

COMMERCIAL ADOPTION OF ALTERNATIVES TO MB IN FLORICULTURE IN DEVELOPING COUNTRIES

Marta PIZANO
Consultant and MBTOC Member
Bogotá, COLOMBIA
mpizano@unete.com

1. INTRODUCTION

Commercial floriculture worldwide is characterized by high investment and stringent quality demands which often imply high pesticide usage. Consumers want perfect flowers – completely free of damage caused by pests and diseases. Presently, more and more flowers are being grown in tropical countries where the climate is benign and allows for year round production at accessible costs. The flowers are then exported to temperate countries. Increasing trade of flowers has led to establishing stringent phytosanitary measures at ports of entry, in an effort made by corresponding authorities to limit and avoid the spread of pests in their countries. Generally, this means that exporters are required to send flowers that are disease and pest free.

Most importantly though, in every country in the world where flowers are grown for commercial purposes, production is greatly affected by severe pests and diseases that prevail and build up in the soil leading to tremendously high losses in yield and quality. Among these, root knot (*Meloidogyne* sp.) and to a lesser extent cyst (*Heterodera* sp.) nematodes can be particularly troublesome (Arbeláez *et. al.* 1985; Osorio, 1995; Navarro, 1995), as well as fungi (*Fusarium*, *Verticillium*) and some bacteria, particularly crown gall (*Agrobacterium tumefaciens*). Eradicating these noxious organisms from the soil can be difficult; they may even render whole areas unsuitable for the production of susceptible flowers, and make soil disinfestation mandatory. Traditionally, the treatment of choice has been fumigating with methyl bromide given its wide spectrum of action, its efficiency and its cost, which is usually lower than that of other fumigants.

Upon learning about the methyl bromide phase out, many flower growers around the world have expressed deep concern, arguing that there exist no truly efficient alternatives to this fumigant and that, given the strict quality demands imposed on their products, they will go out of business.

However, producing flowers of excellent quality without methyl bromide is clearly possible and is already being done. The best example is Colombia, where initial trials with methyl bromide failed, forcing growers to look for alternatives thirty years ago. For many years Colombia has been the second flower exporter in the world after Holland, its export production valued at around US\$675 million in 2002. Pioneer growers initially considered methyl bromide as an option, but abandoned the idea, firstly because it seemed too difficult and dangerous to apply, but also because at the time it was a costly product. Furthermore, the most valid reason for not using methyl bromide is the fact that due to the very high organic matter content in Colombian soils (18% is common). The bromine from the methyl bromide is fixed in the soil, leading to phytotoxicity problems that are difficult to solve.

2. ALTERNATIVES TO MB FOR COMMERCIAL FLORICULTURE

Substituting methyl bromide requires a grower to take a new approach towards producing flowers. There is no single replacement for this product; rather, a whole program, involving different measures which together lead to disease reduction is the answer. In different parts of the world, several alternatives to methyl bromide are already in use in cut flower production, often with excellent results. Depending on circumstances related to environmental conditions, supplies, infrastructure available and others, one or another of these alternatives might be more suited for a particular grower.

The following alternatives have been significantly adopted in developing countries where a large part of commercial floriculture takes place today and deserve further comment:

2.1. Steam sterilization (Pasteurization)

If carried out properly, steam is probably the best alternative to methyl bromide, proving equally effective (Carulla, 2003; MBTOC, 2002). Steam is presently used successfully in countries like Colombia (Pizano, 2002a; Carulla, 2003), Costa Rica (Chaverri and Gadea, 2001) and Ecuador and is starting to be adopted by growers in Uganda, Zimbabwe and Uruguay (Castellá, pers. com. 2003; UNIDO, 2003).

Many variables influence the success and cost effectiveness of steam, for example the boiler and diffusers used, soil type and structure and soil preparation (Morey, 2001; Pizano, 2001; Pizano, 2002 a, b). Other problems may also arise in association with steaming itself, such as accumulation of soluble salts (particularly manganese), ammonium toxicity and recontamination.

Steam is always more effective when a limited amount of substrate is treated but not the ground soil. However, it can be used as an economically feasible alternative to methyl bromide for flowers grown commercially, when it is part of an integrated management system that helps maintain diseases and pests at a low level of incidence (see Table 1); resistant varieties work well with steam, as they can be grown in areas where disease has occurred in the past (Carulla, 2001, 2002). Steam has other benefits when compared to fumigants, as these usually require a waiting period – sometimes at least thirty days - before replanting can occur, while steamed soils can be replanted immediately. This sole fact adds one whole month of flower production to steamed areas, representing nearly 135,000 exportable carnation flowers and about \$10,000 dollars per hectare (Carulla, 2001) or 100,000 exportable rose flowers (Valderrama, 2002).

