FY 2004 National Program 308 Annual Report

Introduction

The Methyl Bromide Alternatives National Program encompasses research to determine alternatives to methyl bromide, which has been officially phased out as of January 1, 2005. This is the result of indications that it negatively impacts the stratospheric ozone layer. While there are a limited number of exceptions to the phase out, continued use of methyl bromide depends upon securing a Critical Use Exemption by providing economic and production information why currently available alternatives are insufficient for pest problems. Methyl bromide remains an extremely important pesticide in the United States, as well as the rest of the world. It has been used to rid the soil of pests before crops are planted and on postharvest commodities to kill pests in order to protect product quality. Preplant use controls soilborne pathogens, nematodes, insects, and weeds. Postharvest use, which kills insects and other arthropods, also includes quarantine treatment, which prevents accidental introduction of organisms into areas where they did not previously exist.

Appropriate alternatives must be found so that the United States can continue economically viable production systems that permit agriculture to maintain its role in domestic and international trade. Quarantine treatments are currently exempted from the phase out, thus the primary focus of research has been on preplant and postharvest uses. In the near term much of the Nation's domestic food production, such as fruits, nuts, and vegetables, will be severely impacted if suitable alternatives, which, in the case of new chemistries, can be registered for use by the U.S. Environmental Protection Agency, are not found. In the long term, systems approaches will be developed using combinations of pest suppressing techniques.

Selected Accomplishments by Component

Component I. Alternatives to Methyl Bromide for Preplant Soil Fumigation

Efficacy of fumigants is improved by reducing volatilization and increasing distribution. ARS scientists in Gainesville, Florida, in collaboration with University of Florida scientists, studied the dispersion patterns and emissions of the methyl bromide alternative preplant soil fumigants: 1,3-dichloropropene (1,3-D), chloropicrin, and methyl isothiocyanate (MITC), the active breakdown product of metam sodium. These were applied to a Florida sandy soil either as drip-tube placement, shank injection, or rototiller incorporation with three types of raised-bed row cover conditions. For all materials, beds covered with virtually impermeable film (VIF) gave higher concentrations for a longer period of time and better distributions of fumigants in the target rooting zones, likely because VIF decreased the volatilization losses to the atmosphere. These findings indicate that the use of VIF film row covers could increase the efficacy of fumigants and might decrease the required amount of material to be applied, while decreasing the volatilization to the atmosphere. This would decrease the hazard to adjacent human habitations and perhaps decrease the set-back requirements of the treated field borders.

Shank injection appeared to be better than either rototilled incorporation or drip-tube application in Florida soil conditions.

Large-scale field trials conducted in commercial tomato and pepper fields in cooperation with growers have validated the use of 1,3-dichloropropene and chloropicrin (Telone C-35) as a technically feasible alternative to soil fumigation with methyl bromide. Scientists in Fort Pierce, Florida have addressed the need to enhance the effectiveness of existing chemical fumigants while minimizing impacts to the environment, and they delivered a solution to commercial vegetable producers currently relying on soil fumigation with methyl bromide. Trials were conducted using broadcast applications of Telone C-35 in combination with the herbicides Devrinol and Treflan and an additional application of chloropicrin in the bed. In a 50 acre trial that was conducted four consecutive years in the same field, yields in the fourth year under the alternative were higher than in adjacent fields fumigated with methyl bromide. The incidence of soilborne diseases was lower than in adjacent fields fumigated with methyl bromide. Additional large-scale field trials were conducted with Telone C-35 applied under virtually impermeable film (VIF) using an Under Bed Fumigator. Yields in those trials were higher than adjacent areas fumigated with methyl bromide, and the incidence of soilborne diseases was lower. However, weed pressure was higher in the Telone C-35 treated areas.

