

Mohamed Besri

Methyl Bromide Technical Options
Committee Co-chair (MBTOC, UNEP)
Institut Agronomique et Vétérinaire
Hassan II, Rabat, Morocco
m.besri@iav.ac.ma

The Montreal Protocol and the Methyl Bromide Phase Out in the Dates' Sector

Abstract

The meeting of the parties (MOP) to the Montreal Protocol called for the Methyl Bromide (MB) phase-out in 1992. In 1997, a global phase-out schedule of this chemical was established by the MOP: Article 5 countries are required to freeze consumption and production of MB by 2002, reduce its use by 20% in 2005 and complete total phase-out by 2015. Non Article 5 countries had to phase-out MB by 2005. However, non article 5 countries were allowed by the parties to present Critical Use Nominations

(CUNs). The exemption application process is extremely rigorous. After analysis of the CUNs, MBTOC makes recommendations on the applications to the Parties to the Protocol. The Parties then determined whether or not to approve each application. The two countries presenting every year CUNs for dates' disinfestation are the US (California) and Israel. Consumption of MB for controlled uses has significantly decreased both in developed and developing countries. In A5 countries, phase-out has been achieved to a large

extent through investment projects funded by the Multilateral Fund of the Montreal Protocol through its implementing agencies and some bilateral agreements. UNIDO designed a project proposal to address the issue of alternative of MB for the palm date sector.

The objective of the project is to demonstrate whether alternatives to MB for the treatment of high moisture dates are technically and economically available in Algeria and Tunisia. UNEP and UNEP/ROWA have organised many activities in North Africa and in the Middle East to discuss and implement alternatives to MB for dates' disinfestation.

Keywords: Montreal Protocol, ozone layer, methyl bromide, dates, critical use exemptions.

Introduction

Stratospheric ozone protects life on earth from the damaging effects of ultraviolet B radiation. In 1974, Molina and Rowland, from the University of California in the United States, proposed the hypothesis that stratospheric ozone was being broken down by volatile man-made Ozone Depleting Substances (ODS). This prediction was of enormous environmental importance and earned both of them a Nobel Prize in chemistry in 1995. In response to the resulting ozone hole being observed in the 1980s, the Vienna Convention to protect the ozone layer was set up in 1985 and in 1987, the Montreal Protocol (MP) was formed and this commenced regulation of ozone depleting gases.

Increased UV radiation on earth created by the ozone hole has many effects on organisms and human health. It affects plants and animals alike. Phytoplankton populations are reduced and this affects the food

chain. In humans, increased exposure to UV-B increases the risk of skin cancer, cataracts, and a suppressed immune system (Fahey, 2006). For example, in Australia it adds to their already high incidence of skin cancer, which is the worst in the world, with two out of three Australians being affected by it at some stage of their lives.

MB was included as an ozone depleting substance under the Copenhagen Amendment of the MP in 1992. Although MB has a much shorter half-life than many other ODS substances in the atmosphere, bromines are up to 50 times more destructive than chlorines and regulation of MB was considered to have immediate benefits to ozone layer recovery. The Copenhagen amendment set different phase-out schedules of 2005 and 2015 for industrialized (Non-A5) and developing (A5) countries, respectively. Quarantine and Preshipment (QPS) uses are presently exempted from controls, although consideration is being given to further regulation. Although many sectors in industrialized countries met the phase out of 2005, a large number of sectors sought to retain MB under the 'Critical Use' provisions of the Montreal Protocol, which allowed for continued use of MB if no technical or economical alternatives existed (Porter et al., 2009). Developing countries are expected to phase out by 2015 with a provision for 'Critical Uses' if required. The two non Article 5 countries presenting every year CUNs for dates' disinfestation are the US (California) and Israel.

The objective of this paper is to present the trends in global MB consumption during the last 20 years, the decision IX/6, the CUNs in the dates sector presented by Israel and the USA, The UNIDO project for Algeria and Tunisia and finally, UNEP activities in North

Africa and in the Middle East in the dates sector.

