Workshop on non-chemical alternatives to replace methyl bromide as a soil fumigant

REPORT
Workshop on non-chemical alternatives to replace methyl bromide as a soil fumigant

REPORT

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R. Labrada

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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## Abbreviations

<table>
<thead>
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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AITC</td>
<td>Allyl Isothiocyanates</td>
</tr>
<tr>
<td>CFU</td>
<td>Colony-Forming Units</td>
</tr>
<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FFS</td>
<td>Farmers Field School</td>
</tr>
<tr>
<td>FOL</td>
<td>Fusarium oxysporum f.sp lycopersici</td>
</tr>
<tr>
<td>FOM</td>
<td>Fusarium oxysporum f.sp melonis</td>
</tr>
<tr>
<td>ICM</td>
<td>Integrated Crop Management</td>
</tr>
<tr>
<td>INIA</td>
<td>Instituto Nacional de Investigaciones Agrarias</td>
</tr>
<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
</tr>
<tr>
<td>MAPA</td>
<td>Agriculture, Fisheries and Food</td>
</tr>
<tr>
<td>MB</td>
<td>Methyl Bromide</td>
</tr>
<tr>
<td>MBTOC</td>
<td>Methyl Bromide Technical Option Committee</td>
</tr>
<tr>
<td>MITC</td>
<td>Methyl Isothiocyanates</td>
</tr>
<tr>
<td>MMA</td>
<td>Ministries of the Environment</td>
</tr>
<tr>
<td>MNSV</td>
<td>Melon Necrotic Spot Virus</td>
</tr>
<tr>
<td>MYCPP</td>
<td>Multy Year Crop Protection Plan</td>
</tr>
<tr>
<td>NCS</td>
<td>Nematode Control Strategy</td>
</tr>
<tr>
<td>NFT</td>
<td>Nutrient Flow Technique</td>
</tr>
<tr>
<td>PCN</td>
<td>Potato cyst nematode</td>
</tr>
<tr>
<td>PE</td>
<td>Polyethylene (PE)</td>
</tr>
<tr>
<td>PPO–AGV</td>
<td>Applied Plant Research</td>
</tr>
<tr>
<td>TOT</td>
<td>Training of Trainers</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>VFA</td>
<td>Volatile fatty acids</td>
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Preface

Soil-borne pests are a major constraint to the production of various economically important crops, especially vegetables and ornamentals. Soil disinfection is a normal practice to combat several soil-borne plant pathogens, weeds and arthropods pests, and is currently implemented before planting to avoid any damage to the crops once they are planted.

Methyl bromide (MB) has been the main agent used for the control of soil-borne pests worldwide. However, the discovery of its ozone-depleting effect has prompted the parties of the Montreal Protocol to agree on a phase-out of its use and production. All country signatories to the Protocol have been identifying and validating new alternatives to replace MB. Significant progress has been made in this area: indeed, the Methyl Bromide Technical Option Committee (MBTOC) has asserted that every single crop can be produced successfully without its use.

The phasing out of MB provides an opportunity for farmers to be more innovative in their approach to pest management. Understanding the biology and host range of the economically important pests that pose risks to a given crop is an important element in the development of a new approach for soil pest control.

At present, there are several chemical fumigants already in use, but some new non-chemical alternatives have also been identified, most of them providing good soil-borne pest control if properly combined and integrated. These alternatives are more environmentally friendly than the routine use of other chemical fumigants, and their success will largely depend on regular pest monitoring and the use of all possible resources to reduce and prevent the incidence and effects of a given disease or pest.

In understanding the need for the development of environmentally viable approaches to soil pest management, FAO and the United Nations Environment Programme (UNEP) decided, jointly with the authorities of the Ministry of Environment in Hungary, to organize a Subregional Technical Workshop with the participation of several specialists from Bulgaria, Hungary and Poland, as well as from other parts of Europe. The Workshop, held in Budapest, 26–28 June 2007, aimed to exchange information and experiences on the non-chemical alternatives already validated in each of the above-mentioned countries and discuss possible ways of their future use in the countries.

The present document compiles most of the information presented and discussed at the Workshop, which may also be useful to scientists, extension workers and farmers in other regions of the world.

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INTRODUCTORY PAPERS
The phasing out of methyl bromide

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Summary
The historical consumption of MB is described as well as the efforts to identify and validate new alternatives for soil-borne pest control, such as the use of floating beds and substrates such as rockwool; the use of the fumigants such as dazomet, metasodium, Nemathorin 10 G and Vydate 10 G (Oxamil); growing of resistant cultivars or grafting on resistant rootstocks, and the use of preparations based on microorganisms for biological control of soil-borne pest.

Introduction
MB has been used in Hungary since 1982 for soil fumigation only, in different vegetables under greenhouse and in the open field. Figure 1 clearly shows the use of the fumigant from 1998 to 2003. Figure 2 indicates that the main uses of MB have always been as a soil fumigant in vegetables, tobacco and other minor crops. Table 1 shows the main target pests for MB application, which were mainly soil diseases, including damping-off, nematodes and Gryllotalpa gryllotalpa, among others.

It is clear that once Hungary started to comply with the initial convention and the Montreal Protocol, the use of the fumigant was reduced year after year. Hungary signed the Vienna Convention in 1988, became a signatory of the Montreal Protocol in 1989, and later signed the amendments of London (1993), Copenhagen (1994), Montreal (1999) and Beijing (2002).

Figure 1: Consumption of MB in Hungary, 1991–2003
Hungary initiated a programme for identifying and validating new alternatives to replace the use of MB in different crops. As a result of this work, there are currently several alternatives already implemented and largely used by farmers: hydroponics, the use of floating beds and various substrates other than soil, e.g. rockwool; the use of other fumigants that are non-aggressive with the ozone layer, such as dazomet, metam sodium, Nemathorin 10 G and Vydate 10 G (Oxamil); growing of resistant cultivars or grafting on resistant rootstocks; and the use of preparations based on microorganisms for biological control of soil-borne pests.

Figure 2: Pre-planting MB use in crops, 1995–98

Table 1: Main target pests for the control by methyl bromid

<table>
<thead>
<tr>
<th>Crops</th>
<th>Pests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables:</td>
<td>Meloidogyne spp. (6 sp.)</td>
</tr>
<tr>
<td>sweet pepper</td>
<td>Fusarium oxisporum</td>
</tr>
<tr>
<td>(paprika)</td>
<td>Sclerotinia spp.</td>
</tr>
<tr>
<td>tomatoes</td>
<td>Bothrytis spp.</td>
</tr>
<tr>
<td>cucumber</td>
<td></td>
</tr>
<tr>
<td>Tobacco seedling</td>
<td><em>Pythium debarianum</em></td>
</tr>
<tr>
<td></td>
<td><em>Fusarium sp.</em></td>
</tr>
<tr>
<td></td>
<td><em>Gryllotalpa gryllotalpa</em></td>
</tr>
<tr>
<td></td>
<td><em>Thrips tabaci</em></td>
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