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Save August 13 - 15 for 25th Annual NOFA Summer Conference

By Dre Rawlings

As the summer conference steadily approaches excitement is building among the enthusiastic conference committee staff. We have been working to finalize plans and look forward to an exciting event, this being our 25th annual celebration!

There are still some areas in which we'd love some input from you, our NOFA members. NOFA Nibbles - our favorite spot to snack and chat - is seeking someone to provide a water filter from Thursday, August 12th at 1:00pm, until Sunday at 2:00pm. If you can help out, please contact Janice Sanford at (203) 263-2626 or by email at jsanford.bittersweet@snet.net.

Richard Murphy is still looking for people interested in debating the organic McDonald's topic. If you have a strong opinion on the subject, please contact him by email at rmurphy@star.net or at (508) 867-5735 . Thanks to those who sent him leads for tracking down a domestic organic beer. At the Friday night party, and also again on Saturday night, attendees will have a chance to quench their thirsts with a Wolaver's organic ale – either Pale Ale, Brown Ale, or India Pale Ale.

Wolaver's is a brand of the Panorama Brewing Company (PBC) of Santa Cruz, California, and is certified organic by Oregon Tilth. But the beer is brewed under contract at small craft-breweries for regional distribution around the US. The Wolaver's we sample will be brewed by the Otter Creek Brewing Company in Middlebury, Vermont. PBC donates 10% of after-tax profits to organic farming and sustainable agriculture causes and invites you to learn more about Wolaver's at www.wolavers.com

Helping Hands are still needed and greatly appreciated. It's a great way to cut your conference costs and meet lots of new people. Remember that there is also scholarship money available for qualifying individuals. We encourage you to get involved and pursue these options. They can enable you to participate in the summer conference - FOR CHEAP! See your registration form for more information.

We'd like to remind everyone of the changes we've made in the format of Saturday's old-fashioned Country Fair. We are planning both a farmer's market AND a crafts market where people can display and sell their produce and handmade wares, but we're changing things around a bit. In order to provide the opportunity for more growers to participate in the farmer's market, we've decided to allow ANY organic produce to be sold this year, whether certified or not. In terms of the crafts market, we are emphasizing only handmade items. (This for example, would exclude authors from selling their books unless they have been HOME PUBLISHED). Potential demonstrators and those of you generous members with auction items to donate, please see the registration form for more details. In other Fair news, a balloon artist has been hired to entertain the kiddies with his original creations, and we're working on some face painters to add some fun and color to the festivities. We're also sending out a call to anyone interested in juggling or clowning around (we're talking the face make-up, big shoes, and the nose!) during the Fair. Please contact Dave Getman at (978)-464-7745.

The Children's Conference update: Day care for the 2-4 year old set will be run during adult workshop times. Parents can drop their kids off 15 minutes early in order to avoid missing any of their workshops. Toys to share, personal comfort items, changes of clothing and towels are recommended items to have along. The teachers have waterplay, art and songs planned to entertain the little ones. Snacks are available, as is a napping place if needed. Animal visits will also be part of the fun. A new program has been planned for the 5 and 6 year olds this year. They will stay with their teacher, and one special workshop will come to them each day. This may not be clear on the registration form, but the change should provide more uninterrupted project time, and less confusion and wandering for the kids.

There are a variety of workshops planned for the 7-12 year olds. There will be active, outdoor subjects to explore, cooking, crafts, and music workshops. Each time slot will have at least two workshop options to choose from in addition to the group leader's planned activity. With everything there is to do over the weekend, the kids should go home tired and happy, having learned new skills and forged new friendships. So join us! Please get your registration in early (for teens and all children by July 31) to avoid disappointment.

photo by Jack Kittredge

Dale Perkins gives a workshop on ruminants at NOFA Summer Conference

As you can see, everything's coming together. We have lots of new and exciting workshops planned - Gardening, Ox Power for Small Farms, and Intro to Aromatherapy, to name just a few. We also have a bunch of thought-provoking films to screen this year, including "Escape From Affluenza" and "Field of Genes". So take advantage of that Early Bird Special and send in your registration forms soon! Looking forward to a fantastic conference this summer -- see you there!