Trends in global methyl bromide consumption

For the past six decades, MB has been the fumigant of choice to ensure effective soil disinfestation for preplant soil treatment in many horticultural sectors. The main reasons for this are its broad spectrum of activity, its high vapor pressure which allows it to act in the gaseous phase in the soil - a characteristic facilitating its distribution through the soil profile - its cost-effectiveness, and the comparatively short plant-back intervals necessary after application. Targets have traditionally included soil borne fungi, bacteria, viruses, insects, nematodes and weeds (Martin, 2003; MBTOC, 2007; TEAP, 2009).

Presently, over 90% of the remaining non-Quarantine and Preshipment (non-QPS) uses of MB (controlled uses) are for soil fumigation, and the remainder is for non-QPS treatment of commodities (rice, dates, chesnuts, pasta, cured pork) and structures (mills). The major crops using MB as a soil fumigant worldwide are tomatoes, strawberry fruit, peppers, eggplant, cucurbits, ornamentals (cut flowers and bulbs), orchards (for replant disease) and nurseries (including, strawberry runners) (TEAP, 2009).

Consumption of MB for controlled uses has significantly decreased since the MP and its Copenhagen Amendment entered into force, both in developed and developing countries. Fig. 1 shows trends in MB consumption in Non-A 5 and A 5 countries for the period between 1991 and 2007. The global consumption of MB for controlled uses was estimated to be about 64,420 metric tons in 1991 and remained above 60,000 tones until 1998 (TEAP 2009).

The official baseline (1991 consumption) for Non-A 5 countries was 56,043 tones in 1991 and since then, consumption has declined to 6,966 tones in 2008 or 12% of the baseline. The official baseline for A5 countries (average consumption for the period 1995- 1998) was 15,703 tones, rising to a peak consumption of 18,125 tones in 1998, declining to 6,226 tones or 40% of the baseline in 2007 (Fig. 1).

As mentioned above, MB consumption for controlled uses (non - QPS) in industrialized countries is only presently permitted under the Critical Use Exemption (CUE) process, a detailed procedure by which Parties must demonstrate that alternatives are not available for a specific use, under the particular circumstances of the nomination. Since 2005, there has been a progressive trend by all Parties to reduce their nominations for consumption for preplant soil uses and post harvest uses of methyl bromide, although this has occurred at different rates (TEAP 2009). Figures 2 and 3 show the trends in the reduction in amounts approved/nominated for 'Critical Use' from 2005 to 2010 for strawberry and tomato crops in the major MB user regions in developed countries.

In A5 countries, phase-out has been achieved to a large extent through investment projects funded by the Multilateral Fund of the Montreal Protocol through its implementing agencies (UNIDO, UNEP and the World Bank) and some bilateral agreements (MBTOC, 2007; TEAP, 2009).

Substantial progress has been achieved in A5 countries that consumed the greatest quantities of MB. Since 2003, total A5 consumption has fallen by 1,420 metric tones per year on average (2003-2007). Only

12 Parties still report consumption between 100 and 500 tones and only two countries remain in the usage category above 500 tones. Phase-out trends, per region, are illustrated in Fig. 4.

Critical use exemptions Decision IX/6

Under Article 2H of the Montreal protocol, the production and consumption of MB is to be phased out in non Article 5 countries by 1 January 2005. However, decision IX/6 established criteria allowing CUEs (TEAP 2009). Production and consumption, if any, of methyl bromide for critical uses should qualify as "critical" only if the nominating party demonstrate that:

The specific use is critical because the lack of availability of methyl bromide for that use would result in a significant market disruption;

There are no technically and economically feasible alternatives or substitutes available to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination;

Methyl bromide is not available in sufficient quantity and quality from existing stocks

All technically and economically feasible steps have been taken to minimise the critical use and any associated emission of methyl bromide;

An appropriate effort is being made to evaluate, commercialise and secure national regulatory approval of alternatives and substitutes, taking into consideration the circumstances of the particular nomination and the special needs of the Parties, including lack of financial and expert resources, institutional capacity, and information;

That research programmes are in place to develop and deploy alternatives and substitutes.

The CUE process

The exemption application process is extremely rigorous. Detailed information is required from each applicant, including comprehensive information on the impact of alternatives on crop yields and profit margins, and a description of efforts undertaken to develop, register, and apply new alternatives. The parties submit the CUN to the Ozone Secretariat of the United Nations Environmental Programme (UNEP). The Ozone Secretariat then forward all CUN's to the Methyl Bromide Technical Options Committee (MBTOC). After analysis of the CUNs, MBTOC makes recommendations on the applications to the Parties to the Protocol. The Parties then determined whether or not to approve each application (TEAP, 2009).

