INNOVATIONS in Sustainable Agriculture

THE NORTHEAST REGION SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM & AGRICULTURE IN CONCERT WITH THE ENVIRONMENT PROGRAM

Inside:

This issue of INNOVATIONS highlights SARE- and ACE-supported efforts to reduce pesticide use in apple, vegetable, and ornamental plant production in the Northeast.

Alternate Vegetable Systems Tested in New "Living Lab"

Early results from a long-term, multi-disciplinary Penn State University project are providing valuable information for vegetable growers who want to cut their pesticide use.

In a cabbage experiment, for example, a living mulch of annual ryegrass between cabbage rows provided better early weed control in first year trials than pre-transplant herbicides, flaming or mowing weeds.

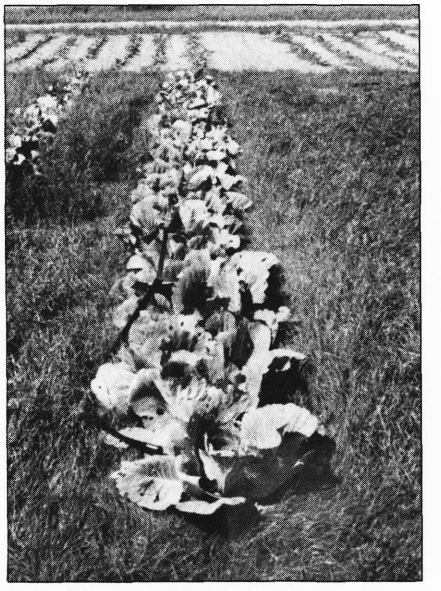
These findings are important, says project coordinator Kenneth Steffen, because intensively managed vegetable crops are high per-acre users of agrichemicals. Steffen is an assistant professor of vegetable crop physiology at Penn State.

"Much of the current public dialogue over the sustainability of agriculture is taking place in the absence of information on the relative ecological, agricultural and economic viability of alternative production systems," Steffen explains.

"Information that is available on alternative vegetable production systems, in particular, is extremely limited with almost no data comparing alternative and conventional systems in replicated tests," he says.

To fill that gap, Steffen is col-

(See Vegetables, page 6)



A test plot using a living mulch of annual ryegrass with cabbage.

INNOVATIONS is published three times a year by the Northeast Region Sustainable Agriculture Research and Education Program (SARE) and the Northeast Region Agriculture in Concert with the Environment Program (ACE). Both programs provide funding for projects that promote environmentally sound, economically viable and socially acceptable agriculture.

SARE, formerly the Low Input Sustainable Agriculture Program (LISA) receives its funding from the US Department of Agriculture. ACE is a joint effort of the USDA and the Environmental Protection Agency.

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A Commonsense Approach to Cutting Pesticides on Apples

Editor's note: Since 1988, an interdisciplinary team from Cornell University, Rodale Institute, Rutgers University, University of Massachusetts and University of Vermont has been developing sustainable apple production systems for the Northeast. More than two dozen researchers, Extension specialist and growers are participating in the project, which has received support from both SARE and ACE.

By Terry M. Schettini
Rodale Institute

Due to the large number of pests that plague apples in the Northeast, commercial apple production is relatively chemical intensive. In a given season, commercial growers may make 12 or more applications of pesticides to control various pests.

> "If scab-resistant varieties are widely adopted ... orchardists could save millions of dollars and prevent millions of pounds of fungicide from being released into the environment each year."

Our research, however, is showing that by using disease-resistant cultivars and advanced integrated pest management (IPM) strategies, growers can significantly decrease their pesticide use while remaining economically competitive.

Scab-Resistant Cultivars

A major focus of our pesticide-reduction work has been developing sustainable production systems for cultivars that have genetic resistance to apple scab, a devastating fungal disease that can make apples unfit for the fresh market.

For conventional varieties, scab control is achieved through the use of fungicides. Two of the most common fungicides, Captan and EBDC's, are either known or suspected of causing human health problems such as cancer and birth defects.

Genetic resistance to apple scab, however, eliminates the main reason to spray fungicides during the spring and early summer in the Northeast, and thus can eliminate between three and four sprays a year.

