LOW TEMPERATURE PHOSPHINE FUMIGATION FOR POSTHARVEST PEST CONTROL ON FRESH VEGETABLES

YONG-BIAO LIU

USDA, ARS

1636 E. ALISAL ST, SALINAS, CA 93905

Email: Yongbiao.liu@ars.usda.gov

U.S. exported lettuce, broccoli, asparagus, and strawberries often harbor western flower thrips (*Frankliniella occidentalis*), a quarantined pest in Taiwan, and therefore require quarantine treatment. Fumigation with pure phosphine at a low temperature of 2°C was studied to control western flower thrips and to determine effects on the quality of the treated products. Total thrips control was achieved in ≥18 hour fumigation treatments with ≥250 ppm phosphine. One day fumigation treatments with phosphine were tested on all products. For all the products, there were no significant differences between the treatments and the controls in postharvest quality and there were no injuries caused by the fumigation treatments.

A commercial scale low temperature phosphine fumigation trial for control western flower thrips on head lettuce, romaine lettuce, asparagus, and strawberries was also conducted in a 40' reefer container. A total of 8 pallets of head lettuce, 1 pallet of romaine lettuce, 2 pallet of ice packed broccoli, 8 boxes of asparagus, and 2 flats of strawberries were fumigated at 2.4°C for 18 hours with 320-940 ppm pure phosphine gas from a pressurized cylinder. Pure phosphine gas was delivered through a modified fresh air inlet into the container to accomplish fumigant injection. The treatment was terminated with four intermittent 30 min aerations with one container door opened separated by 30 min with container doors closed. After fumigation treatment, fresh air exchange for the container was set for lettuce shipping and products were stored in the container for four days to monitor phosphine residue in the container. By the end of aeration, phosphine level in the container dropped to 0.22 ppm measured with phosphine detector tubes. One day after the end of fumigation treatment, phosphine level was below the detectable limit of 0.01 ppm. Quality of strawberries was evaluated one day and 7 days after fumigation treatment and quality of asparagus was evaluated 2 days and 8 days after the

treatment. Broccoli quality and lettuce quality was evaluated 2 weeks after the fumigation. All treated products were compared with untreated controls to determine their quality and potential injuries by the fumigant. Strawberries were scored for levels of berry damage. Asparagus, broccoli, and lettuce were inspected for any discoloration associated with fumigation treatment. There were no negative effects on any of the products by the fumigation treatment. Thrips mortality was scored after lettuce was unloaded from the container 4 days after fumigation. Over 20,424 dead thrips were found dead on the 125 infested lettuce plants and no live thrips were found on fumigated lettuce plants. For the controls, 4594 live thrips were found on 5 lettuce plants. In conclusion, we achieved the objectives of validating efficacy and safety of low temperature pure phosphine fumigation treatment in a commercial scale container trial for control of western flower thrips on head lettuce, romaine lettuce, broccoli, asparagus, and strawberries.