In evaluating the CUNs for soil and post harvest treatments, MBTOC assumes that a technically feasible alternative to MB would need to provide sufficient pest control. Technically feasible alternatives do not necessarily provide superior pest control results than are achieved in practice by MB. When the requirements of Decision IX/6 are substantially met, MBTOC recommends the full amount of the request. Where some parts of a CUN did not meet Decision IX/6, MBTOC recommends a decreased amount, depending on its technical and economic evaluation. MBTOC reduces a nomination when a technical alternative is considered effective or, in a few cases, when the Party failed to show that it was not effective. In cases where Decision IX/6 did not satisfy to a substantial extent, MBTOC did not recommend the nomination (TEAP, 2009).

Critical use nominations in the dates sector: Israel and USA

Most of the dates producing A5 and non A5 countries have been using MB for about fifty years due its effect, efficient penetration, quick actions, low cost, highly killing capacity against the main date's pests (Besri, 2008; Blumberg, 2008). The two countries presenting every year CUNs for dates' disinfestations are the US (California) and Israel (TEAP, 2009).

Israel

Israel submitted CUNs in 2007, 2008 and 2009 for 2008, 2009 and 2010 uses. No nomination was submitted in 2010 for 2011 use. In the 2009 nomination, the most significant change since submission of previous nominations was the adoption of the thermal disinfestation treatment for Mejhool variety during the harvest season of 2008. This treatment was adopted in all the date packing stations. Investigations were then conducted to adopt the thermal disinfestation treatment to other varieties of dates. The results obtained from laboratory and field trials confirmed that this technology can also be used to disinfect all the dates' varieties. Heat technology is now providing a substitute for methyl bromide fumigation for Mejhool, Deglet Noor and also for all the other varieties (Hadrawi, Halawi, Deri, and Zehidi). This is why no critical nomination was submitted in 2010 for 2011 use (Table 1)

From 2006 to 2009, the nominated MB quantities have been reduced from 3.444 tons to 1.560 tons (Table 1). Thermal disinfestation treatment for Mejhool has been adopted during the 2008 harvest season at all date packing stations. In 2008 and 2009, this alternative was not adopted for the other varieties (Amery, Deglet-Noor, Hadrawi, Halawi, Deri, and

Zehidi) because of difference in the handling procedure between Mejhool and these varieties at the point of entry into the packing stations. Mejhool dates are placed one layer high in shallow trays, to avoid the damaging of the soft Mejhool dates. In contrast to Mejhool, the other varieties including Deglet Noor, are harvested and handled within the packing stations in plastic crates of 0.5-1 m³ capacity for bulk storage of 200-400 kg of dates in which the dates are piled to a height of 40 cm. These crates have not sufficient ventilation to permit drying inside the crates. The thermo-physical aspects of the drying procedures inside crates and inside trays are completely different (Navarro, 2006). For the trays, the time needed for the dates to reach 50°C is about 3 hours whereas for dates inside crates the required time is much longer. The conversion of handling the date varieties other than Mejhool, from crates into single layer trays appears as a costly operation not only in the replacement of the crates, but also in the entire handling system. In 2009 round, MBTOC recommended a reduced nomination of 1.040 tones, about 60% of the nominated amount (1.560 tones). The Party nominated 1.560 tones and noted that methyl bromide is only used for those date varieties for which heat treatment or other alternatives have not been shown to be effective. The basis for the reduction in the nomination was to decrease the dosage rate to 20g m⁻³ from 30g m⁻³.