Inside this issue:

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Supplement on Beneficial Insects

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Beneficial Insects & Biocontrol of Pests

For many people, a simple way to describe the difference between conventional and organic growing is that the conventional approach tries to "control" nature, while organic growers try to "cooperate" with nature. A prime example might be a conventional dairy farm like the one down the road from us, where corn is planted in the same chemically-fertilized field year after year. That farm stands in contrast to an organic dairy where not only are grain crops rotated into different fields each year, but as much nutrition as possible is delivered to the cows through grazing of grass. Instead of forcing both corn and cow into a rigid management pattern and trying to deliver to them what they need as outside inputs, the organic approach tries to let living organisms get what they need as much as possible on their own, by setting up an environment conducive to their growth and health. One of the areas where conventional and organic methods diverge most clearly is in management of insect pest problems.

Any objective observer would have to admit that insects are the dominant form of life on earth. The numbers of Insecta, both of individuals and of species, far outdistance those of any other class of creation. Insects are the dominant consumers of plant life on the planet, and have evolved into countless species, each brilliantly suited to thrive in a particular niche. The success of a small number of insects (less than 1% of insect species have achieved the status of agricultural "pests") brings them into conflict with humankind in our struggle also to appropriate the productive energy of plants.

During the last half-century conventional agriculture has attempted to win this conflict by formulating various synthetic chemical pesticides. These are sprayed on crops or otherwise applied in a fashion that is toxic to insects that feed on the plants in question. Although highly successful at first, the widespread success of chemical pesticides has led to problems that threaten their long-term usefulness:

1) Because pesticides exert a strong selective pressure for resistance, and insect reproduction is so prolific and rapid, resistant strains of insects quickly emerge and become dominant, destroying the efficacy of the pesticide.
2) As more and more new chemicals must be developed to replace outmoded ones, research and development costs increase and force the resulting product to become expensive, sometimes so much so that it is no longer practical for use.
3) It is hard to tailor a toxic chemical to a specific species of insect, so pesticides tend to kill a broad spectrum of insects, including the beneficial ones.
4) Because of increasing insect resistance, doses of older pesticides must be increased to be effective, thus raising their cost of use - sometimes beyond the threshold of practicality.
5) Since the introduction of chemical pesticides, observers have increasingly noted their damaging effects on both human health and the natural environment.

Organic farmers have rejected this approach in favor of evading insect damage by crop rotation, smaller and more diverse cropping patterns, and better soil and thus plant health. They also have recognized the value of natural predators of pest insects – largely other insects who have evolved to prey upon the pest and keep it from overpopulating. If the feeding is good and the pest begins to reproduce rapidly, it automatically provides all the more food for the predator, which keeps pace and thus brings balance. This principle has been around for a long time. In ancient Egypt, cats were imported to keep down rats that thrived on the stores of grain produced by the rich delta soil. Linnaeus speaks of beetles and ants brought into citrus groves to control pests.

Unfortunately, with the international travel of humans during the last few centuries, a number of insects have been transported far from their natural habitats. There some find crops quite similar to those they left at home (often the crops and pest were transported thousands of miles together in the form of infested fruit or sacks of seed.) – except for the absence of the predator, which always kept pest numbers in balance. Forty percent (40%) of the insect pests now in the United States are such "exotics". To deal with these "exotics", researchers have returned to the pest's land of origin and searched for the predator which kept it in control. Once found, small populations of the predator have been brought to the infested area and released.

The Natural Farmer Needs You!

The Natural Farmer is the newspaper of the Northeast Organic Farming Association (NOFA). All members receive a subscription as part of their dues, and others may subscribe for $10 (in the US or $14 outside the US). It is published four times a year at 411 Sheldon Rd., Barre, MA 01005. The editors are Jack Kittredge and Julie Rawson, (assisted by their kids), but most of the material is either written by members or summarized by us from information people send us.

Upcoming Issue Topics - We plan a year in advance so that folks who want to write on a topic can have a lot of lead time. The next 3 issues will be:

Autumn 1999 -	Clever Implements
Winter 1999-00 -	Food Safety
Spring 2000 -	Flowers for Market

Moving or missed an issue? The Natural Farmer will not be forwarded by the post office, so you need to make sure your address is up-to-date if you move. You get your subscription to this paper in one of two ways. Direct subscribers who send us $10 are put on our data base here. These folks should send address changes to us. Most of you, however, get this paper as a NOFA member benefit for paying your chapter dues. Each quarter every NOFA chapter sends us address labels for their paid members, which we use to mail out the issue. We don't keep copies of these, and if you moved or didn't get the paper, your beef is with your state chapter, not us. Every issue we print an updated list of "NOFA Contacts" on the last page, for a handy reference to all the chapter names and addresses.