Use of low glucosinolate rapeseed meal as an orchard mulch could be a viable, organic alternative to pre-plant fumigation with methyl bromide for control of apple replant disease. Apple replant disease is a significant factor limiting production and profitability of orchards rejuvenated with new trees. Studies were conducted by ARS scientists in Wenatchee, Washington, to assess the ability of soybean meal and a low glucosinolate rapeseed seed meal to provide control of Rhizoctonia solani AG-5, which causes root rot of apple and contributes to development of apple replant disease. Rapeseed, but not soybean, seed meal amendment suppressed infection of apple roots by this fungal pathogen, and disease control was associated with an increase in populations of Streptomyces spp. bacteria naturally resident to orchard soils, and specifically those Streptomyces spp. that possess the capacity to produce nitric oxide, a chemical known to induce plant defense responses. These studies provide further evidence that sustainable, environmentally friendly systems can reduce apple replant disease.

Research with fumigants that serve as alternatives to methyl bromide will provide growers an alternative soil treatment in sandy loam soils that provides control similar to that achieved with methyl bromide. ARS scientists in Parlier, California, in collaboration with the University of California tested several methyl bromide alternatives in replanted peach and plum orchards and vineyards in a series of field trials located at the SJVASC research station and in growers' fields in Dinuba, CA. Emulsified formulations of alternative fumigants 1,3 dichloropropene (1,3-D) and chloropicrin applied through subsurface drip irrigation systems produced tree growth and yield equal to methyl bromide; and control of plant parasitic nematodes in vineyard replant plots treated with drip-applied 1,3-D or shank-injected iodomethane was comparable to control achieved by methyl bromide after 6 growing seasons.

Biologically-based production systems are an economically feasible alternative to production systems reliant on methyl bromide fumigation, are friendlier to the environment, and contribute significantly to soil fertility. Strategies to replace methyl bromide use for suppression of nematodes and other soilborne plant pathogens are needed for vegetable growers. In a three year field study scientists in Beltsville, Maryland have shown that biologically-based treatments incorporating nematode-resistant cover crops for nematode population suppression in tomato cropping systems provided tomato yields similar to, or greater than, treatments using methyl bromide. In addition, the biologically-based system had significantly lower production costs. The net return per hectare over two years was $20,084 and $20,490 for methyl bromide and velvetbean cover crop treatments, respectively.

Component II. Alternatives to Methyl Bromide for Postharvest Fumigation

Organic sprays as part of Mexican fruit fly suppression program. Area-wide management of fruit fly populations requires treatment of non-agricultural areas, and organic production areas to control or eliminate fruit fly populations. ARS scientists in Weslaco, Texas, successfully applied an organic spray to both agricultural and residential areas to eliminate Mexican fruit flies. Guidelines for spray intervals, dilution rates, and application volume were developed. The success of this program serves as a guide for using less toxic, lower toxicant concentration sprays for area-wide fruit fly control programs.

Biocontrol agent identified to help in the control of olive fly. Olive fruit fly, an exotic pest that was recently found in California, is a serious pest of olive production. Control measures were developed in Parlier, California, in cooperation with the California Olive Commission. Recently these scientists, in cooperation with the ARS scientists in Gainesville, Florida; APHIS-PPQ, Guatemala; and California Department of Food and Agriculture, successfully conducted tests with a biological control agent that culminated with a regional release program for that agent. A successful biological control program for olive fruit fly in California would help protect the $68 million canned olive industry in California.

New synthetic attractant lure for cactus moth. The cactus moth, a serious pest of cactus, has been recently established in the Florida. Tools are needed to delimit the distribution of this invasive species there and provide a means to detect spread to other areas. A synthetic lure has been developed by ARS scientists in Miami, Florida, based on chemicals produced by virgin females cactus moths. Laboratory and field tests done in collaboration with ARS locations in Gainesville, Florida and Tallahassee and USDA-APHIS-CPHST are underway to determine optimum release rates and ratios of chemicals. This lure will allow scientists to monitor spread of this pest as well as provide the means to determine effectiveness of control treatments.