QUARANTINE AND PRESHIPMENT APPLICATIONS
SEARCH FOR MB ALTERNATIVES IN FRESH PRODUCE

H. Krishna[1], R. Ryan[2], Dirk Beven[3], Stephen Barton[4], B.B.C. Page[2], C.W. van Epenhuijsen[2], Z. Zhang[2], Brash, D[2], J. Falco[5], B. Atkinson[6], N. Grant[6]

[1]Crop & Food Research, Private Bag 11600, Batchelar Rd, Palmerston North, New Zealand; [2]BOC Limited, 428-440 Victoria St, Wetherill Park, NSW 2164, Australia [3]BOC International Ltd, Singapore; [4]Dole Asia, PO Box 12-370, Penrose, Auckland, New Zealand, [5]BOC Limited, Julius Avenue, North Ryde, NSW 2113, Australia; [6]BOC Limited, Private Bag93300, Otahuhu, Auckland, New Zealand.

Introduction

Since the Montreal Protocol Agreement there has been unfortunately a sharp increase in the use of MB for quarantine and preshipment (QPS) use which accounts for 19-21% of global production. There is not yet a mandatory need to reduce QPS consumption because of the fear that these restrictions may affect international trade. Quarantine problems are compounded by the rapid expansion of international trade with horticultural produce. The global phase out in durable commodities like grain and soil fumigation has seen a gradual increase in the cost of MB in recent times. BOC's ENVIROSOL® liquid CO_2 application technology is seen as a suitable solvent-propellant system to carry and disperse bioactive alternatives to MB as non-flammable gaseous or vapour mixtures or as aerosol particles. Aerosol particle sizes between 2-20 µm produced by this technology improves efficacy by enhanced penetration into produce and synergism with active compounds can led to the reduced use of fumigants.

Research and Development

Several research projects with Crop & Food Research (New Zealand) are looking at MB alternatives [ethyl formate (VAPORMATE® 16.7 wt % in liquid CO_2), carbonyl sulphide (COS), ethanedinitrile (EDN), phosphine] for QPS at their new fumigation facility in Palmerston North. These include using VAPORMATE® to disinfest tropical arthropods pests like mites, mealybugs and scale on imported bananas and pineapples, thrips in onions for export to Europe, apple leaf curling midge and light brown apple moth larvae in export apples to US, and thrips, scale and aphids in export flowers. Collaborative commercial preshipment disinfestation research with alternatives is also being carried out with countries of origin of produce to reduce biosecurity risk from the introduction of unwanted pests into Australian and New Zealand. Commercial trials with multinationals showed that VAPORMATE® has the potential to disinfest fresh produce with no risk from residues and with the potential to reduce the frequency of interceptions by importing countries.

QPS treatment alternatives for tropical fruit exported out of the Philippines

About 204,000 and 1,3800,000 metric tonnes of fresh pineapples and bananas respectively are exported by multinationals like Dole Food Company Inc. (Dole Philippines Inc.) from the Philippines to Japan, China, Korea, Taiwan, Singapore, the Middle East and New Zealand. Shipments are often intercepted for quarantine pests like mealybugs, mites, scale, thrips and weed seeds. Shipments intercepted are required to be treated with MB. Preshipment box application trials with bananas in the Philippines with alternatives like VAPORMATE® have shown to reduce or eliminate the survival of these pests in shipment. Preliminary studies in pineapples have shown that pineapple fruit can tolerate this product well and surface pests can be easily eliminated with lower doses. However, this product has

limitation in killing weed seeds found in the crowns of imported pineapples. EDN and COS will be trialled to assess their potential to devitalise weed seeds. Registration of VAPORMATE® in the Philippines is in progress so that the product can be made available to multinationals for preshipment applications in tropical fruit.

QPS treatment alternatives for onions

In 2004, New Zealand exported $90 M to 44 countries of which 60% by value went to European Community. Onion thrips are often difficult to notice and control and, pesticide resistant populations are becoming established. Infestations become more apparent on arrival at the export market as live eggs hatch in-transit. MB is the fumigant of choice on arrival. Research is being carried out to help eliminate this risk by fumigation with alternatives like VAPORMATE® and phosphine. VAPORMATE® has the potential to eliminate adult thrips easily and phosphine eggs. Onions can tolerate doses well above efficacy thresholds before premature softening was observed.

QPS treatment alternatives for capsicum

About $24 million capsicum were exported to Japan and other Asian markets by New Zealand growers in 2004. Japan is the major market for NZ fresh vegetables. Quarantine pests like thrips pose biosecurity risk in these stringent markets. Preliminary investigations have shown that adult thrips are susceptible to VAPORMATE® applications. Produce tolerance however may be compromised at full efficacy threshold doses. Ongoing research is focus on application techniques to eliminate tissue injury.

QPS treatment alternatives for flowers

Exports of cut flowers have increased from NZ $8 M in 1985 to about $39 M in 2004. About 44% of the cut flowers exports were orchids. Western flower thrips (WFT), two-spotted mites and scale were the common pests found on flowers for export. Preliminary trials with VAPORMATE® applied as aerosol showed that low doses can eliminate WFT found in callas, orchids and sandersonia. Sandersonia poorly tolerates this product. Ongoing research is focus on novel application techniques to reduce tissue injury.

QPS treatment alternatives for apples, kiwifruit.

Fresh apples valued at $485 million were exported to 60 countries. This amounts to about 367,000 tonnes in 2004. About 65 million trays of kiwifruit valued around $659 were also exported to 42 countries in the same year. Larvae of light brown apple moth (LBAM) and apple leaf curling midge (ALCM) are two important quarantine pests found in NZ apples exported particularly to the US. Bioassay on these pests suggests that VAPORMATE® when applied at lower doses gave complete mortality. ALCM however was not completely controlled with this product and further research with for e.g. phosphine is necessary. Apples and kiwifruit has shown good tolerance to the product.

CONCLUSION

Research and development have shown that MB alternatives like VAPORMATE® have the potential to disinfest fresh produce. Application rate, duration of exposure and fumigation temperature will however need to be optimised for maximum efficacy and minimum effect on quality for individual commodities. Some fresh produce however are less tolerant to ethyl formate vapours. Novel application techniques to reduce this damage to fresh produce are also being investigated. Preliminary research is planned with COS and EDN for potential wider preshipment applications.