Disease Control Treatments of Mango Cultivation

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Abstract

Decay control is accomplished with an adequate preharvest and postharvest integrated program. In postharvest, washing water usually contains about 100 ppm of sodium hypochlorite. It also can contain fungicides depending on the extent of the problem. Careful handling of the fruit, elimination of mechanical injury, rapid cooling, maintenance of low (optimum) temperature, and maintenance of hygienic conditions are essential for decay control. In India we have lot of problems in cultivation of Mango therefore we should give awareness about disinfestations and insects affection.

Keywords: Mango, Insects, Hot water, Fungicides

Introduction

Decay control is accomplished with an adequate preharvest and postharvest integrated program. In postharvest, washing water usually contains about 100 ppm of sodium hypochlorite. It also can contain fungicides depending on the extent of the problem. Careful handling of the fruit, elimination of mechanical injury, rapid cooling, maintenance of low (optimum) temperature, and maintenance of hygienic conditions are essential for decay control. Long hot water treatment used for insect disinfestation can also control some pathogens. However, fruit that does not have to be treated with the long hot water systems for insect control (fruits exported to the European market) can be exposed to hot water (with or without fungicides) for a short period for the control of decay. Short hot water treatments used for decay control consist of temperatures of 48-55°C for 3 to 15 minutes, depending on the variety and the extent of the problem. Banganapalli and Alphonsa mangoes are treated for about 3 minutes. Treatment is applied right after receiving and washing the fruit in ambient water. Immediately after hot water treatment, fruit should be cooled in ambient or cold water.

Hot water temperature should be controlled and water should be circulating to maintain temperature uniformity. Hot water is more effective for the control of anthracnose than for stem end rot. Shorter treatments are sufficient for anthracnose (about 3 minutes), while stem-end rot usually needs longer treatments (7 minutes or more). Hot water tanks are of different sizes. They should be built from materials that do not react with any of the chemical material, are resistant to corrosion, and easily cleaned. These tanks are usually made of fiberglass, plastic, stainless steel, or steel with a protected cover. Tanks should be equipped with temperature control devices, and water should circulate to maintain in a uniform temperature. Tanks should be equipped with filters to avoid accumulation of soil, debris, etc. Heat treatments, either hot air or hot water, are preferable because they are nonchemical treatments, they can delay ripening and senescence when used adequately (and thus delay development of diseases), and they can increase resistance of the fruit to chilling injury. Thus they are looked at as excellent alternatives for pesticide treatments. In addition, hot air is compatible with the use of controlled atmospheres for disease and insect control. Fungicides are sometimes needed, especially when a hot water treatment is not used. However, when combined with hot water, the effectiveness of penetration and action of the fungicide increases at high temperature. The combination of fungicides at high temperature can reduce the concentration of fungicide applied. The most common fungicide used in mango is Thiabendazole (Mertec). Mertec 20S is usually more preferable than Mertec 45, and concentration used is about 400 ppm. Benomyl is added to the water (500-1,000 ppm) and replaced regularly.

Benomyl is not registered in the USA for postharvest use, but it is still registered in other countries. Under neutral conditions, benomyl decomposes rapidly to carbendazim (MBC), but under alkaline conditions it converts to 1, 2, 3, 4-tetrahydr-3-butyl-2, 4-dioxo-s-triazino (alpha) benzimidazole (STB) within a few hours. The antifungal activity of MBC is almost equivalent to that of benomyl but STB has no antifungal properties. In the water tanks, the accumulation of latex may increase the pH and result in the conversion of benomyl to STB rather than MBC. The alkalinity of the latex may also lead to the lower efficacy of benomyl in controlling stem-end rot. MBC is less polar than benomyl and thus it does not penetrate the skin as efficiently as benomyl. Therefore, it is important that water be as clean as possible from latex. Hot thiabendazole (TBZ) was found to be as effective as hot benomyl in controlling stem-end rot, but had less control of anthracnose. Benomyl penetrates plant tissues better than TBZ or MBC. Imazalil in hot water was reported to result in complete control of anthracnose and stem-end rot in several mango cultivars, but also found to be inferior to benomyl. Prochloraz (250-800 ppm for 15-20 seconds) also provides good control of anthracnose and alternaria rot, but not an adequate control of stemend rot. A combination of hot water and benomyl treatment followed by a prochloraz spray was found to be effective for the control of anthracnose, stem end rot, and alternaria rot. The FAO recommends that residue of prochloraz in mangoes should not exceed 2 mg/kg. Although the maximum residue levels are estimated for the whole fruit, most of it is in the skin. For example, in Kensington, residues in skin were found 7 days after treatment to be 17 mg/kg, 1.7 mg/kg in the whole mango, and less than 0.1mg/kg in the flesh.

