# REVIEW AND ANALYSIS OF INTERNATIONAL RESEARCH OF ALTERNATIVES TO METHYL BROMIDE FOR PRE-PLANT FUMIGATION

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Under the Montreal Protocol *c.* 48,000 t of MB for pre-plant fumigation were scheduled to be phased out in developed countries by 1 Jan 2005, however retention of methyl bromide for 'Critical Use' has been possible if the Parties fulfil the criteria of Decision IX/6 under the Protocol. MBTOC provides advice on the Critical Use Nominations (CUNs) to the Protocol as the first stage in evaluation for Critical Use Exemptions (CUEs). Worldwide, industries worth over $8 billion have been granted CUE's for *c.* 15,000 t and 12,000 t of MB for continued use in soils in the years 2005 and 2006 respectively.

The objective of the present study was to assist with the evaluation of specific CUNs by providing a comparison of the reported performance of MB pre-plant alternatives worldwide. With funding from the Parties, MBTOC established this project to:

(a) Develop a database of major studies for MB alternative in industries and regions specified by the CUNs;
(b) Assess the performance of MB alternatives over a number of trials and regions; and
(c) Conduct meta-analyses using statistical comparisons of yields obtained with the major alternatives, paying particular attention to the variation in inoculum density of the pests, soil type, climate, method and rate of application, allowing sound conclusions to be drawn where local data were insufficient to estimate variability and performance.

The database was constructed using a relational database management system created in Microsoft Access. This structure enabled the data to be stored with one-to-many relationships. This was the most efficient and accurate way of recording articles containing several trials and/or treatment combinations (e.g. fumigants, herbicides, biological controls etc.). The structure of the database enables the storage and retrieval of all treatment and result information for statistical analyses.

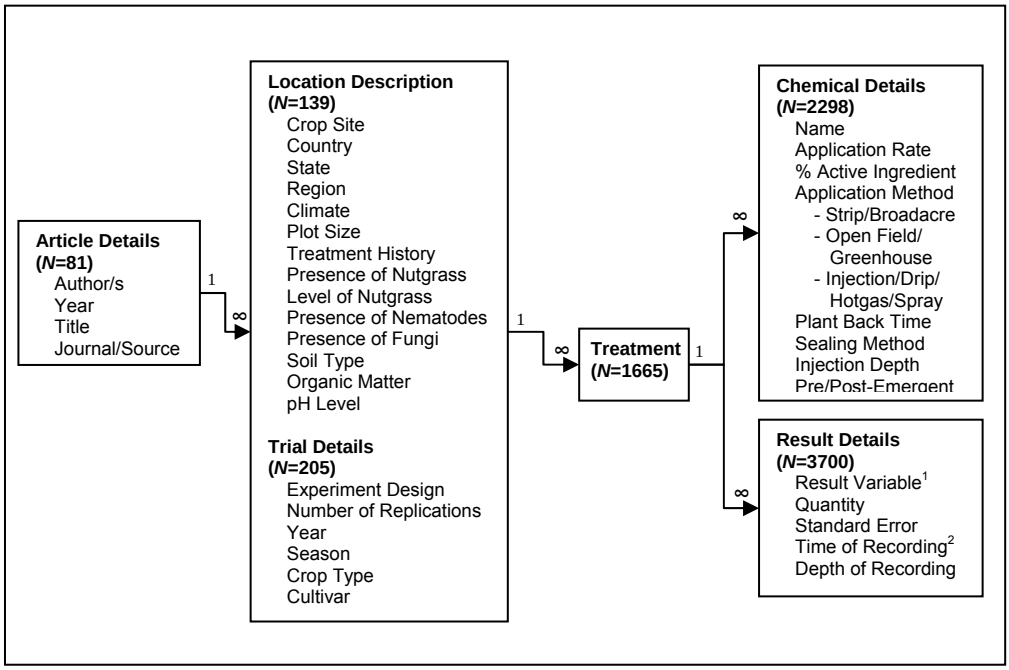
To date, the database contains the details of 1665 treatments gathered from 205 trials reported within 81 refereed and non-refereed publications, conference proceedings and unpublished data sources. Papers from both refereed journal and non refereed articles since 1997 have been included and only those where a minimum set of criteria were available (yield was reported in numeric format, an MB treatment was included, at least one main MB fumigant treatment was included). To date, the database has gained data on strawberry fruit, strawberry nurseries, tomato, melons and cucurbits, peppers,

eggplant). Where reported, details were gathered on all possible sources of variation between the treatments (such as application methods, sealing methods, plant back times etc.), as well as all response variables from the experiments (such as crop yield and pest infestation levels).

The descriptive details of two major industries reviewed for the analysis (strawberry fruit and tomato crops) are given in *Table 1*. For example, nutgrass infestation levels were categorized into low, moderate and high groups based on the number of plants reported in the untreated control plots (i.e. 1 to 5 plants/$m^2$, 6 to 30 plants/$m^2$, and greater than 30 plants/$m^2$ respectively). The dataset can therefore be used to assess the performance of different MB alternatives under different nutgrass infestation levels. This assists making technically-based recommendations and decisions on nutgrass thresholds where the use of MB is critical.

Meta-analyses of the data contained in the database have commenced and MBTOC plans to deliver a preliminary report on the outcomes of the project to the Parties in October 2005. The completion of this project will provide MBTOC and the Parties with a powerful tool for making decisions and technically-based evaluations transparently, relating to the availability of alternatives for the major crops, with a clearer indication of their limitations.

**Figure 1:** Structure and Size of the MBTOC Database Containing Experiments Conducted into Alternative to MB for Pre-Plant Fumigation in Pre-Plant Industries (1997 - 2005).




[1] *Result Variable* itemizes all treatment response variables, such as: marketable crop yield, total crop yield, nematode variety, fungi variety, weed variety.
[2] *Time of Recording* is measured in days after planting.

**Table 1:** Example of Numbers of Trials Contributing to the Database for Two of the Major MB User Industries

| | | Strawberry Fruit* | Tomatoes* |
|---|---|---|---|
| **Total** | | **101** | **61** |
| Location | *USA - California* | 28 | 1 |
| | *- Florida* | 15 | 40 |
| | *- Other* | 9 | 3 |
| | *Spain* | 25 | |
| | *New Zealand* | 15 | |
| | *Italy* | | 9 |
| | *Australia* | 6 | |
| | *Greece* | | 4 |
| | *Other* | 3 | 4 |
| Year | *1997-1998* | 22 | 19 |
| | *1999-2000* | 41 | 20 |
| | *2001-2002* | 28 | 17 |
| | *2003-2004* | 10 | 5 |
| Source | *Refereed Publication* | 2 | 29 |
| | *Non-Refereed Publication* | | 9 |
| | *Conference Proceedings* | 71 | 19 |
| | *Final Reports, etc.* | 28 | 4 |
| Disease | Nematodes | 13 | 35 |
| | Fungi | 18 | 33 |
| Nutgrass Level | *Low (1-5 plant/*$m^2$) | 3 | 5 |
| | *Moderate (6-30 plant/*$m^2$) | 2 | 4 |
| | *High (>30 plant/*$m^2$) | 3 | 10 |
| | *Not Reported* | 93 | 42 |
| Soil Type | *Sand* | 10 | 32 |
| | *Clay* | 7 | 3 |
| | *Loam* | 2 | 10 |
| | *Not Reported* | 82 | 16 |

* Number of trials in the database