As a membership paper, we count on you for articles, art and graphics, news and interviews, photos on rural or organic themes, ads, letters, etc. Almost everybody has a special talent or knows someone who does. If you can't write, find someone who can to interview you. We'd like to keep the paper lively and interesting to members, and we need your help to do it.

We appreciate a submission in any form, but are less likely to make mistakes with something typed than hand-written. To be a real gem, send it via electronic mail (JACKKITT@AOL.com) or enclose a computer disk (3 1/2 inch size). We use a Macintosh G3 with Microsoft Word but can with only modest difficulty convert IBM disks as well. Also, any graphics, photos, charts, etc. you can enclose will almost certainly make your submission more readable and informative. If you have any ideas or questions, one of us is usually near the phone - (978) 355-2853, fax: (978) 355-4046

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Advertise in The Natural Farmer

Advertisements not only bring in TNF revenue, which means less must come from membership dues, they also make a paper interesting and helpful to those looking for specific goods or services . We carry 2 kinds of ads:

The NOFA Exchange - this is a free bulletin board service for NOFA members. Send in up to 100 words (business or personal) and we'll print it free in the next issue. Include a price (if selling) and an address or phone number so readers can contact you directly. If you're not a NOFA member, you can still send in an ad - just send $5 along too!

Display Ads - this is for those offering products or services on a regular basis! You can get real attention with display ads. Send us camera ready copy and enclose a check for the appropriate size:

Full page (15" tall by 10" wide)	$240
Half page (7 1/2" tall by 10" wide)	$125
One-third page (7 1/2" tall by 6 1/2" wide)	$85
One-quarter page (7 1/2" tall by 4 7/8" wide)	$65
One-sixth page (7 1/2" tall by 3 1/8" wide), or (3 3/4" tall by 6 1/2" wide)	$45
Business card size (1 1/2" tall by 3 1/8" wide)	$12

note: These prices are for camera ready copy. If you want any changes we will be glad to make them - or to type set a display ad for you - for $10 extra. Just send us the text, any graphics, and a sketch of how you want it to look. Include a check for the space charge plus $10..

Frequency discounts: if you buy space in several issues you can qualify for substantial discounts off these rates. Pay for two consecutive issues and get 10% off each, pay for 3 and get 20% off, or pay for 4 and get 25% off. An ad in the NOFA Summer Conference Program Book counts as a TNF ad for purposes of this discount.

Deadlines: We should receive your ad copy one month before the publication date of each issue. The deadlines are:

January 31 for the Spring issue
April 30 for the Summer issue
July 31 for the Fall issue
October 31 for the Winter issue

Contact: If you have questions, or want to reserve space, contact our advertising manager at (978) 355-2853.

Disclaimer: The Natural Farmer cannot investigate the claims of advertisers and we don't vouch for anything advertised here. Readers are expected to exercise due caution when inquiring about any product or service. Different NOFA chapters have different standards for fertilizers, for instance, and a product acceptable in one state may be prohibited in another. Please check with your chapter when in doubt. Remember, however, that advertisers are helping support the paper and, when appropriate, please support them.

In some cases, dramatic reductions in pest populations have been the result. At the beginning of this century a new weed appeared in California, along the Klamath River, which was toxic to cattle and sheep. By 1944 the weed, which by then had been identified as of European origin, infested more than 200 million acres in 30 counties. In 1945 and 1946 2 species of beetle — which preyed upon the Klamath weed in Europe – were released in California. Within 10 years the Klamath weed was encountered only rarely and ranchers were estimated to have avoided (and continue to avoid) over $3.5 million a year in damages. Another example of strikingly successful biocontrol – which William Day mentions in his article in this issue – is the introduction of vidalia beetles to control scale in the California citrus industry.

