomet shifts seeding date from February to April. The later the crop is transplanted, the greater the risk from drought and diseases.

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

**TOBACCO TRANSPLANT BEDS - TABLE 12.1 HISTORIC PATTERN OF USE OF METHYL BROMIDE**

| FOR AS MANY YEARS AS POSSIBLE AS SHOWN SPECIFY: | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|
| AREA TREATED *(hectares)* | 427 | 204 | 122 | 52 | 37 | 30 |
| RATIO OF FLAT FUMIGATION METHYL BROMIDE USE TO STRIP/BED USE IF STRIP TREATMENT IS USED | 100 % Bed | 100 % Bed | 100 % Bed | 100 % Bed | 100 % Bed | 100 % Bed |
| AMOUNT OF METHYL BROMIDE ACTIVE INGREDIENT USED *(total kilograms)* | 260,815 | 124,738 | 74,843 | 31,751 | 22,680 | 18,144 |
| 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 *(e.g. injected at 25cm depth, hot gas)* | Gas | Gas | Gas | Gas | Gas | Gas |
| APPLICATION RATE OF FORMULATIONS IN **kg/ha*** | 623 | 623 | 626 | 623 | 626 | 617 |
| ACTUAL DOSAGE RATE OF FORMULATIONS *($g/m^2$)** | 62.3 | 62.3 | 62.6 | 62.3 | 62.6 | 61.7 |
| APPLICATION RATE (KG/HA) FOR THE ACTIVE INGREDIENT | 611 | 611 | 611 | 612 | 611 | 610 |
| ACTUAL DOSAGE RATE OF ACTIVE INGREDIENT *($g/m^2$)** | 61.1 | 61.1 | 61.1 | 61.2 | 61.1 | 61 |

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

## TOBACCO TRANSPLANT BEDS - PART C: TECHNICAL VALIDATION

## TOBACCO TRANSPLANT BEDS - 13. REASON FOR ALTERNATIVES NOT BEING FEASIBLE

**TOBACCO TRANSPLANT BEDS – TABLE 13.1: REASON 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** | | |
| 1,3 D Chloropicrin | Effective against nematodes but not pathogens associated with U.S. tobacco production. Only effective when used in combination. | No |
| Dazomet (Basamid) | Fall use allows for recontamination before the following spring. Spring application delays seeding due to the extended aeration period. Delayed planting can result in greater disease and drought conditions. | No |
| Chloropicrin | Chloropicrin would control the fungal pathogens involved, and in combinations with methyl bromide give superior control. However, chloropicrin also has a long fumigation and waiting interval equal to Basamid and metam sodium and therefore the same limitations. | No |
| Metam sodium | Fall use allows for recontamination before the following spring. Spring application delays seeding due to the extended aeration period. Delayed planting can result in greater disease and drought conditions. | No |
| Dithane | No feasible as only provides mild suppression of *Rhyzocontia spp.* | No |
| **NON CHEMICAL ALTERNATIVES** | | |
| Biofumigation | Not applicable as still experimental. | No |
| Solarization of soil | No consistent effectiveness as is dependent upon meteorological conditions. There is inadequate sunlight during the period immediately preceding seedbed establishment, so solarization must be done the previous summer/fall and recontamination issue are equal or worse than those with fall fumigation. | No |
| Steam sterilization of soil | Not readily available for farm use and the equipment is expensive. | No |
| Biological Control | Not applicable as still experimental. | No |
| Cover crops and Mulching | Not applicable due to the soil borne nature of the pathogens | No |

| | | |
|---|---|---|
| Crop rotation/fallow | Is strongly recommended and usually practiced, which is why the list of soil-borne pathogens is not larger. However, it alone is not adequate to control *Pythium* and *Rhizoctonia spp*. as rotated sites also become recontaminated. The population of these pathogens must still be reduced to near zero immediately ahead of seeding. | No |
| Endophytes | Not applicable. | No |
| Organic amendments/Compost | Not applicable due to the soil borne nature of the pathogens. | No |
| Physical removal/sanitation | Not applicable as completely disease free beds are required for crop production. | No |
| Resistant cultivars | Already used but not sufficient disease control by themselves against any of the key pathogens in a seed situation. In fact, using resistant varieties for this purpose could result in widespread field development of the disease by harboring the pathogens at low levels in a hidden state. It is more desirable for black shank to appear prior to transplanting so that infected plants will not be transferred into the production fields. | No |
| Non-soil culture | Already used but methyl bromide is still needed to sterilize trays. | No |
| Substrates/Plug plants | Already used but methyl bromide is still needed to sterilize trays. | No |
| **COMBINATIONS OF ALTERNATIVES** | | |
| 1,3 D, Brush burning | Not applicable. | No |

** Regulatory reasons include local restrictions (e.g. occupational health and safety, local environmental regulations) and lack of registration.*

**TOBACCO TRANSPLANT BEDS - 14. LIST AND DISCUSS WHY REGISTERED** *(and Potential)* **PESTICIDES AND HERBICIDES ARE CONSIDERED NOT EFFECTIVE AS TECHNICAL ALTERNATIVES TO METHYL BROMIDE:**