Since many of the scab-resistant cultivars are also resistant or tolerant to other diseases, such as powdery mildew, cedar apple rust, quince rust, and fire blight, they provide promise for reducing the need for pesticides even further. In western New York, for example, researchers have been able to reduce fungicide applications by seven or eight sprays a year.

This potential reduction in the need for fungicides (for diseases other than scab) depends on the disease pressure in the area as well as the particular resistance of the cultivar. Therefore, until further information is available, we're advising growers to avoid planting scab-resistant cultivars near apple trees that are susceptible to powdery mildew or near cedar trees.

Still, the potential for reducing fungicide use is significant. If scab-resistant cultivars can be used to eliminate chemical control of this disease, and they are widely adopted by growers in the region, orchardists could save millions of dollars in pesticide use and prevent millions of pounds of fungicide from being released into the environment each year.

In 1991 for example, New York growers applied approximately 23 pounds of fungicide per acre and spent approximately $103 per acre for scab control. Those applications, if consistent over the

68,000 acres of apples grown in New York, translate to roughly 1.5 million pounds of fungicide at an annual cost of $7 million.

Given the potential savings, why do scab-resistant cultivars account for less than 1 percent of apple acreage in the region? There are several reasons. Since it can take up to 10 years before crop sales from new trees equal the cost of establishing and maintaining them, growers are reluctant to replace well-known varieties, such as Red Delicious and McIntosh, with new varieties. Even so, many growers are putting in small blocks of scab-resistant cultivars now to test their success.

Finally, additional information is needed about producing and marketing scab-resistant cultivars. Even though the most recent scab-resistant cultivars hold up well to scab pressure, recent reports of scab development on some earlier cultivars underscores the need for comprehensive pest management programs. In other words, to get the most from scab-resistant cultivars we need to develop and implement a regional management strategy, as used in other crops, and to continue developing integrated strategies that incorporate both genetic and non-genetic control techniques for apple scab.

Neither apple was treated with fungicides. The MacIntosh, at left, shows the devastating effect of apple scab. The disease-resistant apple on the right is not affected.

Other Fungal Diseases

Furthermore, we will still need to deal with the minor or "summer" diseases, since many apple scab fungicides incidentally control diseases such as sooty blotch, fly speck, black rot, white rot, bitter rot, and Brook's spot. These diseases may become problematic in warmer, humid regions or during unusually humid summers.

One approach under investigation includes techniques which increase air circulation and reduce humidity in the tree canopy. In studies so far, summer pruning did reduce incidence of flyspeck, but lowering tree-planting density or closely mowing orchard ground cover had no impact on the incidence of sooty blotch or flyspeck.

Advanced IPM

Advanced IPM programs, such as the "second-level" IPM programs under development in Massachusetts and similar programs elsewhere, integrate the use of genetic, cultural, biological and least-toxic chemical methods of controlling pests. One such program resulted in 30 percent reduction in "dosage equivalents" of insecticide and miticide being applied in the orchard, and 18 percent fewer spray events than with standard IPM.

In New Jersey, for example, a program of three to four sprays later in the season can control sooty blotch and flyspeck on scab-resistant cultivars. In contrast, a program of seven or more sprays must be started in the spring to control scab and other diseases on standard cultivars. Eliminating early season fungicides allows beneficial mite predator populations to grow. But even a reduced-spray program can disrupt bio-control of pest mites. To overcome this problem, we are evaluating alternatives such as summer pruning and fungicides that may be less harmful to mite predators.

(See Apples, page 7)

A Grower's View

New York apple grower Amy Hepworth says scab-resistant cultivars are essential to her operation.

"As an ecological grower, I'm after the least chemical use possible, and they give me one more tool to be more ecological," she explains.

Hepworth, 33, with partner Greg Gervais, now grows apples on about 50 acres of her mother's land in Milton, N.Y. In the past, she's managed 350 acres, but for the time being has cut back to refine her management strategies.

Hepworth's philosophy is one of building soil and plant health. She quit using herbicides in 1980, and has been incorporating other ways to reduce pesticides since then. When certain pest populations threaten her crop, however, she uses chemical controls.

Hepworth relies on integrated pest management techniques to control insect pest populations. But she says she's more tolerant of some pests in her orchards than many apple producers.

"I tolerate a lot in the orchard. That's how I became an ecological grower. I let my mites run amuck. I don't spray for mites. I do the same thing for aphids," she says, explaining pests are needed to attract and maintain predator and other beneficial insects.