USA

The US nomination for dates was for Deglet-Noor harvested in California. The moisture content of US dates at time of harvest is between 17-23%. The length of time needed to achieve date maturity on the tree, results in considerable drying, while the dates are still on the tree. Thus,

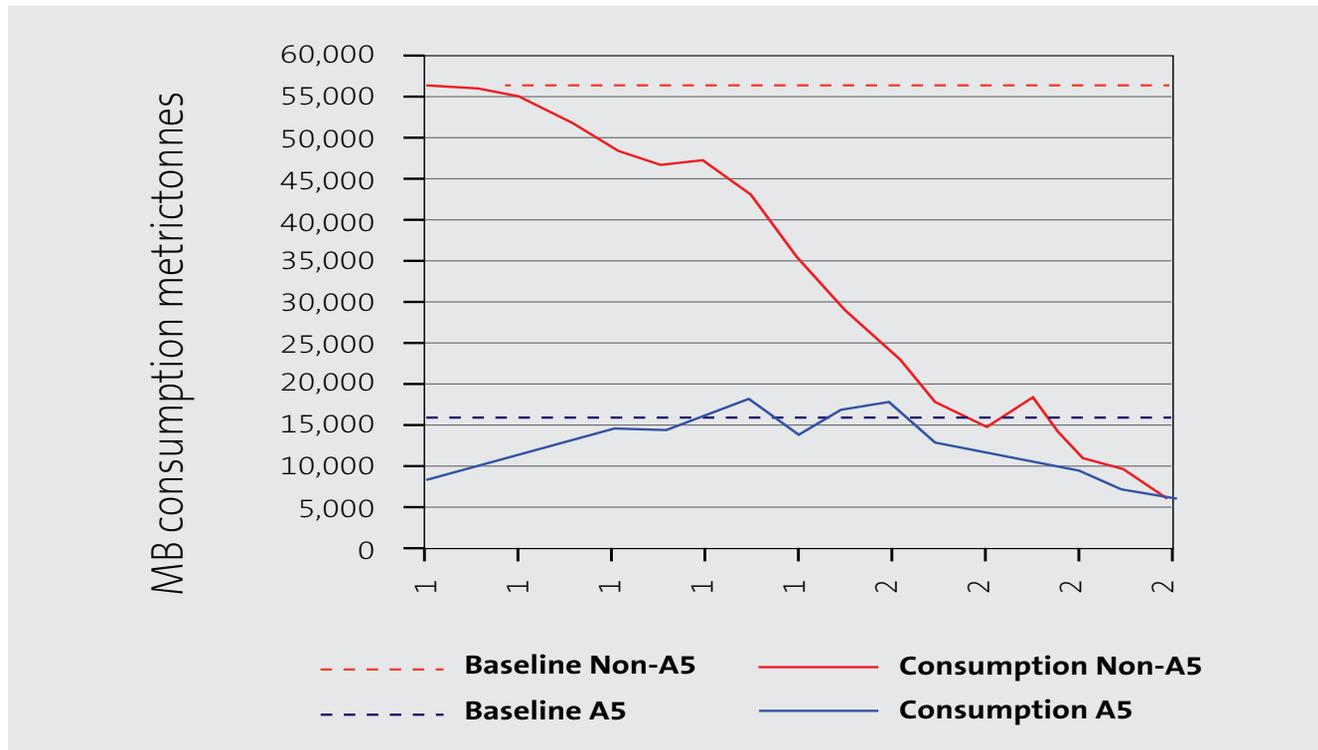
US dates were referred to as 'fresh' but the American definition stands in contrast to the Deglet-Noor dates of North African countries (Algeria and Tunisia) which are also harvested 'fresh' at maturity but are at 30-40% moisture content. It is the moisture content and not the freshness of recent picking that impacts the potential for alternatives to be effective. When dates are at 17-23% moisture content, they are dry fruits (Navarro, 2006; Navarro, 2009; Kader and Hussein, 2009), and for these fruits, alternatives exists (MBTOC, 2007). Heat, phosphine, controlled atmosphere and cold treatment are effective and are registered for use in the US. In addition, sulfuryl fluoride is also registered for treatment of dates and recent trials have indicated efficacy, at least for adults and larvae of some pests (Navarro, 2009). For these reasons, the US nomination was not recommended.