But biocontrol has not always been an unqualified success. In some cases an introduced predator unexpectedly preys upon another predator species. Parasitoids (parasites who kill their prey rather than just parasitizing it) have become hyperparasitoids, attacking another parasite species which they were brought in to bolster. Or the immigrant will surprise everybody and prove so well adapted to the new locale that it displaces native species – as the honeybee did in America, or the European ladybird beetle, brought in to control the Russian wheat aphid, did with midwestern ladybird beetles. Or the newcomer will find other prey to its liking besides the intended host. The Indian mongoose was introduced to Hawaii in the 19th century to control Norwegian rats in sugarcane plantations. Unfortunately, the mongoose is diurnal, whereas the rat ventures forth only at night. They happily coexisted, unaware of each other. But the mongoose did come close to decimating lots of tasty flightless birds and small ground-dwelling mammals.

Biocontrol, as several of the writers in this issue attest, is not primarily practiced by organic farmers – at least at the commercial scale. It makes good sense on a practical basis in any farming system. If you can find a natural enemy with a high reproductive rate, a good search ability, which is specific to and synchronized with the pest, and yet is adaptable to new environments, you have a killer working for you which is more effective than any pesticide you can buy. The advantage that organic farmers have with biocontrol, of course, is that they can get much of it for free. Predators like pollen, second only to hosts. Hedgerows, insectary strips, and patches of wildflowers are all abundant repositories of biodiversity when left unsprayed. A Canadian apple study found that parasitism of orchard pests was from 4 to 18 times as active on farms where wildflowers were present. Farmers who leave such areas uncultivated, or actively plant flowers with blooming periods which overlap and thus can sustain predators throughout a growing season, are essentially giving their farm a healthy “immune” system.

This issue of The Natural Farmer discusses beneficial insects and their role in biocontrol. We hope it gives you ideas for how to farm better, and why farming with nature will always be more satisfying than trying to fight it.

NOFA Exchange

Blow Your Own Horn!

Needed – Organic Farmer/Educator. The Natick Community Organic Farm is a 25 acre diversified operation with vegetable production, livestock, solar greenhouses, syruping and many educational programs. We are looking for a dynamic person, committed to organic farming, with a 2 or 4 year degree in the field and/or equivalent experience in organic agriculture, with carpentry and mechanic skills, who loves teaching and working with people. Computer skills, interest in developing programs a plus. This Town of Natick position will be opening around July 20. Salary: mid 20s, full town employee status. Send letters of inquiry/ resume to Lynda Simkins, NCOF, 117 Eliot St., Natick, MA 01760

Suffolk work horses: We knew nothing of farming or working horses when we started, so we decided to start with horses bred to do the work at hand. We made the right decision, choosing Suffolk horses. They are moderately sized, calm in temperament, and easy to keep. We have trained teams, green teams, breeding and young stock available. Baldur Farm, N7659 950th Street (Cady Lane), River Falls, WI 54022. (715) 425-0040

Garlic – Organically grown in VT. More than a dozen gourmet strains to choose among – hard and softneck, mild to WOW hot, braiders, easy-to-peel, or high medicinal content. Great for farmers market, CSA, gardens. Detailed growing instructions available. Our garlics are acclimatized to New England winters! For catalog, call Rebecca. Northern Prize Garlic, (802) 827-6555.

Heath, MA **Lowbush blueberry farm** in transition. If interested in a connection to the process, call Dave Gott or Ted Watt at 413-625-8357. Or write to 336 Patten Rd., Shelburne, MA 01370

Lovers of Wild Apples: Interested in talking with others who grow, process, and enjoy apples and other tree fruits without sprays of any kind? Contact Dave Gott or Ted Watt at 413-625-8357. Or write to 336 Patten Rd., Shelburne, MA 01370

Looking for Living Space on an organic farm. I have 2 children in college who'd come to stay occasionally. I am also seeking to work at the farm. Particular arrangements are open to discussion. Contact Rita (413) 549-3521

Job Wanted – Experienced farming technician from Senegal, studied in Morocco and France, looking for job in RI on a farm or in the natural foods industry. Also has lots of bookkeeping and managerial experience. Still studying English. Happy to learn the ropes from scratch in the US. For resume and more info, contact Mike Merner at (401) 364-9930