"I just have different tolerances. My thresholds are a little different. My payoff is different. I have an alternative market that pays premium price and can tolerate damage," she says.

Hepworth writes a newsletter for her customers. By helping them learn about fruit production, she says, she's been able to make her production systems a strong marketing tool.

"I'm eliminating one of the 'no-no's' to them. They don't want Captan or Benlate on their fruit. And I can really only do that with the disease-resistant varieties.

"When communication (between producer and consumer) is more direct, ecological food production is more marketable. It's very important that I market our fruit alternatively because we tolerate so much," she says. ◆

Seeding Sustainable Landscapes

By Dr. Richard A. Casagrande
Professor of Entomology
University of Rhode Island

There should be no need to apply pesticides to trees and shrubs in the landscape. Carefully selected plants that are properly sited and maintained will escape the ravages of serious insect and disease pests and should outlast any of us.

For the most part, however, consumers don't know much about the pests of trees and shrubs, and growers tend to plant whatever sells. Thus our landscapes contain many plants that require extensive management and excessive pesticide applications, but still die prematurely.

Recently, for example, I came across a Rhode Island bed and breakfast that was installing a new hedge at considerable expense. The inn's owners planted approximately 75 Canadian hemlocks, and three flowering dogwoods at an estimated cost of $6,700, not counting labor.

The property owners can now look forward to annually applying insecticides against the hemlock woolly adelgid, which is presently killing their neighbor's hemlocks. They'll also need up to three annual sprays of fungicides on the dogwoods to control anthracnose disease. With diligent care, these trees will mature to a size where they are too large and too costly to spray. They will die later, rather than sooner, with a substantial cost for removing and replacing them.

These problems could have been avoided.

The hedge could have been planted with Japanese or western hemlocks. The dogwoods could have been Cornus kousa or Stellar series hybrids. For roughly the same planting cost, the inn's owners could have used plants that will withstand pests. In the long-run, it would have saved them hundreds of dollars in annual pesticide costs.

With support from growers and the Northeast Region ACE program, our team is helping landscapers, homeowners and nursery producers discover and use plants that require less pesticides, water, and fertilizer. The goal of our project is to get everyone working from the same menu — a list of sustainable trees and shrubs.

The list is the key element in our program. But the project also involves the development of a logo, a point-of-sale tag, a manual, and demonstration landscapes - all intended to further the use of sustainable plants.

The first edition of the list, "Sustainable Trees and Shrubs for Southern New England," was released in September. This publication describes approximately 200 useful landscape plants which, to our knowledge, are non-invasive and require less water, pesticides, and maintenance. It also lists 128 common landscape plants which are more trouble-prone, and the major problems that eliminated these plants from the sustainable list.

Development of the list has been a cooperative venture involving the Rhode Island Nurserymen's Association and faculty from the University of Rhode Island and the University of Massachusetts. It has been reviewed by two dozen leading experts in the region, including nursery producers, landscapers, arboretum managers, and faculty.

How did we gauge the "sustainability" of various plants? Primarily through observation and experience. We've found that a number of the plants on our list contain chemicals that seem to confer protection against insects and pathogens. For other plants, physical characteristics, such as hairy or waxy leaves provide protection.

These plants are on display at a demonstration site, the "Learning Landscape," surrounding the URI Cooperative Extension Center. This 1.5-acre landscape demonstrates the latest low- maintenance techniques and plant materials for homeowners.

The demonstration landscape, designed and managed by the Cooperative Extension Center, received a large boost from the Rhode Island Nurserymen's Association, which provided the plant materials and labor (a donation of approximately of $100,000) for the project.