**TOBACCO TRANSPLANT BEDS – TABLE 14.1: TECHNICALLY INFEASIBLE ALTERNATIVES DISCUSSION**

| NAME OF ALTERNATIVE | DISCUSSION |
|---|---|
| | There are no available alternatives for the control of fungal pathogens. |

## TOBACCO TRANSPLANT BEDS - 15. LIST PRESENT *(and Possible Future)* REGISTRATION STATUS OF ANY CURRENT AND POTENTIAL ALTERNATIVES:

**TOBACCO TRANSPLANT BEDS – TABLE 15.1: PRESENT REGISTRATION STATUS OF ALTERNATIVES**

| NAME OF ALTERNATIVE | PRESENT REGISTRATION STATUS | REGISTRATION BEING CONSIDERED BY NATIONAL AUTHORITIES? (Y/N)* | DATE OF POSSIBLE FUTURE REGISTRATION: |
|---|---|---|---|
| Iodomethane | Not-registered | Y | Unknown |
| Fosthiazate | Not-registered | Y | Unknown |
| Furfural | Not-registered | Y | Unknown |
| Sodium azide | Not-registered, no request submitted to US | N | Unknown |
| Propargyl bromide | Not-registered, no request submitted to US | N | Unknown |
| Diallyl sulfide | Registered to control *Sclerotinia* fungus, but not on tobacco seed beds. | N | Unknown |

* Pesticide companies are not interested in labeling pesticides on tobacco for disease control due to economic and image issues.

## TOBACCO TRANSPLANT BEDS - 16. STATE RELATIVE EFFECTIVENESS OF RELEVANT ALTERNATIVES COMPARED TO METHYL BROMIDE FOR THE SPECIFIC KEY TARGET PESTS AND WEEDS FOR WHICH IT IS BEING REQUESTED

**DITHANE IS RECOMMENDED FOR RHIZOCTONIA CONTROL IN PLANT BEDS (U KY)**

**TOBACCO TRANSPLANT BEDS – TABLE 16.1: EFFECTIVENESS OF ALTERNATIVES – *Phytophthora parasitica nicotianae***

| KEY PEST: *Phytophthora parasitica nicotianae* | AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS | | | | |
|---|---|---|---|---|---|
| METHYL BROMIDE FORMULATIONS AND ALTERNATIVES *(include dosage rates and application method)* | # OF TRIALS | DISEASE (% OR RATING) | # OF TRIALS | ACTUAL YIELDS (T/HA) | CITATION |
| Methyl bromide | | 100 | 1 | | Nesmith* |
| Vapam (Metam sodium) fumigation | | 54 | 1 | | |

*Nesmith, W. 1992/93. On Farm Test in Powell County, Ky. Not published.

**TOBACCO TRANSPLANT BEDS – TABLE C.1: ALTERNATIVES YIELD LOSS DATA SUMMARY**

| KEY PEST: *Pythium spp.* | AVERAGE DISEASE % OR RATING AND YIELDS IN PAST 3~5 YEARS | | |
|---|---|---|---|
| **ALTERNATIVE** | **LIST TYPE OF PEST** | **RANGE OF YIELD LOSS** | **BEST ESTIMATE OF YIELD LOSS** |
| Metam Sodium (Vapam) Fumigation | pathogens | 46 | 46 |
| **OVERALL LOSS ESTIMATE FOR ALL ALTERNATIVES TO PESTS** | | | **46** |

**TOBACCO TRANSPLANT BEDS - 17. ARE THERE ANY OTHER POTENTIAL ALTERNATIVES UNDER DEVELOPMENT WHICH ARE BEING CONSIDERED TO REPLACE METHYL BROMIDE?**

No. The tobacco market is not sufficiently large to support labeling products and liability is high. Further, minor crop funding is not allowed for tobacco. Pesticide companies are not interested in labeling pesticides on tobacco for disease control due to economic and public perception issues.

**TOBACCO TRANSPLANT BEDS - 18. ARE THERE TECHNOLOGIES BEING USED TO PRODUCE THE CROP WHICH AVOID THE NEED FOR METHYL BROMIDE?**

No. While most of the larger operations have moved to soil-less media float bed transplant production, methyl bromide is still essential to ensure healthy transplants.

**TOBACCO TRANSPLANT BEDS - SUMMARY OF TECHNICAL FEASIBILITY**

Methyl bromide is still essential to ensure healthy transplants for field production of tobacco. While there are other fumigants registered, dazomet and metam sodium, their use is compromised by field conditions whether applied in the fall or spring. Until float tray production of seedlings in small farm operations can be guaranteed to produce pathogen free seedlings or acceptable alternative fumigants are registered for use on tobacco, methyl bromide is essential to field tobacco transplant production.