Wanted: Apprentice for Jersey Dairy – making cheese, yogurt, and other products. Milking experience helpful, along with a strong interest in dairy processing. Please contact Town Farm Dairy, 73 Wolcott Rd., Simsbury, CT 06070, (860) 658-5362, Email: Townfm@aol.com

Summer internship available with GreenSpace Collaborative and Sidehill Farm. Opportunity to work on two straw bale buildings, one house and one studio, in different stages of construction. Position includes 35 hours per week construction work, 5 hours office work, and 20 hours homestead-scale farm work. Meals, campsite and stipend. June through August. For more information contact Paul Lacinski, PO Box 107, Ashfield, MA 10330, (413) 628-3800

Part-Time Position: The New Entry Sustainable Farming Project is developing opportunities for disadvantaged persons to practice agriculture in Massachusetts and adjacent areas. You would help survey farmable open space in northern Worcester County and gather details such as location, access, size, crop suitability, water access, lease potential, costs, etc. for a data base. You would also solicit interest and help negotiate with landowners lease terms and other conditions. You would also identify new entry farmers and help determine their resource needs, working with the Farm Service Agency and others to provide technical assistance. Skills in outreach/organizing, computer skills, writing, agriculture all helpful. Vehicle necessary. Begin as soon as possible, for summer or longer. Minimum 20 hrs. per week, funding for 6 months available with additional funds expected. Home office is Farm Service Agency in Holden or Tufts University in Medford. Salary is $12 - $15/ hr. To apply send letter and resume to Hugh Joseph, School of Nutrition and Policy, Tufts University, 126 Curtis St., Medford, MA 02155 or email hjoseph@emerald.tufts.edu (617) 627-5442.

Peace Corps is looking to fill over 100 two-year Agriculture Science Assignments overseas. Posts include El Salvador, Guatemala, Paraguay, Suriname, Tanzania, Gabon, and Uganda. Volunteers would encourage sustainable crop production through promotion of organic farm techniques and better farm management. Requirements include U.S. citizenship and a degree in an agricultural science. Some applicants may qualify with no degree and three years' full-time farm experience. Volunteers receive a monthly living stipend, housing, medical/dental care, transportation to their host country and a $6,000 readjustment allowance. For more info. call Peace Corps at (800) 424-8580, press 1, or www.peacecorps.gov.

Help The Natural Farmer get advertising and sponsorships from organic industry. Looking for ad representative to work on commission. Call Jack at 978-355-2853 or write: TNF, 411 Sheldon Rd, Barre, MA 01005, JACKKITT@AOL.COM.

News Notes

compiled by Jack Kittredge

Ladybug Habitat Preferences Listed – The Northwest Coalition for Alternatives to Pesticides has published a list of plants attractive to Ladybugs. Not all are suitable for all areas of the country, but among them are: Alfalfa, Alpine Cinquefoil, Alyssum, Angelica, Beans, Black Locust, Carpet Bugleweed, Clover Bur, Coriander, Cosmos (White Sensation), Crimson Clover, Dandelion, Dill, Evergreen Eunomymus, Flowering Buckwheat, Four-wing Saltbrush, Golden Marguerite, Hairy Vetch, Mexican Tea, Morning Glory, Peas, Rocky Mountain Penstemon, Rye, Sesbania, Sowthistle, Spike Speedwell, Sulfur Cinquefoil, Sweet Fennel, Tansy, Wild Carrot, Yarrow (Common), Yarrow (Fern-leaf). *source: Journal of Pesticide Reform, Fall, 1998*

NOP Rears Its Head, Again – Rumors abound that the second proposed organic rule may be issued for public comment as early as late August or early September, 1999. Provisions are said to include a number of victories for hard-line organic advocates: no use of genetically modified organisms, irradiation, or sludge; for animals: 100% organic, a ban on antibiotic use, and required access to outdoors as well as pasture for ruminants; NOSB authorization for all approved synthetics, and no restrictions on label claims other than organic itself. The USDA will seek a one-time authorization to cover the costs of first-round certifier accreditation and a compromise is rumored allowing certifiers, after certain internal procedures and appeals, to revoke use of their seals pending an appeal to the Secretary of Agriculture. *source: Organic Forum, April 25, 1999 and Alternative Agriculture News, April, 1999*

