CURRENT PROGRESS ON NITRIC OXIDE FUMIGATION RESEARCH

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SUMMARY

Since nitric oxide was reported to a potent new fumigant for postharvest pest control in 2013, many studies have been conducted to develop treatments against various insects and mites, evaluate effects on nitric oxide fumigation on postharvest quality of fresh products, and determine residues of nitric oxide fumigation on fresh products.

More than ten species of insects and mites have been tested to date and effective control are achieved for all the pests. They include codling moth, confused flour beetle, Indian meal moth, lettuce aphid, light brown apple moth, long-tailed mealybug, rice weevil, spotted wing drosophila, western flower thrips, and bulb mites and represent different taxonomical groups on both fresh and stored products. Efficacy of nitric oxide fumigation is affected by nitric oxide concentrations, treatment times, and temperatures. There are also large variations among different insect species in susceptibility to nitric oxide fumigation. Eggs and pupae, in general, are less susceptible to nitric oxide fumigation than mobile life stages. Treatment times range from a few hours to several days affected by species susceptibility, nitric oxide concentration, and temperature.

As nitric oxide reacts with oxygen to produce nitrogen dioxide, nitric oxide fumigation needs to be conducted under ultralow oxygen conditions. Fumigation also needs to be terminated by flushing with nitrogen to prevent products from exposure to nitrogen dioxide which can cause injuries to fresh products. When terminated properly with nitrogen flush, nitric oxide fumigation is safe to all fresh products in small scale tests. Nitric oxide fumigation for pest control also enhances postharvest quality of strawberries as compared with controls. Fumigation for control of bulb mites also does not affect germination and growth of flower bulbs.

Nitrate and nitrite residues from nitric oxide fumigation were analyzed on 20 fresh fruit and vegetable species. Nitric oxide fumigation when terminated with nitrogen flush does not leave significantly higher levels of the residues on any fresh products. Residue analyses for stored products are in progress.

Nitric oxide has been demonstrated to be a safe and effective fumigant against all insects and mites tested to date at various life stages on a variety of fresh products. Its beneficial effects on postharvest quality of fresh products and lack of residue also represent significant advantages over other fumigants. All these results show that nitric oxide has good potential to become a favorable alternative to methyl bromide for postharvest pest control.