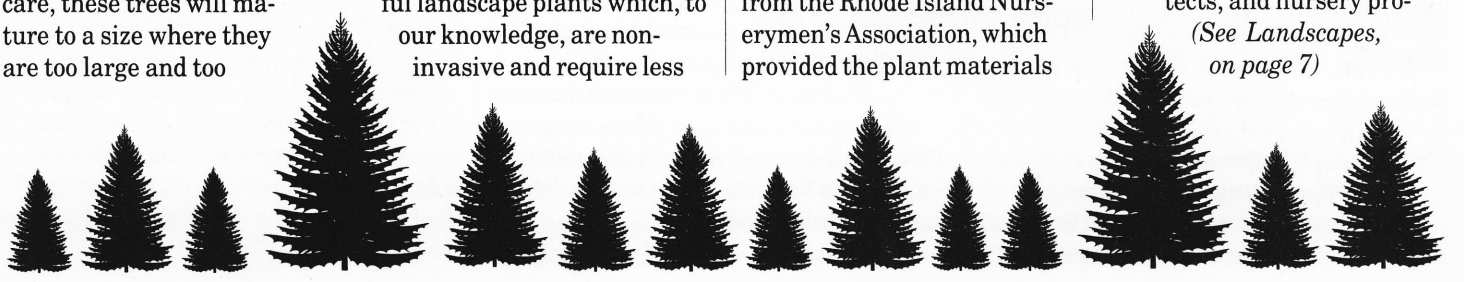
Trees and shrubs were selected from the sustainable list, demonstrating many excellent plants less familiar to the trade.

The landscape was dedicated at the GreenShare Field Day. Now in its third year, GreenShare annual draws about 2,000 people who are interested in low-maintenance landscapes and gardens.

The "Learning Landscape" represents roughly one-quarter of the grounds surrounding the URI greenhouses. The remaining land is a formal garden featuring stone walls built through the Works Projects Administration in the 1940s. We have completed the design and construction plans for transforming the garden into a low maintenance landscape. The plans emphasize plants from the sustainable list and make extensive use of perennials and groundcovers.

The renovation of this garden will began this fall and probably will take four to five years to complete — unless we find a significant source of funding, which could greatly speed up the process. When complete, the formal garden and "Learning Landscape" will provide an unparalleled opportunity for the entire community, including students, homeowners, landscape architects, and nursery pro-

(See Landscapes, on page 7)



Spores Instead of Sprays

By Michael Brownbridge
Assistant Research Professor
University of Vermont

In laboratories and test greenhouses, our research team has been developing a new arsenal against common greenhouse pests: insect-killing fungi. Our results to date show that these fungal pathogens, used as part of integrated pest management strategies, could significantly reduce insecticide use in greenhouse production.

The greenhouse has an optimal environment for plant production that, unfortunately, also favors insect survival and reproduction. Pest outbreaks can precipitate major losses of revenue through direct feeding damage, transmission of diseases, and the costs associated with insect control. As a result, insect control in the $7-plus billion greenhouse and nursery industry is still largely based on the routine use of agrichemicals.

But greenhouse growers want alternatives. In fact, because of concerns about insecticide resistance, environmental contamination, restrictive regulations, cost, and food and worker safety, many leading greenhouse grower organizations have made bio-control one of their highest research priorities.

Since 1991, we have been testing native insect-killing fungi against three major pests of greenhouse-grown ornamental and vegetable crops: western flower thrips, sweet potato whitefly, and the green peach aphid. More than 150 fungal isolates have been screened against these three pests.

The results have demonstrated that some fungi might be used quite effectively to control insect pests. We have found, however, that there is great variation in the effectiveness of the fungi for different target pests.

For example, *Beauveria bassiana, Metarhizium anisopliae,* and *Verticillium lecanii* were the most effective species against western flower thrips and green peach aphid; *B. bassiana, Paecilomyces farinosus* and *P. fumosoroseus,* were the most effective against sweet potato whitefly.

How do these fungi kill insects? First, the insects must come into direct contact with fungal spores. The spores stick to the cuticle, or exoskeleton, of the insect, until the spore germinates. The fungus then penetrates the cuticle to reach the inside of the insect. There, it must overcome the insect's immune defense mechanisms to establish itself and grow.

Having infected an individual, the fungus kills its hosts in one of two ways. The fungus can produce toxins that are lethal to the insect, or the fungus can literally eat away at the inside of the insect until the insect dies. Once the insect is dead, the fungus proliferates throughout the insect cadaver.