## PART D: EMISSION CONTROL

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

**TABLE 19.1: TECHNIQUES TO MINIMIZE METHYL BROMIDE USE AND EMISSIONS**

| TECHNIQUE OR STEP TAKEN | VIF OR HIGH BARRIER FILMS | METHYL BROMIDE DOSAGE REDUCTION | INCREASED % CHLOROPICRIN IN METHYL BROMIDE FORMULATION | LESS FREQUENT APPLICATION |
|---|---|---|---|---|
| **WHAT USE/EMISSION REDUCTION METHODS ARE PRESENTLY ADOPTED?** | Currently some growers use HDPE tarps. | No | No | No |
| **WHAT FURTHER USE/EMISSION REDUCTION STEPS WILL BE TAKEN FOR THE METHYL BROMIDE USED FOR CRITICAL USES?** | The U.S. anticipates that the decreasing supply of methyl bromide will motivate growers to try high barrier films. | The U.S. anticipates that the decreasing supply of methyl bromide will motivate growers to try lower dosage rates. | The U.S. anticipates that the decreasing supply of methyl bromide will motivate growers to try increasing chloropicrin percentages. | The U.S. anticipates that the decreasing supply of methyl bromide will motivate growers to try less frequent applications. |
| **OTHER MEASURES** *(please describe)* | Not available. | Examination of promising but presently unregistered alternative fumigants, alone or in combination with non-chemical methods, is planned | Not available. | Research is underway to develop float bed transplant production systems which will ensure pathogen free seedlings |

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

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 growing of tobacco seedlings in plant beds 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 that 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 is most often machine injected into soil to specific depths.

As methyl bromide has become scarcer, 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 95% methyl bromide and 5% 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.

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.

## PART E: ECONOMIC ASSESSMENT

### 21. COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER 3-YEAR PERIOD:

**TABLE 21.1: COSTS OF ALTERNATIVES COMPARED TO METHYL BROMIDE OVER 3-YEAR PERIOD**

| ALTERNATIVE | YIELD* | COST IN YEAR 1 *(US$/ha)* | COST IN YEAR 2 *(US$/ha)* | COST IN YEAR 3 *(US$/ha)* |
|---|---|---|---|---|
| Methyl Bromide | 100% | $84 | $84 | $84 |
| Floating Trays | 100% | $14 | $14 | $14 |
| Metam Sodium | 54% | $84 | $84 | $84 |

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

### 22. GROSS AND NET REVENUE:

**TABLE 22.1: YEAR 1 GROSS AND NET REVENUE**

| YEAR 1 | | |
|---|---|---|
| ALTERNATIVES | GROSS REVENUE FOR LAST REPORTED YEAR *(US$/ha)* | NET REVENUE FOR LAST REPORTED YEAR *(US$/ha)* |
| Methyl Bromide | 10,210 | 6,477 |
| Floating Trays | 10,210 | 6,568 |
| Metam Sodium | 5,514 | 1,865 |

**TABLE 22.2: YEAR 2 GROSS AND NET REVENUE**

| YEAR 2 | | |
|---|---|---|
| ALTERNATIVES | GROSS REVENUE FOR LAST REPORTED YEAR *(US$/ha)* | NET REVENUE FOR LAST REPORTED YEAR *(US$/ha)* |
| Methyl Bromide | 10,210 | 6,477 |
| Floating Trays | 10,210 | 6,568 |
| Metam Sodium | 5,514 | 1,865 |

**TABLE 22.3: YEAR 3 GROSS AND NET REVENUE**

| YEAR 3 | | |
|---|---|---|
| ALTERNATIVES | GROSS REVENUE FOR LAST REPORTED YEAR *(US$/ha)* | NET REVENUE FOR LAST REPORTED YEAR *(US$/ha)* |
| Methyl Bromide | 10,210 | 6,477 |
| Floating Trays | 10,210 | 6,568 |
| Metam Sodium | 5,514 | 1,865 |

## MEASURES OF ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

**TOBACCO TRANSPLANT BEDS - TABLE E.1: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES**

| TOBACCO TRANSPLANT BEDS | METHYL BROMIDE | FLOATING TRAYS | METAM SODIUM (VAPAM) |
|---|---|---|---|
| YIELD LOSS (%) | 0% | 0% | 46% |
| YIELD PER HECTARE | 2,316 | 2,316 | 1,250 |
| * PRICE PER UNIT (US$) | 4.41 | 4.41 | 4.41 |
| = GROSS REVENUE PER HECTARE (US$) | 10,210 | 10,210 | 5,514 |
| - OPERATING COSTS PER HECTARE (US$) | 3,733 | 3,642 | 3,649 |
| = NET REVENUE PER HECTARE (US$) | 6,477 | 6,568 | 1,865 |
| **Loss Measures** | | | |
| 1. LOSS PER HECTARE (US$) | $0 | +$91 | 4,612 |
| 2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$) | $0 | +$27.12 | $1,371.62 |
| 3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%) | 0% | +1% | 45% |
| 4. LOSS AS A PERCENTAGE OF NET REVENUE (%) | 0% | +1% | 71% |

## SUMMARY OF ECONOMIC FEASIBILITY

The economic analysis compared the costs of two alternative control scenarios to the baseline costs for controlling tobacco pests with methyl bromide to determine the likely economic impact if methyl bromide were unavailable. The two alternatives are floating trays and Vapam or metam sodium. Various measures were used to quantify the impacts, including the following:

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

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

(3) **Loss as a Percentage of Gross Revenue.** This measure has the advantage that gross revenues are usually easy to measure, at least over some unit, *e.g.*, a hectare of land or a storage operation. However, high value commodities or crops may provide high revenues but may also entail high costs. Losses of even a small percentage of gross revenues could have important impacts on the profitability of the activity.