Insects

Several insects attack the fruit of mango, including mango weevils, mango seed borer, and several fruit flies. Fruit flies are widespread. The Mediterranean fruit fly *(Ceratitis capitata)* is established in 95 countries including India, and considered the most destructive among the many fruit flies in existence. Therefore several mango importing countries, such as Japan and USA, require quarantine systems for this insect.

The commonly quarantined pests in mango (depending on the importing country) include:

- Cryptorhyinchus Manguiferae (Fabricius)
- Coleoptera: Curculionidae
- Ceratitis Capitata
- Anastrepha Ludens
- Anastrepha Obliqua
- Anastrepha Suspensa
- Anastrepha Serpentina
- Anastrepha Striata
- Anastrepha Fraterculus
- Anastrepha Disctincta
- Bactrocera Tryoni
- Bactrocera Dorsalis
- Bactrocera Orientalis

Measures to control insects include preharvest and postharvest programs. Preharvest programs include cultural practices, traps, chemical treatments, and the use of sterilized insects. Pre-harvest chemical control has been achieved using organophosphates and hydrolyzed albumen. This is usually based on baited traps and the appearance of the first trapped males. The chemical control agents are dimethoate (0.1%) and fention (15%). The bait spray is based on Neziman (1:1 protein hydrolysate: malathion 4 L in water). Weekly application of malathion is commonly used. Removal of fallen fruits is important to prevent build-up of Mediterranean fruit fly populations. Some biological controls, using parasitoids, are used commercially.

Heat Treatments

Heat treatments are not used in India, but can result in several advantages. They can delay ripening and control decay and insects. Heat treatments can be applied in the form dry hot air, humid hot air, or in the form of hot water. Hot water is commonly used in several countries to disinfect mango from fruit flies. For this purpose the fruit is submerged in water at 46.1°C for 65 to 90 minutes, depending on type of mango and fruit weight. Hot water treatments should be applied at the beginning of the packing line or packing process. They can be applied on a moving belt (most common and most practical), or in tanks. However, these treatments should not be used when fruit is harvested over-mature orwith serious bruises or mechanical injury, since that heat would augment theseinjuries. Fruit should be cooled right after heat treatment, commonly with ambient water followed by forced air cooling.

Insect Disinfestation Treatments

In case fruit is to be shipped to a market that restricts the entry of certain insects andrequires a quarantine treatment, it should be treated with a legal system establishedthrough an agreement between exporting and importing authorities. Handling of the fruit should follow the protocol of the quarantine system. The protocol usually defines preharvest treatments and precautions, restrictions of type of fruit that can be treated, and fields from which fruit for treatment can be harvested, traps for insects in the field, integrated preharvest treatments and control systems, etc.

At arrival to the packinghouse where the quarantine system is applied, fruit that has been harvested according to the quarantine protocol should be sampled to assure the absence of insects (at any stage). Fruit found to be infested should not be treated or packed. In addition, it is common that quarantine protocols require that export be prevented from fields that produce infested fruits, until that infestation is corrected. Quarantine systems using fumigants such as ethylene dibromide (EDB) and methyl bromide (MB) are not acceptable anymore by almost all importing countries. The quarantine system commonly used for mango in many countries is the use of hot water or vapor heat.