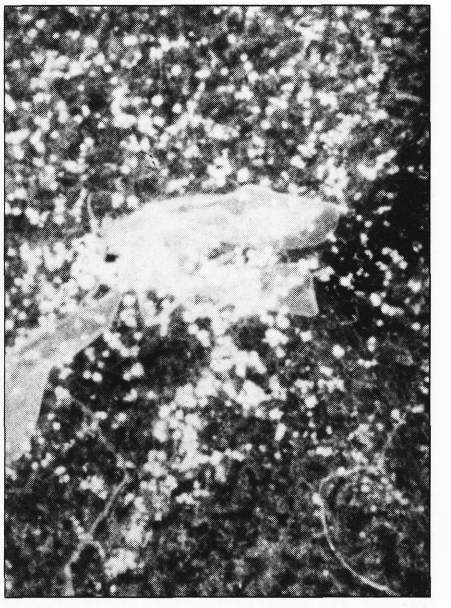
Once an individual insect dies of a fungal infection, it can infect other insects. If conditions are favorable — high temperature and humidity levels — the fungus will grow back through the cuticle and sporulate on the surface of the dead insect. These spores can then infect other, insects that come into contact with them.

Our research thus far has focused on evaluating a range of pathogens and formulations for use on an assortment of plants, with the goal of determining which fungi are active against more than one insect pest species. We have found several isolates to be effective, at least under lab conditions, at killing several insect pests.

Presently, we are conducting additional assays to make the final isolate selections for greenhouse trials. We are also evaluating fungal preparations in on-plant and in-soil trials against western flower thrips and in small-scale trials against sweet potato white flies infesting poinsettias. In the future we plan to expand the scope of work to include trials on high-value vegetable crops, such as peppers, cucumbers and tomatoes. Actual commercial trials might begin in 1995 or 1996.

Before doing commercial trials, we need to determine the most effective formulations, optimal dosage rates and best application procedures for enhanced on-plant performance. We have established collaborative links with fungal technology companies, and we hope to begin work soon using formulated materials to control western flower thrips and

(See fungus on page 7)



Above: A healthy adult sweet potato whitefly. Right: A sweet potato whitefly with a lethal fungal infection. Under favorable conditions, spores from this whitefly will infect other insects.

(Vegetables, continued from page 1)
laborating with a diverse group of Penn State researchers and Pennsylvania growers in an ambitious SARE-funded project. Their goal is to develop and test production practices and systems that are more resource efficient, more profitable and more environmentally sound.

Five different production systems are being evaluated in replicated tests for their ecological, agricultural and economic performance. The production systems range from certified organic to conventional soil and pest management practices. Most of the work is being done on a 12-acre research site Steffen calls a "living laboratory/classroom."

The researchers are using realistic, farm-scale operations to manage the different production systems, or "farms," on the research site. Each "farm" grows four to five vegetable crops in a given season as part of an intensive four-year rotation. Overseeded living mulches and green manure crops are included in some of the systems.

At the same time, researchers are collecting detailed baseline data on each system so that they can determine which factors and interactions are important in each one's performance.

Living Mulches Beat Herbicides

In the cabbage studies, a living mulch of annual ryegrass between cabbage rows provided the most effective weed suppression, followed pre-transplant herbicides, flaming at the two- to four-leaf stage of growth with a propane gas burner, and mowing vegetative growth several times during the growing season.

"We found the greatest plant vigor in the herbicide and living mulch treatments, followed by mowing and then flaming," says Horticulture Professor Michael Orzolek, who directed the studies. Additionally, reports Orzolek, there was no apparent reduction in cabbage growth from rye establishment.

But the researchers also noted other important interactions.

"While the living mulch was effective against lambsquarter and red-root pigweed (the two most prevalent weeds in the weedy check plot) it would not suppress the growth of perennial weeds such as Canada thistle or horseradish," Orzolek says. Also, researchers found, the flaming had the additional benefit of controlling flea beetles.

This initial work, says Orzolek, is significant because it shows the potential of alternate management strategies for a prime production problem: weeds.

Early weed infestation is a crucial grower concern because it reduces both early and total marketable yield and quality. Also, weeds can serve as reservoirs for insect and disease organisms, especially viruses. In fact, surveys of organic growers in the United States and Europe indicate that weeds are their primary production problem.

Conventional growers rely heavily on herbicides for weed control. But, says Orzolek, vegetable crops are considered minor crops by pesticide manufacturers, and a number of crops have few or no herbicides labeled for weed control during the season.

"Clearly, alternatives to synthetic herbicides would benefit a wide range of growers," he says.

Alternatives for Early Blight

The research team is screening a number of alternative materials, including selected plant extracts, antagonistic bacteria, hydrogen peroxide and bicarbonate for their efficacy in the control of early blight in tomato.