The UNIDO project for Algeria and Tunisia

In Algeria and Tunisia, The main problem of Deglet-Nour variety is its high moisture content which is between 30 and 40% (w/w). The main pest which infests dates in these two countries before and after the harvest is a Lepidoptera, the carob Moth (*Apomyelois ceratoniae* = *Ectomyelois ceratoniae*)

In Decision XV/12, the Parties to the Montreal Protocol recognizes the risk of potential non-compliance for those A5 countries that rely on the use of Methyl Bromide to stabilize and disinfest high moisture dates at time of harvest. Indeed, up to now, MBTOC has not been able to identify feasible alternatives to replace the use of this fumigant in the specific sector of high-moisture dates (MBTOC, 2007; TEAP, 2009). In the same decision the Parties requested the Executive Committee

Fig. 1. Baselines and trends in MB consumption in Non-A 5 (developed countries) and A 5 (developing countries) 1991 – 2007 (metric tonnes).



Source: MBTOC estimates calculated from Ozone Secretariat data at September 2009 (TEAP, 2009).

of the Multilateral Fund to consider financing demonstration projects on alternatives for high-moisture dates. On behalf of the Governments of Algeria and Tunisia, UNIDO designed a project proposal to address the issue of alternative of MB for the palm date sector.

The objective of the project is to demonstrate whether alternatives to MB for the treatment of high moisture dates are technically and economically available in Algeria and Tunisia (UNIDO, 2008; Savigliano, 2009).

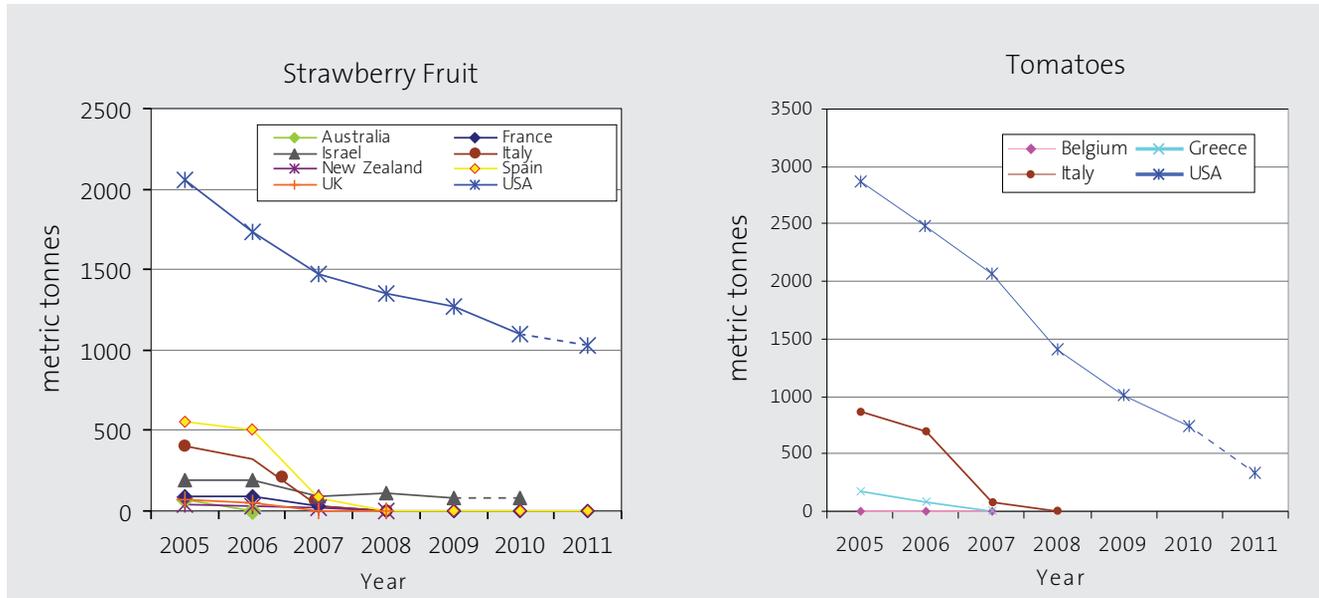
The project proposal was submitted to the 54th Meeting of the Executive Committee of the Multilateral Fund for the implementation of the Montreal Protocol for its consideration. The

project was approved in April 2008 at the 54th Meeting of the Executive Committee, for a total cost of US\$ 306,812 for the two countries, plus US\$ 23,011 of support costs for UNIDO. The duration of the project is 24 months thus allowing tests in two consecutive harvesting seasons, namely in November 2008 and November 2009. Based on the actual needs of palm date producers and exporters and taking into consideration the locally available infrastructures, equipment and skills, the following five alternatives have been considered as potential alternatives to Methyl Bromide: heat treatment, ethyl formate, phosphine, modified atmospheres and sulphuryl fluoride (Ducom and Ciesla, 2009).