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

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

These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide users, who are producers in this case. Because producers (suppliers) represent an integral part of any definition of a market, we interpret the threshold of significant market disruption to be met if there is a significant impact on commodity suppliers using methyl bromide. The economic measures provide the basis for making that determination. Several methodological approaches will help interpret the findings. Economic estimates were first calculated in pounds and acres and then converted to kilograms and hectares. Costs for alternatives are based on market prices for the control products multiplied by the number of pounds of active ingredient that would be applied. Baseline costs were based on the average number of annual applications necessary to treat tobacco beds with methyl bromide.

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

One of the issues tobacco beds growers are facing is whether or not it will be financially prudent to convert from a bed system that requires fumigation of the soil to a floating tray system. A floating tray system uses trays floating in shallow pools to grow seedlings. After the seedlings are removed the trays are fumigated, stored and reused again. Although it is seen as an alternative, seedling producers using the floating tray system are starting to move back to soil beds for a couple of reasons. For starters, if the water becomes contaminated the entire stock of seedlings is lost as pathogens spread unabated. Secondly, there is virtually no insurance crop available as growers cannot keep seedlings floating in trays beyond transplant maturity whereas with a bed system growers can maintain insurance or back up stock. In fact, some seedling producers are now converting from floating trays back to beds even though the management costs are higher. This analysis considers the floating tray system and fumigation with Vapam as alternatives to fumigation with methyl bromide.

The costs for the first alternative are based on using a floating tray system to minimize pathogen transfer while the costs for the second alternative is based on the cost of applying and metam sodium (Vapam) in place of methyl bromide. The baseline costs were based on the average number of applications to treat tobacco beds with methyl bromide per year (one) with 3 pounds methyl bromide per 1,000 cubic feet.

The loss per hectare measures the value of methyl bromide based on changes in operating costs and/or changes in yield. The loss as a percentage of the gross revenue is based on the ratio of the loss to the gross revenue. Likewise for the loss as a percentage of net revenue. The profit

margin percentage is the ratio of net revenue to gross revenue per hectare.

The differences in the cost of production were primarily from the cost of the capital investments and/materials costs for the floating tray system when compared to a bed system using methyl bromide. The basis for the fumigation alternative costs and differences in net revenue are from the estimated yield loss if metam sodium is used in place of methyl bromide. Labor was assumed to cost $6.50 per hour. Yield losses ranged from 0% to 46%.

Under Alternative 1 (floating tray system), yield losses were estimated to be 0% compared to methyl bromide. Operating costs in U.S. dollars per hectare were estimated to be $3,643 per year. The estimated net revenue was $6,568 per hectare. The gain per hectare is estimated to be $91 due to the estimated reduced cost of a tray system compared to soil fumigation with methyl bromide. The gain per kilogram of methyl bromide in U.S. dollars is estimated to be $27.12 per kilogram. If growers are going from floating tray systems back to seedbeds because of performance problems, the economic consequence of using a system that doesn't work is that revenue falls to zero in some cases for seedling growers that experience pathogen problems as their entire stock is lost. The probability of this loss is not known but converting to a different production technology is an indication that the risk of loss is too great. It is understood that in some cases floating trays do work, but the economic consequences of float tray failure impacts and the financial risk avoidance can be measured by the cost of converting back to seedbeds. Conversion costs were not available for this analysis.

Under alternative 2 Vapam (metam sodium), yield losses were estimated to be 46% compared to methyl bromide. Operating costs in U.S. dollars per hectare were estimated to be $3,649 per year. The estimated net revenue was $1,865 per hectare. The loss per hectare is estimated to be $4,612. The loss per kilogram of methyl bromide in U.S. dollars is estimated to be $1,371.62 per kilogram.

## PART F. FUTURE PLANS

### 23. WHAT ACTIONS WILL BE TAKEN TO RAPIDLY DEVELOP AND DEPLOY ALTERNATIVES FOR THIS CROP?

Since 1997, the United States EPA has made the registration of alternatives to methyl bromide a high registration priority. Because the U.S. EPA currently has more applications pending in its registration review queue than the resources to evaluate them, U.S. EPA prioritizes the applications. By virtue of being a top registration priority, methyl bromide alternatives enter the science review process as soon as U.S. EPA receives the application and supporting data rather than waiting in turn for the U.S. EPA to initiate its review.