The goal is to gain a better understanding of the effect of these compounds on the natural ecosystem of plant surfaces. Because some of the compounds are usually considered innocuous, factors other than chemical toxicity are being investigated.

"A better understanding of leaf surface ecology may provide us with some effective biocontrol methods for vegetable foliar diseases," says +-Plant Pathology Professor Felix Lukezic, who is leading these studies.

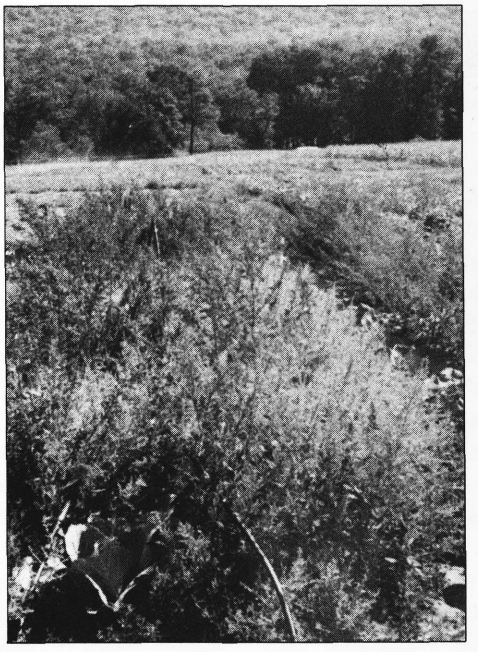
One possibility, he says, is that certain germicidal compounds alter or eliminate the natural microbiological population, and that the bacteria and/or yeasts which move in are antagonistic to the pathogens. The team is testing this hypothesis using an antibiotic-resistant labeled antagonist bacterium to monitor changes in the leaf surface ecosystem.

Refining Insect Control Techniques

Insect pests are targeted in several portions of the project.

For example, in tomatoes and snap beans, predators (pre-fed early instar *Chysoperla* larvae) are being hand released to control aphids. Natural enemies are being obtained under commercial conditions, and economic data are being compiled.

Also in tomatoes, project participants



A living mulch provided the most effective weed suppression in a cabbage experiment. Left: The weedy check plot. Right: The herbicide plot. Opposite Page: Cabbage with the living mulch .

were able to control an early immigration of Colorado potato beetle using adulticides (rotenone or esfenvalerate) followed by a well-timed spray of microbial pathogen in both conventional and ecologically-oriented plots.

"This demonstration of the importance of proper timing with the microbial material is relevant to all grower audiences," says Assistant Entomology Professor Shelby Fleischer, who is coordinating the insect studies.

In still other studies, the team is testing alternative strategies for European corn borers and cucumber beetles.

"Integrated pest management (IPM) programs for vegetables will be more complex than those in use with field crops," Fleischer predicts. "They will require all the parameters used with field crops, but will also need to be modified by factors such as nutrient value, consumer acceptance, storage loss, etc."

Fleischer also notes that much additional information still needs to be generated.

"While many of our observations are preliminary, these studies are beginning to offer some insight into possibilities for a more biorational pest control strategy in high-value food crops," he says. ◆

Cabbage plant vigor was greatest in the herbicide and living mulch treatments

(Apples, continued from page 3)

We are also studying alternatives to chemical fumigation for apple replant disease. Replant disease, caused by a number of factors including parasitic nematodes, can occur when a grower replaces an old orchard with new trees.

Possible alternatives for suppressing parasitic nematode populations include planting cover crops of canola, marigold, or new turfgrass varieties before planting new apple trees, or incorporating peat moss, compost, or water-absorbent copolymers into the soil of the planting hole.

Marketing and Economic Issues

Scab-resistance, together with advanced IPM strategies can provide growers with both production and marketing advantages.

For example, one study indicated that a grower could save $178 per acre by growing scab-resistant cultivars instead of McIntosh or Empire. However, since this savings is only 3 percent of the crop value (assuming 725 bushels/acre @ $8 per bushel), the productivity and quality of scab-resistant cultivars must be high to realize a profit. Early yield data and taste panels from some scab-resistant cultivars show promise in both quantity and quality. Consumers who have been surveyed say that the newer releases taste as good, or better, than the current favorites.