OCIA Faces Budget Shortfall, Centralizes Certification Decisions – The Organic Crop Improvement Association International, one of the major North American organic certification groups, lost $246,000 on its 1998 operations. Reasons given include reduced sales of organic products in Asia due to the economic downturn there, and an exodus of members to less expensive certifiers. To make up the shortfall, OCIA voted at their February meeting in Lincoln, NE to increase fees by .25%. They also voted to remove the right of local chapters to grant certification, requiring all such decisions to be made at the international level. Although many members questioned whether the group has the capacity to process these some 3000 - 4000 files at the central level, chapter inconsistency has been a problem for OCIA in gaining IFOAM and RvA accreditation. *source: Organic Broadcaster, March-April, 1999*

FVO to Offer Genetically Natural ™Certification – Farm Verified Organic, one of the earliest organic certification programs, has joined up with Genetic ID, a company which has developed technology to detect genetically modified organisms. The new company will offer 4 certification programs:

1) traditional organic certification to international standards
2) non-GMO certification of farm process backed up by DNA testing to assure GMOs are excluded from certified products to a tolerance of 0.1%
3) Below Detectable Level (BDL) certification for residue-free assurance, and
4) Dual certification as organic and non-GMO.

The company expects increasing demand for non-GMO certification as more and more GMO products enter the marketplace. *source: FVO Press Release, January 27, 1999*

Cabbage and Cattails Detoxify Chromium – Plant biologists at the University of California, Berkeley are finding that these plants, as well as other brassicas, lettuce, spinach, cucumber, cantaloupe, radish, tomato, water hyacinth and saltmarsh bulrush take up chromium from the soil but transmit it to the shoots and leaves in a non-toxic form. The exact mechanism is not yet understood, but the results are of interest to California industries which are having difficulty meeting regulatory chromium discharge levels. *source: Acres, USA, March, 1999*

Drill-Powered Poultry Plucker on Market – JAKO, Inc. at 6003 E. Eales Rd., Hutchinson, KA 67501 (316) 663-1470 http://www.jakoinc.com offers a small plucker powered by a hand drill, for home use. The unit is designed to be mounted on a table and chucked to a hand drill. (ed: Let us know how you like it if you buy one!) *source: OEFFA News, Winter, 1999*

Bette Midler Saves NYC Community Gardens – Folks worried by the effort of New York City to sell off 112 city-owned vacant lots which had been used for community gardens can rest easy now. Bette Midler told her private conservation organization to buy a number of them and organized other groups to save the rest. Plans to turn ownership over to the community groups using them are underway. *source: New York Times, May 12, 1999*

Canada Rejects rBGH – After a 9-year review of Monsanto's synthetic bovine growth hormone, Health Canada has prohibited use of the production-enhancing drug in Canadian dairy operations because it poses an "unacceptable threat to the safety of the cows." The US thus remains the only country where use of this bio-engineered drug is allowed. *source: Food & Water Journal, Winter, 1999*

Clay Particles Suppress Curculio – A new product, Kaolin clay, released under the trade name Surround, is said to create a barrier to plum curculio in apple trees. ATTRA reports impressive results when the particles are mixed with water and sprayed into the trees every 5 to 10 days. It is also said to work against leafrollers, leafhoppers, pear psylla, and Japanese beetles! There is no effect on beneficials other than making the tree undesirable for them. The clay is currently used as an anti-caking ingredient in food and has to known effect on humans. Guy Ames of ATTRA has offered further information at 800-442-9842 or guya@ncatark.uark.edu. *source: private communication*

Organic Tobacco Prices Attract Farmers – Organic tobacco sells for about twice what the conventional crop does, and many farmers in the North Carolina tobacco belt are becoming interested in it. On a scale of several acres, the extra management necessary to replace chemicals is reasonable, and extra fertility costs for organic inputs is not excessive given today's market prices. Will this be the debate topic at a future NOFA Conference? *source: Stewardship News, March - April, 1999*

EPA Raises Roundup Limit – The Environmental Protection Agency has given approval to a Monsanto petition to raise the acceptable levels of glyphosate (Roundup) herbicide residues on sugar beets and grain crops. The company won a similar concession from the agency during development of it's "Roundup Ready" soybean variety, lifting the acceptable level from 6 ppm to 20 ppm. *source: Greenpeace Email, April 15, 1999*