Amending steamed soil with compost and / or beneficial organisms such as *Trichoderma* also gives good results (Carulla, 2001, 2002; Chaverri and Gadea, 2001). Good control of soil fungi such as *Phoma* and *Pythium*, and of lesion nematodes, *Pratylenchus* sp. has been reported in *Dendranthema* ranges (Valcárcel, 2001, Rodríguez & Martínez, 1996). Growers also report fewer problems with soluble salts and an overall improvement in plant vigor and productivity. In *Dendranthema* nurseries, compost is easily incorporated into the soil as cropping cycles are short (about four months) and plants have to be completely removed and new ones put in. However, it can also be applied during the cropping cycle of many flowers with excellent results (Pizano, 2001).

2.2. Soil-less substrates

Cultivation of cut flowers on raised beds and in artificial (inert) or soil-less substrates (sometimes called hydroponic production) has been widely used for many years in developed countries such as Holland and Israel. The reasons for using them have generally been associated with the presence of poor soils that are not suited for flower or vegetable production. Raised or otherwise isolated beds offer several advantages, in particular not needing fumigation or offering the possibility of sterilizing a limited amount of substrate. Better control of plant nutrition is also possible. In the past, growers in the developing world often considered this option too costly and “high-tech”. Materials such as rock-wool and even peat moss were often not available and needed to be imported. Concrete raised beds and floors are usually very expensive. These factors, together with the availability of plentiful extensions of fertile, rich soils, explain why soil-less culture did not become widespread in tropical and subtropical countries where flowers are produced. For many years, when soil-borne diseases that were difficult to control caused economic losses, a grower would simply plant the next crop on “new” soil, leaving the infested areas for producing species not affected by such problems.

However, in recent years this situation has started to change. In developing countries flower industries have often developed around large cities where international airports are readily accessible for shipping their products. As cities have developed over time, land often becomes expensive and expansion of farms is restricted, hence new soil is no longer within easy reach. Wide-spectrum fumigants either will not be available (for example methyl bromide) or are restricted in their use by other environmental or health concerns and steam is too costly as a control measure for soils already containing high populations of pathogens.

These reasons have stimulated flower growers to look for materials and systems that are locally available, suitable for soil-less production and economically feasible. Among these rice hulls, coir, sand and composted bark, are possibly the most promising (Calderón, 2001). Pumice stone and volcanic scoria are another option (Pizano, 2001). Although setting up a soil-less production system is expensive – around 47% more expensive than traditional ground beds - growers are able to compensate the extra cost through significantly better yields (20-25%) that result from higher planting density, optimum plant nutrition and better pest and disease control (Carulla, 2001; Valderrama & La Rota, 2001).

Production in substrates is a definite trend in most Latin American countries where commercial floriculture is important, for example Brazil, Ecuador and Colombia (Pizano, c, d) and also in Kenya (Pizano, 2001; UNIDO, 2003; MBTOC, 2002).

2.4. Fumigants

Trials and experiences with soil fumigants in floriculture have shown that their effectiveness varies with factors like the pathogens to be controlled, soil characteristics and crop species. These chemicals have been combined together or with other options such as steam with variable results (Arbeláez, 2000).

Several fumigants are being evaluated as alternatives to methyl bromide, both by commercial growers in many countries, as well as in several demonstration projects conducted by the Montreal Protocol's implementing agencies (Pizano, 2001). The most promising results have been obtained with metam sodium, dazomet and 1,3 dichloropropene + chloropicrin (Correa, 2001; Marroquín and Arbeláez, 1991; MBTOC, 2002; Palacios, 1998.)

Table 1 below presents costs of different treatments in Colombia. However, when determining the treatment of choice, cost is not the only factor to be considered as the environment, sustainability of production, health hazards and others also play an important role in this decision.

TABLE 1. Comparison of general costs for sterilizing the soil with several fumigants and steam in Colombia¹ (Carulla, 2001; Rodríguez & Martínez, 1996; Trujillo, 2001)

TREATMENT	COST PER HECTARE ²
Dazomet	\$5,680
Metam Sodium	\$5,120
Dichloropropene ³	\$8,695
Methyl Bromide	\$5,030
Steam ⁴	\$8,479

¹ Figures in US dollars. ² Includes general hand labor costs. ³ Usually in combination with chloropicrin. ⁴ Low disease incidence, in combination with integrated pest management.