Hot Air

The hot air is usually forced over the surface of the fruit which will slowly heat the pulp. When air at 50°C was forced over mango surfaces all stages of mango fruit fly, West Indian fruit fly, and *Anastrepha serpentina* were killed when the seed surface temperature reached 48°C. Mango fruit weighing over 700 g cannot be treated with this system. Vapor heat was approved in Japan in 1986 for the importation of mango from the Philippines. This treatment requires that mango be treated with vapor heat until surface temperature is 46°C and seed temperature reaches 46.5°C and held that way for 10 minutes. A vapor heat treatment has also been approved for the control of the Queensland fruit fly in Kensington mango exported from Australia to Japan. The treatment consists in raising the pulp temperature to 46.5°C and holding it for 10 minutes. The USA also approved a quarantine vapor heat treatment for the control of Mexican fruit fly (*Anastrepha ludens*) and other *Anastrepha* species in Manila mango, and for mango from Taiwan infested with the oriental fruit fly.

Hot water

The use of hot water treatments as a quarantine system was intensified after theelimination of ethylene dibromide. In Mexico, for the control of fruit fly (*Anastrepha ludens* and *A. obliqua*), this quarantine system started in 1988 for fruit exported to the USA and Japan, and consists of immersion of fruit in water at 46.10C (1150F) for, 75 or 90 minutes, depending on the weight of the fruit. This system is now widely used in different mango growing regions in Mexico, Central and South America, and the West Indies. By 1995 almost 90 plants had been installed in these regions with an estimated cost of 150,000 to 300,000 dollars/plant. This system did not reduce the mango export as it was thought, but rather increased it. For example, in 1986 (using ethylene dibromide as a quarantine system) Mexico exported to the USA 36,685 MT, worth 25 million dollars, while in 1993 (using hot water treatment) export was up to 94,439 MT, worth almost 72 million dollars. Other countriesoutside of America have started experimenting and using hot water quarantine systems. It was also found to be effective in the disinfestation of several insects, other than the genus *Anastrepha*. Hot water treatments can damage the fruit. In the first few seasons the treatment caused major fruit injury in Mexico. However, now the treatment is used much more properly and therefore the damage has been controlled. After quarantine treatment, fruit must be introduced to an isolated, insect-proof area prevent re-infestation. From here on (packaging, transport, etc) and until the fruit is received at the importing end, secure measures are implemented to prevent reinfestation. After heat treatment, fruit is usually cooled with water at ambient temperature and/or forced air cooling. In Mexico, fruit is first cooled in ambient water (at temperatures of < 21°C), packed, and then cooled with forced-air cooling.

Irradiation

Fruit flies sterilized by gamma irradiation are used in several countries to reduce the fly population in the field. The postharvest use of gamma irradiation, which is approved in several countries, has been tried in mango to control ripening, diseases and insects. Gamma rays at a dose of about 0.15 to 0.3 KGy has been found to delay ripening and sterilize insects. This treatment, although expensive and not accepted by some consumers, is being looked at as an alternative quarantine system. Third instar larvae of the Mediterranean fruit fly usually do not emerge from the pupae when treated with a dose of 250 Gy. Unfortunately only marginal disease control is achieved when mango is treated with doses lower than 1000 Gy. Mango is usually damaged with doses above 0.5 KGy. Irradiated food needs to be labeled adequately to inform the consumer.

Conclusion

Mango is perishable commodity so cultivators should follow above prevention methods to get maximum benefits of production. Insects, Fungicides and Irradiation are mostly affects the production of mango cultivation at the same time disinfestations activities like heat water, hot air, pesticides are prevention things to the mango cultivation. In India we have been following some traditional methods to protect the trees from insects. Organic methods are always better for mango cultivation.

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