A workshop was organized in Vienna where scientific and technical experts

have discussed the results of the experiments conducted in Biskra, Algeria (UNIDO, 2009): Controlled atmosphere is not compatible with the disinfection of Deglet Nour dates because the exposure time is so long that the dates ferment and become inedible. Phosphine with ammonia fumigation makes darker the dates and reduce the quality of the fruit. All other alternatives have potential to replace methyl bromide. Nevertheless, sulfuryl fluoride and ethyl formate can not be considered for the next tests in full scale because they are not registered in Algeria. Therefore, the Vienna workshop recommended only two alternatives to be commercially tested: Phosphine without ammonia (with an exposure

Figs. 2 and 3. Amounts of Methyl Bromide exempted for CUE uses in strawberry and tomato from 2005 to 2010 (TEAP 2009).



Solid lines indicate trends in MB used for CUEs. Dashed lines indicate the quantity of methyl bromide nominated by the party in either 2010 or 2011 (TEAP, 2009). CUEs: Critical Use Exemptions

time of 3 days and high temperatures) and heat treatment.

UNEP activities in the Middle East

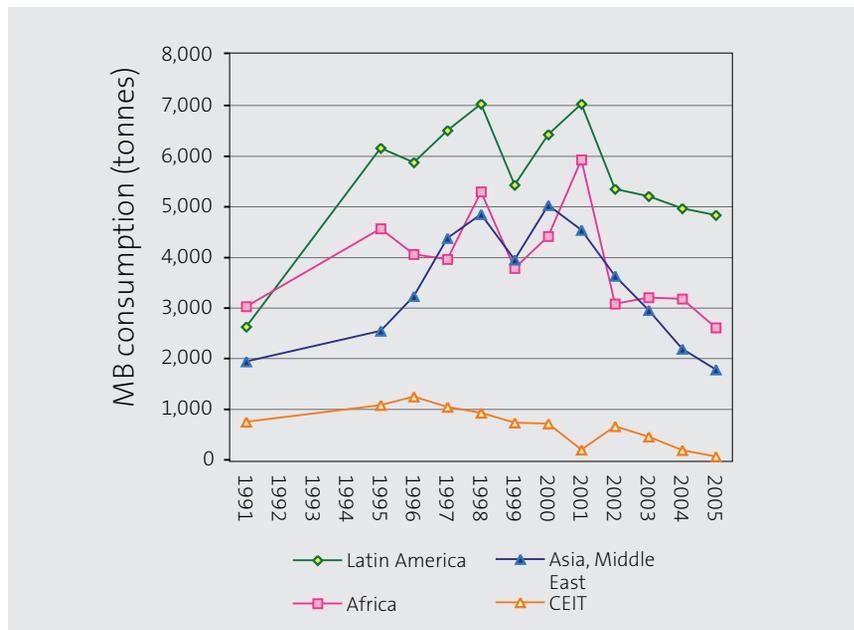
UNEP has organised many activities in the Middle East to discuss alternatives to MB for dates disinfestation (UNEP/ROWA, 2008; UNEP/ROWA, 2009). The Regional Workshop on “Uses of MB Alternatives in the Date Sector” held in May, 2008 in Cairo, Egypt, (UNEP/ROWA, 2008) recommended the member states to establish a database on date production in the region. The main objectives of such database is to assist the countries (1) accessing to a wide range of data about MB consumption in all sectors in general and in date sector and related industries in particular, (2) obtaining significant and reliable information about the trends in MB consumption in date sector of each country, (3) identifying alternatives availability in each country which