As one incentive for the pesticide industry to develop alternatives to methyl bromide, the Agency has worked to reduce the burdens on data generation, to the extent feasible while still ensuring that the Agency's registration decisions meet the Federal statutory safety standards. Where appropriate from a scientific standpoint, the Agency has refined the data requirements for a given pesticide application, allowing a shortening of the research and development process for the methyl bromide alternative. Furthermore, Agency scientists routinely meet with prospective methyl bromide alternative applicants, counseling them through the preregistration process to increase the probability that the data is done right the first time and rework delays are minimized

The U.S. EPA has also co-chaired the USDA/EPA Methyl Bromide Alternatives Work Group since 1993 to help coordinate research, development and the registration of viable alternatives. This coordination has resulted in key registration issues (such as worker and bystander exposure through volatilization, township caps and drinking water concerns) being directly addressed through USDA's Agricultural Research Service's US$15 million per year research program conducted at more than 20 field evaluation facilities across the country. Also U.S. EPA's participation in the evaluation of research grant proposals each year for USDA's US$2.5 million per year methyl bromide alternatives research has further ensured close coordination between the U.S. government and the research community.

### 24. HOW DO YOU PLAN TO MINIMIZE THE USE OF METHYL BROMIDE FOR THE CRITICAL USE IN THE FUTURE?

The U.S. wants to note that our usage rate is among the lowest in the world in requested sectors and represents efforts of both the government and the user community over many years to reduce use rates and emissions. We will continue to work with the user community in each sector to identify further opportunities to reduce methyl bromide use and emissions.

## 25. ADDITIONAL COMMENTS ON THE NOMINATION?

While most tobacco producers have moved to the float tray system for seedling transplant production, methyl bromide is still critical to ensure pathogen free seedlings. In recent years, a number of producers have abandoned the float tray system and returned to small plot field production of tobacco transplants. This move has occurred due to the greater potential for disease production in the greenhouse float tray system. This indicates that float tray systems still have problems which must be eliminated before they can be considered a viable alternative for seedling production in the United States.

## 26. CITATIONS


Nesmith, W. 1992/93. On Farm Test in Powell County, Ky. Not published.

Gutierrez, WA, HD Shew and TA Melton. 1997. Sources of Inoculum and Management for *Rhizoctonia solani* Damping-off on Tobacco Transplants under Greenhouse Conditions. Pla. Science 81:604-606


## CITATIONS REVIEWED BUT NOT APPLICABLE


Hensley Sr., R and DJ Fowlkes. The Float System for Producing Tobacco Transplants.

Bateman K. 2002. Tobacco Greenhouse Float Tray Sanitation. NC State University Cooperative Extension Service. http://www.utextension.utk.edu/tobaccoinfo/2002TOC.htm

Reed, TD. 1998. Float Greenhouse Tobacco: Transplant Production Guide. Virginia Cooperative Extension. Publication Number 436-051. http://www.ext.vt.edu/pubs/tobacco/436-051/436-051.html

Vani Muller, J J. 2000. Brazilian Tobacco Growers Choose Floating Seed Trays as Methyl Bromide Replacement. RUMBA April 2000. http://www.uneptie.org/ozonaction/compliance/rumba/00april.html

Dimock, WJ, CS Johnson, TD Reed, PJ Semtner, RL Jones and MJ Weaver. 2001. Crop Profile for Tobacco in Virginia. USDA/NASS. http://cipm.ncsu.edu/cropprofiles/docs/vatobacco.html

Mulrooney, B. 1998. Weekly Crop Update – Sanitation of Greenhouse Trays. University of Delaware Cooperative Extension. Volume 1, Issue 1 March 13, 1998. http://www.rec.udel.edu/Update98/upd31398.html

Hensley, DD. Disease Management in Transplant Production.

Nesmith, W. 1995. New Harvest - Disinfect Planter Flats and Materials for Growing Transplants. University of Kentucky Cooperative Extension Service. http://www.ext.vt.edu/news/periodicals/commhort/1995-07/commhort-35.html

Salles, LA, DA Sosa and A Valeiro. 2001. Alternatives for the Replacement of Methyl Bromide in Argentina. FAO Plant Production and Protection Paper, No.166:3-11. http://fao.org/DOCREP/004/Y1809E/y1809e02.htm

Salles, LA. 2001. Effective Alternatives to Methyl Bromide in Brazil. FAO Plant Production and Protection Paper, No.166:13-24. http://fao.org/DOCREP/004/Y1809E/y1809e02.htm

The mentioned articles were reviewed but not cited because either they contained material only outlining the production methodology or did not include relevant scientific methods and data in support of the conclusions.

## APPENDIX A. 2006 Methyl Bromide Usage Numerical Index (BUNI).

**Methyl Bromide Critical Use Exemption Process** **Date:** 2/26/2004 **Average Hectares in the US:** not available

**2006 Methyl Bromide Usage Numerical Index (BUNI)** **Sector:** TOBACCO BEDS **% of Average Hectares Requested:** not available

| 2006 Amount of Request | | | | 2001 & 2002 Average Use* | | | Quarantine and Pre-Shipment | Regional Hectares** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| REGION | Kilograms (kgs) | Hectares (ha) | Use Rate (kg/ha) | Kilograms (kgs) | Hectares (ha) | Use Rate (kg/ha) | | 2001 & 2002 Average | % of 2001 & 2002 Average | % of Requested Hectares |
| TOBACCO TRANSPLANT BEDS | 16,431 | 27 | 611 | 20,412 | 33 | 611 | 0% | not available | not available | not available |
| TOTAL OR AVERAGE | 16,431 | 27 | 611 | 20,412 | 33 | 611 | 0% | not available | not available | not available |