REFERENCES

- Arbeláez, G. 2000: Investigación y desarrollo en el control de la marchitez vascular del clavel en Colombia. *In*: Pizano, M. ed. Clavel. Ediciones Hortitecnia, Bogotá, Colombia. Pp. 89-98.
- Arbeláez, G, E. Garcés y G. Acosta. 1985: El nematodo quiste *Heterodera trifolii* G., una nueva enfermedad del clavel en Colombia. *In*: *Asocolflores* (5) :17-18, sep., 1985.
- Calderón, F. 2001: Qué son los cultivos hidropónicos y el por qué de la hidroponía. *In*: Calderón, F. Ed. Memorias, Primer curso de hidroponía para la floricultura. Mayo 31 – Junio 2, 2001. Bogotá, Colombia. Pp. 1-20.
- Carulla, R. 2001, 2002: Flexport de Colombia. *Personal communication*.
- Castellá, G. 2003. Personal communication. UNIDO, Viena, Austria.
- Castro, G. C. Estévez and M. Defaz 1995: Principales problemas patológicos identificados en plantas ornamentales en la sierra ecuatoriana.
- Chaverri, F. and A. Gadea. 2001b. Alternatives to Methyl Bromide for soil fumigation on Costa Rican cut flowers. UNDP project report. COGO, San Jose.

- Correa, J. E. 2001: Evaluación de Basamid GR para el control de nematodos fitoparásitos en pompón variedad 'Vero'. In: Acopaflor 8 (2) :10, 12, 14-15, mar-abr.
- MBTOC, 2002: Methyl Bromide Technical Options Committee Assessment of Alternatives to Methyl Bromide. UNEP, Nairobi
- Marroquín, A. y G. Arbelaez. 1991:Control químico del nematodo quiste *Heterodera trifolii* en clavel miniatura. In: Agronomía Colombiana 8 (2) :248-252, jul/dic.
- Morey, L. 2001: Steam rolling – a reliable system for beds. *Growertalks* (Oct.): 60-62.
- Navarro, R. 1995: Manejo integrado de nematodos en floricultura. In: *Simposio Internacional "El Manejo Integrado de Plagas y Enfermedades en Floricultura"* ASOCOLFLORES Bogotá , Feb.1995 :146-152.
- Ortiz, L. F. 2000: Enfermedades causadas por nematodos. In: Pizano, M. ed. Clavel. Ediciones Hortitecnia, Bogotá, Colombia.
- Osorio, W. 1995: Efecto de la densidad de nematodos fitoparásitos en el crecimiento del crisantemo c.v. 'Polaris'. *Asocolflores* (43) :8-12
- Palacios, G; B. Forero. 1998: El manejo adecuado del suelo en el cultivo del pompón. *Asocolflores* (48): 16-23
- Pizano. M. 2001. Floriculture and the Environment – growing flowers without methyl bromide. UNEP/ DTIE, Paris 115 pp.
- Pizano, M. 2002a. Alternatives to Methyl Bromide for use in Cut Flower Production. Pp 218 – 222 In: *Proceedings of International Conference on Alternatives to Methyl Bromide – The remaining challenges*. Seville, Spain, 5 – 8 March 2002.
- Pizano, 2002b. Pasteurización y Maneo Integrado de Plagas – alternativas al Bromuro de Metilo. ONUDI – DINAMA – Oficina del Ozono Montevideo, Uruguay. 51pp
- Pizano, M. 2002c. New trends in Latin American rose production and export. . *FloraCulture International* April 2002: 18 - 21.
- Pizano, M. 2002d. Ceará, Brazil: Europe's newest flower source? . *FloraCulture International* June 2002: 22 - 25.
- Rodríguez-Kábana, R.; Martínez-Ochoa, N. 1996: Cut flower production in Colombia without methyl bromide. In: Banks, J. ed. Agricultural production without methyl bromide – four case studies. CSIRO, Australia. Pp. 8-28.
- Trujillo, A. 2001: Agrícola Cardenal. *Personal communication*.
- UNIDO, 2003. Demonstration project on alternatives to Methyl Bromide in cut flowers in Kenya.
- Valcárcel, F. 2001: Jardines de los Andes *Personal communication*.
- Valderrama, H.; La Rota, R. 2001, 2002: Flores Sagaró. *Personal communication*.