CHEMICAL ALTERNATIVES TO METHYL BROMIDE IN ITALY: AN UPDATE

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Background

Due to the importance of its horticultural sector, Italy was one of the largest consumers of methyl bromide (MB). Italian horticulture is characterized by intensive cultivation systems where high plant density and repeated planting of the same crop in the same land cause a build-up of detrimental biological factors in the soil that reduce yields.

In 1995, Italy consumed more than 7600 metric tons of MB, mainly for soil fumigation (tomato and strawberry), ranking first in Europe and second in the world after the United States. As a Member State of the European Union, Italy had to comply with reduction targets established under the EU Regulation (Reg. CE 3093/94 and Reg. CE 2037/2000). Approximately 3700 metric tons of MB were used in Italy in 2001, over the 50% less of the 7600 tons applied in 1995. Most MB is still applied for preplant soil fumigation mainly in Southern Italy (89%) including 56% in Sicily where horticultural production is more intensive. The largest uses of MB by crop are for tomatoes (42%), strawberries (17%), ornamentals (8.4%) and eggplants (8%). Structural fumigation with MB represents only 6% of total consumption: mills and pasta factories are the main users (Gullino *et al*., 2003).

Chemical alternatives currently or recently registered.

Different substances are registered for soil disinfestation in Italy (table 1). An emulsifiable formulation of 1,3 D (1,3 D EC, 94% p.a. - Dow AgroSciences), a formulation of metham potassium (Tamifum - 50% a.i. - Taminco) and an emulsifiable formulation of chloropicrin (Tripicrin - 94% a.i. - Triagriberia SL) have been respectively registered since November 2001, June 2002 and July 2002. The application rates vary between 150 and 250 l/ha for the 1,3 D EC. The chloropicrin formulation can be applied at 120 - 240 l/ha, while the metham potassium formulation can be distributed at 800 - 1200 l/ha. 1,3 D EC and metham potassium are registered for annual and perennial crops. 1,3 D EC is now registered in protected crops, while the old formulation of 1,3 D was registered for open field applications only. Chloropicrin formulation can be applied only by professional licensed workers: it is registered for open field and protected tomato, pepper, strawberry, melon, watermelon, eggplant and zucchini crops: a label extension to lettuce and perennial crops is expected within 2006.

Concerning the EC formulations of 1,3 D and chloropicrin, their application is now admitted throughout drip irrigation systems: this application is totally new for Italian growers, and particularly adapted to the fumigation under greenhouses.

Unfortunately, even if 1,3D EC and chloropicrin are currently registered, the possibility to made mixtures directly in the field, by adopting the separate formulations, is forbidden, reducing the technical possibility to substitute MB.
Among non fumigant alternatives to MB, carbofuran, fenamiphos, fosthiazate, oxamyl, cadusafos and ethoprophos could be applied against nematodes alone or integrated with soil solarization before and after crop transplant: their adoption can be recommended to increase or to extend the effects of soil fumigation (Lamberti *et al*., 2003). Unfortunately as well as for 1,3 D, metham sodium, metham potassium, dazomet and chloropicrin, also such non fumigant substances are under revision according to European regulation 91/414/CEE.

The Italian market of fumigants

Compared to the market of chemical compounds for agricultural uses, which progressively decreased, the fumigants alternative to MB maintained a stable trend (figure 1). The MB reduction does not seem to strongly influence the consumption of alternative fumigant and not fumigant compounds. The registration of the formulation of 1,3 D, admitted for greenhouse application, and of chloropicrin, in conjunction with the MB phase out after the 31st December 2004, will probably generate a positive trend in the market of chemical alternatives to MB (Lamberti *et al*., 2003).

Perspectives

In the next future, other chemicals will probably be registered, particularly following the experiences carried out in USA. Mixtures of 1,3 D + chloropicrin and MB + chloropicrin, at different ratios, could be registered within 4-5 years.
Obviously chemical alternatives cannot be considered the only suitable and effective alternative: other solutions and strategies will replace the chemical fumigation. Soilless cultivation systems, soil steaming, grafting onto resistant rootstocks, biocontrol agents and crop rotation are effective methods, but need, respectively, a relevant economical investment, a large fuel availability, a relevant increase of costs of propagative material, an increase of knowledge concerning pest and disease to be limited and a large soil availability to organize a effective rotation.

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Literature cited

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Table 1 - Fumigants registered for soil disinfestation in Italy.

Active ingredient	Available commercial formulations	Admitted application methods	Toxicological category	Under revision according to 91/414 UE regulation
methyl bromide	98%a.i.+ 2% chloropicrin	pre-plant soil disinfestation throughout soil injection or hot gas fumigation	highly toxic *	yes
1,3 D	97% a.i.	pre-plant soil disinfestation throughout soil injection	toxic	yes
1,3 D	94% a.i. EC	pre-plant soil disinfestation throughout drip irrigation system	toxic	yes
Chloropicrin	94% a.i. EC	pre-plant soil disinfestation throughout soil injection or drip irrigation system (strawberry, tomato, eggplant, pepper, melon, watermelon, zucchini crop)	highly toxic *	yes
Metham sodium	many (water soluble)	pre-plant soil disinfestation throughout soil injection, drip irrigation system or soil mixing	harmful	yes
Dazomet	98% a.i. granules	re-plant soil disinfestation throughout soil mixing	harmful	yes
Metham potassium	liquid solution	pre-plant soil disinfestation throughout soil injection	harmful-corrosive	yes

* all application and handling activities are reserved to professional and qualified workers according to Italian law (R.D. 9.1.1927 n. 147; art. 25-26 D.P.R. 23.04.2001 n. 290).

Figure 1 – Annual consumption (quantity and economical value) of chemical alternative to MB in Italy including: aldicarb - dazomet - 1,3 D - ethoprophos - fenamiphos - fosthiazate - metham sodium) (adapted from Lamberti *et al.*, 2003).