HENRY A. WALLACE INSTITUTE
FOR ALTERNATIVE AGRICULTURE

9200 Edmonston Road, Suite 117
Greenbelt, Maryland 20770-1551
Phone: (301) 441-8777
Fax: (301) 220-0164
E-mail: hawiaa@access.digex.net
Web Site: www.hawiaa.org

DA: February 3, 1999
TO: National Organic Standards Board
FR: Kathleen Merrigan and Mark Keating
RE: Quarantine treatment of certified organic commodities

INTRODUCTION

International agricultural trade requires postharvest treatments to disinfest fresh fruits, vegetables, grains, and dried goods of economically important quarantined insects. Over the past two decades, increases in the variety and volume of commodities shipped internationally, regulatory restrictions on widely used synthetic fumigants, and the emergence of insect resistance to certain treatments has spurred extensive research in new technologies to satisfy quarantine requirements. The directions this research takes and the outcomes it produces directly impact the ability of organic producers and handlers to participate in international trade. Not only does international commerce in organic commodities need to comply with the quarantine requirements of the importing and exporting countries, it must also utilize treatments which are consistent with organic production and handling standards. It is vitally important that the organic community participate in ongoing quarantine research initiatives to ensure that treatment options which conform with organic principles and practices become increasingly available, effective, and economical.

The purpose of this memorandum is to evaluate the suitability of alternative quarantine treatments for organic certification and to assess their status in the research and development pipeline. These alternative treatments include variations of currently approved practices, including thermal regulation and controlled atmosphere, which may be applicable to a wider variety of commodities. Other possibilities, such as systems approaches, pest free zones, are not treatments *per se* but may both satisfy quarantine requirements and prove compatible with organic certification. Potential treatments too experimental to address in this memorandum, including radio frequency heat treatment, ozone, and biological controls, may emerge as significant options in the future.

At its October, 1998 meeting, the National Organic Standards Board (NOSB) recommended that the Department of Agriculture (USDA) identify approved quarantine practices for inclusion in national organic standards. Within the USDA, the development and enforcement of quarantine treatments is the responsibility of two agencies: the Agricultural Research Service (ARS) and the

Table 1. Approved and Potential Uses for Four Quarantine Treatments.

COMMODITY	METHYL BROMIDE	COLD TREATMENTS	HEAT TREATMENTS	MODIFIED ATMOSPHERE
FRESH FRUITS				
Apple	T	T	X	X
Pear	T	T	X	X
Apricot	T	T		
Cherry	T	T		X
Peach	T	T		
Strawberry	T		O	
Grapes	T	T		
Grapefruit	T	T	X	
Lemon/Lime	T	X/O	X	
Orange	T	T	X	
Banana	O	O	X	
Papaya	O	X	T	
Mango	O		X	
Banana	T/O	O	X	
Avocado	T/O		X	
VEGETABLES				
Tomato	T		T	
Pepper	T		T	
Eggplant	T		T	
Cucumbers	T		T	
DRIED GOODS				
Raisins, prunes	T	X	X	X
Tree Nuts				
Almond	T	X	X	T
Walnut	T	X	X	T
Grains				
Corn	(phosphine)	X	X	X
Wheat	(phosphine)	X	X	X

"T" indicates that a treatment of that variety has been approved for one or more pests on the commodity. "X" identifies those commodity/treatment combinations that have show experimental potential to control pests. "O" indicates commodity intolerance and therefore no potential treatment. Commodity/treatment combinations which have been inadequately researched are left blank.

Treatment with methyl bromide is not an accepted practice under existing organic certification standards, but information on its uses is included here to help illustrate its significance in contemporary quarantine systems. An amendment to the FY 1999 Agricultural Appropriations bill modified the United States' commitment to phase out the use of methyl bromide and created a permanent exemption for quarantine applications.[3] The historic dependence on methyl bromide and other treatments incompatible with organic certification (including the grain fumigant phosphine) has constrained the amount of research conducted on non-synthetic alternatives. Cold treatment has a relatively long list of approved uses because it was widely employed for quarantine purposes prior to the introduction of synthetic fumigants. Cold treatments also provide the added benefit of delayed ripening, making the time and expense they require more justifiable. The other most promising non-synthetic treatments - heat regulation and controlled atmosphere - have received less research funding, and their approved uses are largely restricted to commodities which do not tolerate fumigation. Typically, an extensive research investment is required to bring treatment costs into the range which makes adoption viable for the commercial sector. While the commitment which the ARS has made to alternative treatment technologies has yielded promising results, the commercial viability and marketplace adoption of these approaches will be influenced by the price and availability of synthetic fumigants. The continuing availability of the non-certifiable quarantine treatments currently preferred by the conventional sector (due to cost, time, and capacity considerations) will impact the development of certifiable alternatives.