In another study, an IPM program using scab-resistant cultivars had 1/3 the cost and 1/4 the pesticide use of a typical IPM program using standard varieties. Unfortunately, sooty blotch and flyspeck, though "minor" problems, can make the crop unmarketable in current mainstream marketing channels unless consumer acceptance increases. While growers say it is difficult to motivate consumers, who are often reluctant to change, some growers have shown it can be done in niche markets.

While we are a long way from many of the answers we are seeking, we hope that this project is bringing the day closer when the Northeast will have sustainable apple production systems in place. And, we hope our research on scab-resistant cultivars will help Northeast growers

(Fungus, continued from page 5)

sweet potato whitefly infestations in our experimental greenhouse.

Other areas that will need attention are the integration of fungi with other pest control strategies and evaluation of their effects on other biocontrol agents, such as predators and parasitoids.

Preliminary data suggest that while certain beneficial species may be susceptible to lethal fungal infections in the lab, in actual greenhouse conditions they would not contract the infection because their behavior protects them from exposure to the spores.

We think the fungi represent a viable, ecologically acceptable alternative to chemical pesticides. Results to date have been encouraging, but we still have a long way to go before a commercial product becomes available.

Furthermore, it would be naive to expect the fungi to replace all other pest management options. Rather, their development as dependable and inexpensive components of IPM will reduce our reliance on chemical insecticides while providing long-term benefits to growers and the environment.

Michael Brownbridge is an entomology assistant research professor at the University of Vermont. UVM Professor Bruce Parker and Assistant Professor Margaret Skinner are collaborators in this research. They are concluding their first year of SARE- and ACE-supported projects.◆

(Landscapes, continued from page 4)

ducers, to learn about the use of sustainable plants and designs.

The sustainable list is available through the URI Cooperative Extension Center. We're also planning to distribute it through the University of Massachusetts and elsewhere.

Send a check for $4 to Cooperative Extension Center, University Rhode Island, Kingston, RI 02881. The proceeds will be used to maintain the demonstration landscape.◆

Time Is Running Out!

The 1994 SARE/ACE and Farmer Grant application deadlines are approaching.

- **SARE/ACE proposals are due January 19, 1994.**
- **Farmer/Grower Grant applications are due January 26, 1994.**

To obtain the Call for Proposals and/or a Farmer Grant application, call 802-656-0471 or write SARE/ACE, Hills Building, UVM, Burlington, VT 05405-0082

Sustainable Agriculture Resources & Materials

❑ ***The Sustainable Agriculture Directory of Expertise — 1993,*** lists 717 people with expertise in farming more safely and more profitably. Funded by the Sustainable Agriculture Network and compiled by Appropriate Technology Transfer for Rural Areas (ATTRA). $14.95.

❑ ***The Real Dirt,*** due out in Early 1994, will give you a vivid snapshot of organic and low-input farming in the Northeast in the early 1990s. Based on interviews with more than 60 farmers in eight states, the book summarizes the practical methods for ecological soil, pest, diesease, crop, greenhouse and livestock management that have been discovered and used over the past few decades. It offers a farmer's-eye view of how to go about the site-specific work of designing rotations, selecting crops and surviving economically. It also poses many questions that farmers and researchers need to answer for the future.

"What an amazing catalogue of ingenious responses to variable conditions faced by farmers," says Williams-town Massachusetts farmer Sam Smith. "It will encourage the creativity of aspiring and experienced farmers."

The Real Dirt was edited by Miranda Smith and members of the Northeast Organic Farming Association and the Cooperative Extension. $13.95 through SARE (see instructions below) or through the Northeast organic growers association nearest you.

❑ ***Managing Cover Crops Profitably,*** a practical, introductory guide to using cover crops to save money, prevent soil erosion and prevent pest problems. Funded by the Sustainable Agriculture Network, it was produced and edited by the Rodale Institute. You'll find a region-by-region guide to proven strategies, as well as listings of expert contacts who can help you get started. $9.95.

❑ ***Showcase of Sustainable Agriculture Information & Educational Materials,*** lists scores of publications about sustainable agriculture. Each entry includes an abstract and information about how to order. $4.95.

To order, send a check or purchase order to Box I-4, Sustainable Agriculture Publications, Hills Building, Burlington VT 05405-0082. Please allow 4-6 weeks for delivery. For information on rush orders and bulk discounts call 802-656-0554

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