METHYL BROMIDE ALTERNATIVE FOR GREEN COFFEE

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Importation of green coffee into Hawaii is the foundation for the roasting, blending, and brewing sectors of the Hawaii coffee industry. Together, they are valued at over $116.7 million and provide about 500 jobs in the state. The annual amount of imported green coffee exceeds 2.5 million pounds worth over $3.3 million.

Green coffee imported into Hawaii must be fumigated upon entry into the state with methyl bromide at a rate of 48 mg/liter (3 lbs/1,000 ft^3) for 8 hours at ambient temperature and relative humidity and normal atmospheric pressure to kill potential infestations of coffee berry borer (CBB), *Hypothenemus hampei* (Ferrari), and coffee leaf rust (CLR), *Hemileia vastatrix* Berk. & Br., life stages. CBB and CLR, which are two of the most destructive pests of coffee production worldwide, are not found in Hawaii.

ARS initiated research to determine the efficacy of ozone (O_3) under vacuum against CBB. Coffee quality tests and CBB bioassays showed that a 10,000 ppm O_3 fumigation under –30.5 cm Hg vacuum at 13 ± 3°C for 6 h did not reduce coffee quality and controlled all CBB life stages except eggs.

CBB is known as a field pest, but not as a stored product pest, i.e., CBB is not known from stored green coffee. Tests with green coffee at 10, 15, 20, 25, 30, 35, 40 or 45% moisture content level showed little or no CBB survival or reproduction below 20% moisture content. Therefore, the egg stage may not be present in green coffee, for which the international coffee industry standard is 9-13% moisture content. Additional research on CBB survival from coffee berries harvested from infested fields through standard processing to green coffee at 9-13% moisture content level is needed to assess the risk of infestations in exported green coffee beans.

If fumigation at 10,000 ppm O_3 fumigation under –30.5 cm Hg vacuum at 13 ± 3°C for 6 h is efficacious against CBB, efficacy research on CLR will be initiated.

CLR, an obligate parasite host specific to coffee plants, is one of the unique rusts that have only a uredospore stage. Although coffee production in Hawaii must be

protected against CLR, the need for requiring methyl bromide fumigation against CLR uredospores in green coffee is uncertain. CLR is a hydrophilic fungus. For infection to be successful, free water is required and is usually derived from rain. Spores germinate in 2-4 hours under optimum conditions. After uredospores germinate through germ pores in the spore, appressoria are produced which in turn produces a vesicle from which entry into the substomatal cavity is gained. Within 24-48 hours, infection is completed. The presence of free water is required for infection to be completed. High relative humidities will not substitute for free moisture. If free moisture is absent, exposure to high relative humidity is not sufficient to induce spore germination. Loss of moisture after germination has been initiated inhibits the infection process and recovery does not occur even when adequate moisture is reintroduced (http://www.extento.hawaii.edu/kbase/crop/Type/h_vasta.htm). An aspect of risk assessment that must be ascertained is whether CLR uredospores can survive on coffee berries harvested from infected fields and processed to green coffee at 9-13% moisture content. Additionally, efficacy studies will be initiated to determine the effect of fumigation at 10,000 ppm O_3 fumigation under –30.5 cm Hg vacuum at 13 ± 3°C for 6 h on CLR uredospore survival.

Advantages with implementation:

- An efficacious O_3 fumigation at 10,000 ppm under –30.5 cm Hg vacuum at 13 ± 3°C for 6 h against CBB and CLR would provide an alternative to fumigation with methyl bromide that, under present regulations, can be certified for organic labeling.

Problems with implementation:

- Vacuum chambers for ozone fumigation must be built to accommodate coffee exports, and moisture content of green coffee may be required as a regulatory condition to ensure the absence of CBB eggs and CLR uredospores.