STATUS OF NEW TREATMENTS WITH POTENTIAL FOR CERTIFICATION

1. Controlled Atmosphere /Temperature Treatment Systems (CATTS)

Treatments combining thermal regulation and suppression of available oxygen represent a promising direction in ARS research which is readily applicable to organic commodities. Elevating a commodity's core temperature by immersion in hot water or through exposure to vapor heat, forced hot air, or steam is an approved pest control treatment, primarily for fruit flies, on a variety of fruits and vegetables. However, many fruits and vegetables deteriorate when exposed to heat treatments for the extended intervals needed to insure pest mortality. The length of treatment is also a significant consideration in time and expense for processors who need to turn over large volumes of product. Controlled atmosphere has long been studied as a quarantine practice but has received limited application due to equipment constraints and extended treatment intervals. Controlled atmosphere has very few approved uses for quarantine purposes but plays an important role in systems approaches to pest control in bulk commodities including grains, dried fruits, and nuts.

An interest in the relative capacity of fruits and vegetables to withstand heat treatment led to a breakthrough in developing CATTS technology. Dr. Krista Shellie at the ARS Subtropical Agricultural Research Center in Westlaco, Texas measured the heat dose (or the amount of energy

---

[3]The amendment also replaced the requirement in the 1990 Clean Air Act that prohibited use of Class 1 ozone depleting compounds after 2001 with the provisions of the Montreal Protocol which allow developed countries to use it in agricultural production through 2005..

released) from hot water immersion treatments and found that they were considerably less than those produced by heat vapor, hot forced air, or steam treatments. This led to the hypothesis that fruit fly larvae, when submerged in water and deprived of oxygen, were much more susceptible to heat-induced mortality. Dr. Shellie confirmed that while the oxygen available to fruit fly larvae exposed to open air treatments did not decrease significantly, it did during immersion in hot water. Further research indicated that, by dropping the available oxygen from 21% to 2%, the length of treatment needed to achieve quarantine level control of fruit flies on varieties of citrus could be cut from five hours to three hours.

Dr. Lisa Neven at the ARS Fruit and Vegetable Insects Research Laboratory in Yakima, Washington has adapted CATTS technology for the eradication of coddling moth in apples, sweet cherries, and pears. Dr. Neven's research indicates that a combination of high heat and low oxygen (temperatures in excess of 47 degrees Celsius, and oxygen at 1.0% or less) can provide quarantine level insect mortality. Research to date indicates that the treatment benefits fruit quality by increasing firmness, preventing storage scald, suppressing decay organisms and providing adequate shelf life. Dr. Neven anticipates that CATTS treatments for stone fruits could be submitted to APHIS for review by the year 2000. If approved, this treatment could resolve one of the most intractable quarantine requirements faced by domestic producers: the use of methyl bromide on all cherries and apples exported to Japan and South Korea. The treatment may also prove effective against apple maggot and plum curculio, the two other primary pests of quarantine concern to stone fruit.

Private industry has developed and is beginning to build facilities which are capable of performing CATTS -style treatments on a commercial scale. APHIS is currently inspecting a forced hot air unit in Mexico with single load capacity of five tons. The facility is designed to perform the forced hot air treatment approved against Mexican fruit fly on grapefruit, tangerines and oranges entering domestic production zones including Florida, California, Texas, and Arizona. Should CATTS treatments be approved, controlled atmosphere capacity can be added to this unit. The Wetlaco lab is working on other commercially viable technologies, including long range shipments in containers equipped with CATTS technology. Rather than maintain the produce at the low temperatures normal for such shipments, the lab is experimenting with a slightly warmer environment. The elevated temperature causes the targeted pest to respire quicker, and the controlled atmosphere results in quarantine level mortality. These treatments could be implemented with no new technology (APHIS already certifies such containers) and does not interrupt the normal distribution process. There are indications that APHIS will dedicate additional resources to CATTS research. Research Leader Jack Armstrong, who conducted much of the pioneering work in hot water immersion and other thermal treatments, is acquiring CATTS laboratory equipment. The ARS laboratory in Fresno, California is also preparing to conduct CATTS research.

2. Systems Approaches / Pest Free Zones

A systems approach establishes a series of pre- and postharvest practices used in the production, harvest, packaging, and distribution of a commodity which cumulatively meet the requirements for quarantine security. They are holistic approaches which minimize the presence of pests throughout production and use intensive quality control measures to remove any that reach the processing and shipping stages of distribution. Pest free zones are institutionalized systems approaches in which the region of production can be certified free from pests of quarantine concern. Pest free zones integrate aggressive pest suppression practices (removal of alternative host species, mating disruption through sterile releases or pheromones, or application of synthetic pesticides) with intensive monitoring. Systems approaches are predicated on controlling pest populations and preventing the infestation of commodities intended for export. Pest free zones operate on a zero threshold approach based on eradication on the quarantined pest from the region of production.