| 2006 Nomination Options | Subtractions from Requested Amounts (kgs) | | | | | Combined Impacts Adjustment (kgs) | | MOST LIKELY IMPACT VALUE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| REGION | 2006 Request | (-) Double Counting | (-) Growth or 2002 CUE Comparison | (-) Use Rate Difference | (-) QPS | HIGH | LOW | Kilograms (kgs) | Hectares (ha) | Use Rate (kg/ha) | % Reduction |
| TOBACCO TRANSPLANT BEDS | 16,431 | - | - | - | - | 16,431 | 16,431 | 16,431 | 27 | 611 | 0% |
| Nomination Amount | 16,431 | 16,431 | 16,431 | 16,431 | 16,431 | 16,431 | 16,431 | 16,431 | 27 | 611 | 0% |
| % Reduction from Initial Request | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | | |

| Adjustments to Requested Amounts | Use Rate (kg/ha) | | (%) Karst Topography | | (%) 100 ft Buffer Zones | | (%) Key Pest Distribution | | Regulatory Issues (%) | | Unsuitable Terrain (%) | | Cold Soil Temp (%) | | Combined Impacts (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REGION | 2006 | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | HIGH | LOW |
| TOBACCO TRANSPLANT BEDS | 611 | 611 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 100% | 100% |

| Other Considerations | Dichotomous Variables (Y/N) | | | | | Other Issues | | | Economic Analysis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REGION | Strip Bed Treatment | Currently Use Alternatives? | Research / Transition Plans | Tarps / Deep Injection Used | Pest-free Cert. Requirement | Change from Prior CUE Request (+/-) | Verified Historic MeBr Use / State | Frequency of Treatment | Loss per Hectare (US$/ha) | Loss per Kilogram of MeBr (US$/kg) | Loss as a % of Gross Revenue | Loss as a % of Net Revenue | Quality/ Time/ Market Window/ Yield Loss (%) | Marginal Strategy |
| TOBACCO TRANSPLANT BEDS | Yes | No | ? | Yes | Yes | + | No | ? | | | | | 54% | Metam-Sodium |

Conversion Units: 1 Pound = 0.453592 Kilograms 1 Acre = 0.404686 Hectare

**Footnotes for Appendix A:**

Values may not sum exactly due to rounding.

1. **Average Hectares in the US** – Average Hectares in the US is the average of 2001 and 2002 total hectares in the US in this crop when available. These figures were obtained from the USDA National Agricultural Statistics Service.
2. **% of Average Hectares Requested** - Percent (%) of Average Hectares Requested is the total area in the sector's request divided by the Average Hectares in the US. Note, however, that the NASS categories do not always correspond one to one with the sector nominations in the U.S. CUE nomination (e.g., roma and cherry tomatoes were included in the applicant's request, but were not included in NASS surveys). Values greater than 100 percent are due to the inclusion of these varieties in the U.S. CUE request that were not included in the USDA NASS: nevertheless, these numbers are often instructive in assessing the requested coverage of applications received from growers.
3. **2006 Amount of Request** – The 2006 amount of request is the actual amount requested by applicants given in total pounds active ingredient of methyl bromide, total acres of methyl bromide use, and application rate in pounds active ingredient of methyl bromide per acre. U.S. units of measure were used to describe the initial request and then were converted to metric units to calculate the amount of the US nomination.
4. **2001 & 2002 Average Use** – The 2001 & 2002 Average Use is the average of the 2001 and 2002 historical usage figures provided by the applicants given in total pounds active ingredient of methyl bromide, total acres of methyl bromide use, and application rate in pounds active ingredient of methyl bromide per acre. Adjustments are made when necessary due in part to unavailable 2002 estimates in which case only the 2001 average use figure is used.
5. **Quarantine and Pre-Shipment** – Quarantine and pre-shipment (QPS) hectares is the percentage (%) of the applicant's request subject to QPS treatments.
6. **Regional Hectares, 2001 & 2002 Average Hectares** – Regional Hectares, 2001 & 2002 Average Hectares is the 2001 and 2002 average estimate of hectares within the defined region. These figures are taken from various sources to ensure an accurate estimate. The sources are from the USDA National Agricultural Statistics Service and from other governmental sources such as the Georgia Acreage estimates.
7. **Regional Hectares, Requested Acreage %** - Regional Hectares, Requested Acreage % is the area in the applicant's request divided by the total area planted in that crop in the region covered by the request as found in the USDA National Agricultural Statistics Service (NASS). Note, however, that the NASS categories do not always correspond one to one with the sector nominations in the U.S. CUE nomination (e.g., roma and cherry tomatoes were included in the applicant's request, but were not included in NASS surveys). Values greater than 100 percent are due to the inclusion of these varieties in the U.S. CUE request that were not included in the USDA NASS: nevertheless, these numbers are often instructive in assessing the requested coverage of applications received from growers.
8. **2006 Nomination Options** – 2006 Nomination Options are the options of the inclusion of various factors used to adjust the initial applicant request into the nomination figure.
9. **Subtractions from Requested Amounts** – Subtractions from Requested Amounts are the elements that were subtracted from the initial request amount.
10. **Subtractions from Requested Amounts, 2006 Request** – Subtractions from Requested Amounts, 2006 Request is the starting point for all calculations. This is the amount of the applicant request in kilograms.
11. **Subtractions from Requested Amounts, Double Counting** - Subtractions from Requested Amounts, Double Counting is the estimate measured in kilograms in situations where an applicant has made a request for a CUE with an individual application while their consortium has also made a request for a CUE on their behalf in the consortium application. In these cases the double counting is removed from the consortium application and the individual application takes precedence.
12. **Subtractions from Requested Amounts, Growth or 2002 CUE Comparison** - Subtractions from Requested Amounts, Growth or 2002 CUE Comparison is the greatest reduction of the estimate measured in kilograms of either the difference in the amount of methyl bromide requested by the applicant that is greater than that historically used or treated at a higher use rate or the difference in the 2006 request from an applicant's 2002 CUE application compared with the 2006 request from the applicant's 2003 CUE application.
13. **Subtractions from Requested Amounts, QPS** - Subtractions from Requested Amounts, QPS is the estimate measured in kilograms of the request subject to QPS treatments. This subtraction estimate is calculated as the 2006 Request minus Double Counting, minus Growth or 2002 CUE Comparison then