allow exchanging and transferring experiences as well as information sharing and (4) addressing their future needs of policies, regulations and legislations updating as well as research and/or assistance required (UNEP/ROWA, 2008). A regional experts group meeting on applications of methyl bromide alternatives in dates’ sector was organised in, 2009, in Al Khobar, Saudi Arabia (UNEP/ROWA, 2009). Before the meeting, a survey form was sent to technical experts experienced in MB and its alternatives use in date sector in some regional dates producing countries (Iraq, Jordan, Saudi Arabia, UAE, Yemen, Egypt, Tunisia, and Algeria). The surveys have shown that the date’s situation in the Middle East is completely different from the one in North Africa. In Tunisia and Algeria, Deglet Nour (which is not grown in the Middle East, except in Israel) has high moisture content, varying between 30 and 40 %. In Jordan,

only Mejhool (semi dry) is fumigated. Egypt fumigates only dry varieties. In the surveys, Phosphine as alternative has been reported by Jordan, Egypt, and Tunisia. Therefore, in the Middle East the date’s fumigation problem is completely different from the one reported in Tunisia and Algeria. The approach to propose commercially and economically feasible alternatives should also be different (UNEP/ROWA, 2009).

The participants to Al Khobar workshop recommended also to establish a “Regional Date/MB Helping Desk” to achieve the following objectives: (1) Establishment of a database to exchange knowledge among Arab countries in relation to date production and protection, (2) Organizing workshops and seminars for sharing information in relation to dates production and treatments, (3) Organise training (capacity building) in various fields of dates production and protection (preharvest and post

Fig. 4. Methyl Bromide trends in A 5 and CEIT countries 1991 – 2007 (TEAP 2009).



Source: Ozone Secretariat data, 2009. CEIT: Countries with Economies in Transition (TEAP, 2009)

harvest), (4 Editing a newsletter/journal on dates, 5) Helping scientists to address needed research areas, (6 Facilitating the creation of networks in the region to increase the scientific cooperation between the members countries, 7) Providing consultancies to the members states and to the private sector, (8 Raising awareness concerning the depletion of the ozone layer by MB and alternatives to this fumigant, 9) develop a training handbook in the dates' sector. The MB Helping Desk will promote the date sector in all Arab countries and will provide solutions to the problems related to the use of MB alternatives faced by the date's producers.

Conclusions

The increasing demand for high quality dates that are not chemically treated and the phase out of MB, which is used in fumigation and disinfestation of dates, have

created the interest for searching and adopting alternatives. Two parties, Israel and USA, are regularly submitting CUNs in the date sector. Researchers in Israel have tested and developed an effective and practical alternative (heat treatment) to control pests in their date varieties under their packing house circumstances. Israel has not submitted any CUN in 2010 for 2011 use. MB has been completely phased out in the date sector in this country. It is unknown whether heat treatment would be suitable for fresh moisture dates in other countries. A UNIDO project will test this alternative in Algeria and Tunisia. The US 2009 CUN is for Deglet-Noor variety (low moisture content). In its evaluation, MBTOC considered that alternatives exist and did not recommend this nomination. On behalf of the Governments of Algeria and Tunisia, UNIDO designed a project proposal to address the

issue of alternative of MB for the palm date sector. The objective of the project is to demonstrate whether alternatives to MB for the treatment of high moisture dates are technically and economically available. The first results obtained are encouraging. UNEP/ROWA has organised many activities in the region to discuss and to implement strategies for phasing out MB in the dates' sector.

Decision XVII/12 requests MBTOC to continually review progress in availability of alternatives for dates. Non article 5 countries should develop alternatives as soon as possible and before 2015. Cooperation between Non Article 5 and Article 5 countries is needed. Funds from the MLF should be made available for A5 countries to develop alternatives.

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Table 1. Years of nomination, years of use, quantities nominated and recommended by MBTOC (TEAP, 2009).

Year of nomination	Year of use	Quantities (tons)	
		Nominated	Recommended
2005	2006	3.444	3.444
2006	2007	3.444	2.755
2007	2008	2.200	2.200
2008	2009	1.800	1.800
2009	2010	1.560	1.040
2010	No nomination		

Table 2. Methyl Bromide historical use in the US dates' sector (tonnes) (TEAP, 2009).

2003	2004	2005	2006	2007	2008	2009
2.616	2.468	2.887	3.145	1.999	2.019	0

From 2003 to 2008, The MB quantities used for the US dates' disinfestation varied from 3.145 tonnes (2003) to 2.019 tonnes (2008). The CUNs for 2009 use has not been recommended by MBTOC.

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