ALTERNATIVES TO METHYL BROMIDE FOR CUT FLOWERS IN TURKEY

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Expansion of intensive commercial floriculture occurred from 1985 onwards in Turkey when growers identified a good opportunity of exporting cut flowers to Europe. In 2006, flower exports reached $40 million USD (405 million stems). Production comprises mainly carnations (43 %), roses (13 %), gladioli (12 %) and gerbera (9 %), with the remaining 23% composed by other flowers (Mediterranean Fresh Vegetable and Fruit Exporter Union, 2006, pers. comm.). The flower sector in Turkey is complex, being composed by 800 – 900 growers varying in size and technical development, and producing many flower types (Yilmaz *et. al*., 2006).

MB was used in the past mainly by carnation growers for the control of nematodes (*Meloidogyne* spp) and fusarium wilt (*Fusarium oxysporum* f.sp. *dianthi)*. Also by gerbera producers for controlling soilborne fungi, namely *Fusarium* (Oztürk *et. al.* 2002). In 2000, Turkey reported a consumption of 487.6 tonnes of MB in the horticulture sector including floriculture. Demonstration projects funded by the MLF and implemented by UNIDO and the World Bank provided an opportunity to identify alternatives to MB for floriculture. Solarisation combined with chemical alternatives proved to be technically and economically suitable, while steam application proved to be efficient but very expensive.

Through the investment project, which is ongoing at present with UNIDO as implementing agency, these alternatives have been further trialled and adopted by growers. The project works with model farms that agree to implement alternatives under commercial conditions. Once the model farms are having success, a larger group of growers is supported with technical assistance and necessary materials (chemicals, plastics) so they can also implement the technique. An even larger group is monitored and offered technical assistance, to ensure dissemination and proper adoption of the selected alternatives.

Very good results are obtained with solarization + 1,3-dichloropropene (Condor®) and solarization + metham sodium in the Mediterranean region of Turkey, where climatic conditions favour the effects of solarization (Table 2 a,b) (Yilmaz *et al.,* 2007). In Isparta, where the climate is cooler and not suited for solarization, soil-less production has been introduced for carnations with very good results: although significantly more expensive than MB (Table 1), the additional investment is compensated by higher yields and better quality (Table 2c) (Yilmaz *et al.,* 2007). Soil-less culture has proven to be a viable alternative for the cut flower sectors; however, Turkish growers need to acquire further expertise to establish and operate this system extensively (Yılmaz *et. al*., 2006; (Yilmaz *et al.,* 2007).

As additional support, the project will open a propagation facility through which growers can obtain disease-free flower cuttings. Cultural techniques and IPM are continuously demonstrated to growers, as these are essential for the success of these alternatives. Good Agricultural Practices (GAP) and traceability of crops have also been introduced, since these are important for exporters. A very detailed survey of MB users, soilborne pests, grower profiles, and infrastructure of the cut flower sector was conducted to ensure that training efforts were successful (Yılmaz *et. al*., 2006). The project has further encompassed intensive training activities for floriculture and all other relevant sectors; training included workshops, meetings with growers and technical staff, field visits, training sessions in the field, domestic and international training activities and radio and TV programs. Overall in the horticultural sector (including floriculture), about 1,000 growers and technical personnel were reached and nearly 12,000 growers were visited and directly trained.

Complete phase-out of MB will be achieved by the end of 2007 in the floriculture sector, well before the 2015 deadline set forth by the Montreal Protocol in Article 5 countries.

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Table 1. General costs of MB alternatives for cut flower production in Turkey

Sector	Alternatives	Registration Status	Application Method	Cost USD$/ha	Target Pest
Cut-Flower	MB	Registered	Dripping	3.350	SBP,N,W*
	Chloropicrin + 1.3D	Not Registered	Dripping	2.380	SBP, N.
	MS	Registered	Dripping	3.180	SBP, N
	1.3D	Registered	Dripping	1.430	N
	Dazomet	Registered	By hand	2.240	SBP, (W),
	Steam application	-	Steam machine	23.000	SBP, N, W
	Soilless Culture	-	-	13.159 (inc. initial inv. cost)	SBP, N, W

SBP = Soilborne pathogens. N = Nematodes. W = Weeds

Table 2 a. Economic feasibility of alternatives to MB for cut flowers: Solarization + chemicals (Tan Tarim Carnation Model Farm, Altinova, Antalya) Figures in USD.

Alternative	Gross Production/ da	Total Cost	Net Profit
Control	13,246	11,365	1,881
S + MS	17,214	12,601	4,613
S + Dz	16,839	12,923	3,916
S + Cr	16,613	12,479	4,134

S= Solarization. MS = Metham Sodium. Dz = Dazomet Cr = Condor.

Table 2b. Economic feasibility of alternatives to MB for cut flowers: Solarization + chemicals (Gerbera model farm, Tempo Tarim, Altinova, Antalya) Figures in USD.

Alternative	Gross Production	Total Cost	Net Profit
Control	15,079	14,058	1,021
S + MS	20,501	16,061	4,440
S + Dz	20,436	16,073	4,363
S + Cr	21,510	16,309	5,201

S= Solarization. MS = Metham Sodium. Dz= Dazomed Cr = Condor.

Table 2c. Economic feasibility of alternatives to MB for cut flowers: Soil-less production (Carnation model farm, SDÜ, Isparta)

	GPI (USD)	Total cost (USD)	Net Profit (USD)
Soil-less production	**19,180**	**15,421**	**3,758**