The ARS has made significant contributions to the development of both systems approaches and pest free zones for domestic producers. The agency plays a leading role in efforts to implement a systems approach to the management of codling moth in the Pacific Northwest (including British Columbia). By achieving quarantine level security against the codling moth, growers would not have to treat the cherries and apples they ship to Japan and South Korea with methyl bromide. The program incorporates cultivar selection, pheromonal mating disruption, chemical applications as needed, and intensive scrutiny during packing. The ARS has also been central to the designation of pest free zones in the states of Florida and Texas, and in Chile, Mexico, Brazil, Ecuador and other countries wishing to export to the United States. Pest free areas involve clearly defined geographic boundaries and some degree of isolation or a physical barrier to protect them from re-infestation. Pest free zones are maintained through intensive monitoring programs to ensure that the production zones remain free of the quarantined pest. Pest free zones have greatly facilitated commerce between regions that are vulnerable to similar types of infestation, particularly with very damaging varieties of fruit flies.

Systems approaches and pest free zones are promising approaches to a variety of problems confronting conventional agriculture, but they may prove of limited use for solving the quarantine requirements of organic growers. While field documentation demonstrates that the codling moth management program in the Pacific Northwest is capable of achieving quarantine level protection, it has not been accepted as an approved treatment by the principal importers of the region's fruit. The Japanese quarantine law, for example, requires a specific post-harvest "kill step" which the systems approach does not provide. While enjoying remarkable success with codling moth suppression, ARS and producers have not achieved the ultimate goal - an alternative to methyl bromide - they sought. Pest free zones also present difficulties to growers: the intensive monitoring can be expensive, and detection of a quarantined pest can result in an emergency application of the prohibited pesticide malathion. One treatment with malathion could preclude certification of a grove for one year or more. Organic grapefruit producers in Florida, for example, have avoided the pest free zone approach and instead use an approved cold storage treatment for shipments headed to Japan.

Animal and Plant Health Inspection Service (APHIS). Through its Methyl Bromide Alternatives National Program, the ARS conducts research in quarantine technologies and reviews data from exporting countries in support of proposed treatments. One of the objectives of the Methyl Bromide Alternatives National Program is "to develop alternatives to post-harvest (commodity, quarantine, and structural) uses of methyl bromide including heat, cold, radiation, controlled atmosphere and systems based approaches using new risk-based alternatives."[1] Currently, staff at eight ARS Agricultural Research laboratories are working on one or more post-harvest treatment technologies.

Once the ARS validates the efficacy of a proposed of a proposed treatment in the laboratory, the Plant Protection and Quarantine (PPQ) division of APHIS must determine if it can be practically applied and verified in the field. PPQ staff are responsible for establishing specifications and drafting procedures for all approved treatments. An approved treatment is a condition of entry for imported products at risk of introducing a quarantined pest. States seeking to prevent the introduction of pests (most commonly fruit flies) from other states can also require that produce receive an approved treatment. The USDA uses the PPQ approved treatments as its scientific basis when petitioning other countries to allow American agricultural commodities to enter. APHIS also oversees the inspection and certification of all domestic and foreign facilities which are licensed to conduct approved quarantine treatments.

SUMMARY OF APPROVED AND POTENTIAL POSTHARVEST TREATMENTS

The table on page 3 provides an overview of the approved uses as well as the potential suitability of four treatment technologies for a variety of commercially important fruit, vegetable, and grain commodities.[2] The symbol "T" indicates that a treatment for control of one or more pests has been approved for the commodity. The symbol "X" identifies commodity/treatment combinations which show potential for controlling pests. Conversely, the symbol "O" indicates that the commodity is intolerant of the treatment and therefore the combination is not viable. A blank box indicates the absence of sufficient information from which to draw a conclusion. Treatment technologies with no current approved uses, including systems approaches, pest free zones and biological controls, are not included in this table.

---

[1]Information on the ARS Methyl Bromide Alternatives National Program is available at http://www.nps.ars.usda.gov/programs/308s2.htm .

[2]This table is a modified version of work conducted by the ARS and the Western Land Grant Colleges and was assembled by Dr. G. Mitchell, UC - Davis. Cited in Insect Pests & Fresh Horticultural Products: Treatments and Responses, eds. Lyons and Armstrong.