multiplied by the percentage subject to QPS treatments. *Subtraction from Requested Amounts, QPS = (2006 Request – Double Counting – Growth)*(QPS %)*

14. **Subtraction from Requested Amounts, Use Rate Difference** – Subtractions from requested amounts, use rate difference is the estimate measured in kilograms of the lower of the historic use rate or the requested use rate. The subtraction estimate is calculated as the 2006 Request minus Double Counting, minus Growth or 2002 CUE Comparison, minus the QPS amount, if applicable, minus the difference between the requested use rate and the lowest use rate applied to the remaining hectares.

15. **Adjustments to Requested Amounts** – Adjustments to requested amounts were factors that reduced to total amount of methyl bromide requested by factoring in the specific situations were the applicant could use alternatives to methyl bromide. These are calculated as proportions of the total request. We have tried to make the adjustment to the requested amounts in the most appropriate category when the adjustment could fall into more than one category.
    16. **(%) Karst topography** – Percent karst topography is the proportion of the land area in a nomination that is characterized by karst formations. In these areas, the groundwater can easily become contaminated by pesticides or their residues. Regulations are often in place to control the use of pesticide of concern. Dade County, Florida, has a ban on the use of 1,3D due to its karst topography.
    17. **(%) 100 ft Buffer Zones** – Percentage of the acreage of a field where certain alternatives to methyl bromide cannot be used due the requirement that a 100 foot buffer be maintained between the application site and any inhabited structure.
    18. **(%) Key Pest Impacts** - Percent (%) of the requested area with moderate to severe pest problems. Key pests are those that are not adequately controlled by MB alternatives. For example, the key pest in Michigan peppers, *Phytophthora* spp. infests approximately 30% of the vegetable growing area. In southern states the key pest in peppers is nutsedge.
    19. **Regulatory Issues (%)** - Regulatory issues (%) is the percent (%) of the requested area where alternatives cannot be legally used (e.g., township caps) pursuant to state and local limits on their use.
    20. **Unsuitable Terrain (%)** – Unsuitable terrain (%) is the percent (%) of the requested area where alternatives cannot be used due to soil type (e.g., heavy clay soils may not show adequate performance) or terrain configuration, such as hilly terrain. Where the use of alternatives poses application and coverage problems.
    21. **Cold Soil Temperatures** – Cold soil temperatures is the proportion of the requested acreage where soil temperatures remain too low to enable the use of methyl bromide alternatives and still have sufficient time to produce the normal (one or two) number of crops per season or to allow harvest sufficiently early to obtain the high prices prevailing in the local market at the beginning of the season.
    22. **Combined Impacts (%)** - Total combined impacts are the percent (%) of the requested area where alternatives cannot be used due to key pest, regulatory, soil impacts, temperature, etc. In each case the total area impacted is the conjoined area that is impacted by any individual impact. The effects were assumed to be independently distributed unless contrary evidence was available (e.g., affects are known to be mutually exclusive). For example, if 50% of the requested area had moderate to severe key pest pressure and 50% of the requested area had karst topography, then 75% of the area was assumed to require methyl bromide rather than the alternative. This was calculated as follows: 50% affected by key pests and an additional 25% (50% of 50%) affected by karst topography.
23. **Qualifying Area** - Qualifying area (ha) is calculated by multiplying the adjusted hectares by the combined impacts.
24. **Use Rate** - Use rate is the lower of requested use rate for 2006 or the historic average use rate.
25. **CUE Nominated amount** - CUE nominated amount is calculated by multiplying the qualifying area by the use rate.
26. **Percent Reduction** - Percent reduction from initial request is the percentage of the initial request that did not qualify for the CUE nomination.
27. **Sum of CUE Nominations in Sector** - Self-explanatory.
28. **Total US Sector Nomination** - Total U.S. sector nomination is the most likely estimate of the amount needed in that sector.
29. **Dichotomous Variables** – dichotomous variables are those which take one of two values, for example, 0 or 1, yes or no. These variables were used to categorize the uses during the preparation of the nomination.
    30. **Strip Bed Treatment** – Strip bed treatment is 'yes' if the applicant uses such treatment, no otherwise.
    31. **Currently Use Alternatives** – Currently use alternatives is 'yes' if the applicant uses alternatives for some portion of pesticide use on the crop for which an application to use methyl bromide is made.

