Comparison of IPM Tactics in Home Vegetable Gardens: Tomato

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Introduction

Eighty-three percent (est. 91 million) of all U.S. households participated in one or more types of do-it-yourself indoor and outdoor lawn and garden activities in 2005 (1). According to the U.S. Environmental Protection Agency, 888 million pounds of pesticide active ingredients were applied in the U.S. in 2001, 100 million pounds were applied in homes and gardens. Home gardeners used 13 percent of total herbicides, 16 percent of total insecticides and miticides, and 16 percent of total fungicides.

Pesticide use affects the quality of human health, the environment, and non-target organisms in the ecosystem. Therefore, any pesticide application warrants a careful assessment of the expected benefits and risks. Too often, however, home gardeners use pesticides inapropiately or without careful consideration of alternatives. Integrated pest management (IPM) is a science-based decision-making process that uses information on pest biology and available technology to manage pests in a manner that poses the least possible risk to non-target organisms, human health, and the environment. Using an IPM approach in the home landscape will ensure that pesticides are used only when other management tactics have not controlled the pest problem at an acceptable level. It will also ensure that pesticides are used in a manner to minimize associated risks.

This project outlines three strategies for vegetable disease and insect pest management that can easily be implemented for home gardens.

Materials & Methods

A pilot project focused on IPM for home gardens was conducted in 2006 by establishing demonstration trials at public garden sites in three cities (Wooster, Stow and Twinsburg) in northeastern Ohio, USA. Three strategies for disease and insect pest management were compared:

1) “low maintenance” with emphasis on cultural practices, without chemicals, which is a management style common among gardeners lacking time for labor-intensive gardening:
   - Row covers to exclude insects
   - Newspaper mulch to suppress weeds and conserve moisture
   - Natural pesticides used, only if pests were above a critical level

2) “integrated biorational”, utilizing integrated cultural and biorational tactics, with biorational pesticides applied only when needed:
   - Newspaper mulch to suppress weeds and conserve moisture
   - Biological controls: cilantro border rows to attract natural enemies
   - Hand removal of pests once per week
   - Scouting (Inspection for pests) once per week
   - Natural pesticides used, only if pests were above a critical threshold level

3) “traditional IPM”, utilizing cultural tactics and conventional synthetic chemicals:
   - Fertilizer: used twice
   - Weed block fabric over soil, to suppress weeds
   - Watering once per week if rainfall was less than 1 inch
   - Conventional insecticides used if any insect pests found
   - Conventional fungicides used for preventive disease control

At each site the trial was arranged in a randomized complete block design with three treatments and three replicate blocks. Each treatment plot was divided into four 4 ft x 4 ft subplots each with one crop: tomato, zucchini squash, snap bean and collards. While data were collected for all four crops, only results for tomato are presented.

Subplots for tomato cv. ‘Celebrity’ (W. A. Lee Burpee & Co., PA) were planted with two rows (2 ft apart) each with two plants for total of 4 plants per subplot. Mulched alleys 2 ft wide between crops and 4 ft wide between replicate blocks were included.

Composted (~6.5 T/A) straw- and sawdust-bedded dairy barn manure (OARDC, Wooster-OH) were broadcast and incorporated into the test field. At all sites, no fertilizer was applied to “low” or “integrated biorational” plots. In “traditional IPM” plots, Miracle-Gro was applied twice, at 15-30-15, then at 18-18-21 about 4 weeks later when tomatoes and zucchini started flowering.

Pesticides were tested against key arthropod pests and diseases: tomato fruitworm and tobacco hornworm, potato flea beetle, stink bug, whiteflies, aphids, Colorado potato beetle, anthracnose and early blight on tomato (Table 1).

Tomatoes in the traditional IPM and integrated biorational systems had less foliar disease throughout the season, as measured by the Area Under the Disease Progress Curve (AUDPC; Table 3), and at the end of the growing season than the low maintenance system in all three sites.

Conclusions

Although there is a strong interest in garden IPM, easy-find, research-based guidelines are lacking for home gardeners. There is a wealth of information available about individual garden pests and diseases and individual strategies, but it is difficult to find information on how to pull multiple strategies together into an overall management system for each crop. Three strategies for disease and insect pest management were compared in independent, replicated trials in or near community gardens. Early blight and Septoria leaf spot were the principal foliar diseases observed in tomatoes. Tomatoes in the traditional IPM and integrated biorational systems generally had less foliar disease throughout the season than the low maintenance system. The traditional IPM system yielded the greatest total yield or percentage of marketable fruit in all three sites. While yields were generally lower in the biorational IPM plots than in those in which conventional pesticides were used, these treatments improved plant health and productivity in general over the low maintenance treatments.

References

5. Market Estimates. U. S. Environmental Protection Agency

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