32. **Research/ Transition Plans** – Research/ Transition Plans is 'yes' when the applicant has indicated that there is research underway to test alternatives or if applicant has a plan to transition to alternatives.
33. **Tarps/ Deep Injection Used** – Because all pre-plant methyl bromide use in the US is either with tarps or by deep injection, this variable takes on the value 'tarp' when tarps are used and 'deep' when deep injection is used.
34. **Pest-free cert. Required** - This variable is a 'yes' when the product must be certified as 'pest-free' in order to be sold

35. **Other Issues**.- Other issues is a short reminder of other elements of an application that were checked
36. **Change from Prior CUE Request**- This variable takes a '+' if the current request is larger than the previous request, a '0' if the current request is equal to the previous request, and a '-' if the current request is smaller that the previous request.
37. **Verified Historic Use/ State**- This item indicates whether the amounts requested by administrative area have been compared to records of historic use in that area.
38. **Frequency of Treatment** – This indicates how often methyl bromide is applied in the sector. Frequency varies from multiple times per year to once in several decades.

39. **Economic Analysis** – provides summary economic information for the applications.
40. **Loss per Hectare** – This measures the total loss per hectare when a specific alternative is used in place of methyl bromide. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
41. **Loss per Kilogram of Methyl Bromide** – This measures the total loss per kilogram of methyl bromide when it is replaced with an alternative. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
42. **Loss as a % of Gross revenue** – This measures the loss as a proportion of gross (total) revenue. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars.
43. **Loss as a % of Net Operating Revenue** -This measures loss as a proportion of total revenue minus operating costs. Loss comprises both the monetized value of yield loss (relative to yields obtained with methyl bromide) and any additional costs incurred through use of the alternative. It is measured in current US dollars. This item is also called net cash returns.

44. **Quality/ Time/ Market Window/Yield Loss (%)** – When this measure is available it measures the sum of losses including quality losses, non-productive time, missed market windows and other yield losses when using the marginal strategy.
45. **Marginal Strategy** -This is the strategy that a particular methyl bromide user would use if not permitted to use methyl bromide.

## APPENDIX B. SUMMARY OF NEW APPLICANTS

A number of new groups applied for methyl bromide for 2005 during this application cycle, as shown in the table below. Although in most cases they represent additional amounts for sectors that were already well-characterized sectors, in a few cases they comprised new sectors. Examples of the former include significant additional country (cured, uncooked) ham production; some additional request for tobacco transplant trays, and very minor amounts for pepper and eggplant production in lieu of tomato production in Michigan.

For the latter, there are two large requests: cut flower and foliage production in Florida and California ('Ornamentals') and a group of structures and process foods that we have termed 'Post-Harvest NPMA' which includes processed (generally wheat-based foods), spices and herbs, cocoa, dried milk, cheeses and small amounts of other commodities. There was also a small amount requested for field-grown tobacco.

The details of the case that there are no alternatives which are both technically and economically feasible are presented in the appropriate sector chapters, as are the requested amounts, suitably adjusted to ensure that no double-counting, growth, etc. were included and that the amount was only sufficient to cover situations (key pests, regulatory requirements, etc.) where alternatives could not be used.

The amount requested by new applicants is approximately 2.5% of the 1991 U.S. baseline, or about 1,400,000 pounds of methyl bromide, divided 40% for pre-plant uses and 60% for post-harvest needs.

The methodology for deriving the nominated amount used estimates that would result in the lowest amount of methyl bromide requested from the range produced by the analysis to ensure that adequate amounts of methyl bromide were available for critical needs. We are requesting additional methyl bromide in the amount of about 500,000 Kg, or 2% or the 1991 U.S. baseline, to provide for the additional critical needs in the pre-plant and post-harvest sector.

| Applicant Name | 2005 U.S. CUE Nomination (lbs) |
|---|---|
| California Cut Flower Commission | 400,000 |
| National Country Ham Association | 1,172 |
| Wayco Ham Company | 39 |
| California Date Commission | 5,319 |
| National Pest Management Association | 319,369 |
| Michigan Pepper Growers | 20,904 |
| Michigan Eggplant Growers | 6,968 |
| Burley & Dark Tobacco Growers USA - Transplant Trays | 2,254 |
| Burley & Dark Tobacco Growers USA - Field Grown | 28,980 |
| Virginia Tobacco Growers - Transplant Trays | 941 |
| Michigan Herbaceous Perennials | 4,200 |

| | |
|---|---|
| Ozark Country Hams | 240 |
| Nahunta Pork Center | 248 |
| American Association of Meat Processors | 296,800 |
| Total lbs | **1,087,434** |
| Total kgs | **493,252** |