Bt Crops Threat to Beneficials – Entomologists meeting in Basel, Switzerland, in March warned that crops containing genetically engineered Bt exude 10 to 20 times the amount of toxins contained in traditional Bt sprays. As a result, they say, beneficials such as ladybugs, lacewings, and soil microorganisms are being harmed. They called for a moratorium on Bt plantings. *source: CFS News, April 16, 1999*

USDA Approves Irradiation of Meat – Raw meat and raw meat products can now be irradiated, announced Dan Glickman, Secretary of Agriculture. The procedure has been touted as reducing the number of dangerous microorganisms on meat and poultry, allowing for a "safer" carcass. Expensive recent recalls of meat and poultry products caused the meat industry to become concerned about product quality, forcing either a reevaluation of the industrial scale on which meat products are produced, or a search for a high-tech "fix". *source: Acres, USA, May, 1999*

Soy Food Allergies on Rise – Researchers at the York Nutritional Laboratory announced on March 12 that soy food allergies among the British public rose a staggering 50% in 1998, coinciding with a large increase in US genetically engineered soy imports. Foreign proteins, produced by genes spliced into soy to carry such traits as resistance to Roundup, are under suspicion for triggering the allergies. *source: CFS News, April 16, 1999*

GE-free Demand Fuels Markets – Intense consumer opposition to genetically engineered (GE) foods in Europe and Japan has caused grain export giant Archer Daniels Midland to create a program for GE-free "identity preserved" soybeans. The company is hoping to preserve a portion of the $4.5 billion in US annual soy exports which is threatened by the current policy of "co-mingling" GE and traditional grains. *source: CFS News, April 16, 1999*

Monsanto Satirized in Song – The British folk band "Seize the Day" has E-published a song called "Food 'n' Health 'n' Hope" satirizing Monsanto. Hear, copy, and distribute it at www.seizetheday.org *source: CFS News, April 16, 1999*

GE-Vandals Set Free – In a precedent-setting victory for the anti-genetic engineering (GE) movement, all charges were dropped against two defendants on trial for destroying a test plot of GE corn last year. The prosecution feared that the campaigners, who claimed they were acting in the public interest, would be set free by the jury and this would encourage further direct action. *source: CFS News, April 16, 1999*

GE Crops Increase as Market Shrinks – Ask any farmer what happens when more of a crop is produced at the same time as the market for that crop is shrinking. This, apparently, is what is happening to GE crops in Europe. McDonalds, Burger King and Kentucky Fried Chicken all are eliminating GE soy and corn ingredients from their menus, according to the British newspaper *The Daily Mail*. At the same time, however, world farmers planted 69.5 acres of GE crops worldwide in 1998. *source: Acres, USA, May, 1999*

Pioneer Valley Seed Saver's Conference Report

By Sara Weil

The first annual Pioneer Valley Seed Savers' Conference and seed swap convened 13 March 1999 at the Hampshire College Red Barn in Amherst, Massachusetts. About sixty people attended.

To answer the need for a local seed saving organization, David Fisher, farmer, homesteader and seed activist from Conway, organized the conference. This gathering represents the beginning of a hopefully long-standing tradition of grassroots seed saving in the valley. David aims to establish a network of farmers and gardeners to provide for their own seed needs and to gain independence from the corporate stranglehold on the seed industry. He envisions collaboration among farmers in which each farmer grows one crop for seed thus making easy the otherwise onerous task of saving seeds from all the crops on any one farm. David particularly hopes to include farmers as well as gardeners in the Connecticut Valley Seed Savers Cooperative. The expense and the small seed quantities available through organizations specializing in open pollinated cultivars discourage farmers from growing open-pollinated varieties. A regionally based seed collective could overcome this barrier. David seeks to grow open pollinated crops at his farm, Natural Roots. One crop that David particularly appreciates growing this year, the Clear Dawn Onion, he obtained from Tom Stearns of High Mowing Organic Seed Farm. Clear Dawn is the dehybridized form of the widely popular Copra onion. For a taste of this interesting allium look for David at the Amherst and Springfield, Massachusetts Farmer's Markets this summer.

At the seed saving conference tables arranged around Hampshire's Red Barn provided space for local seed savers to lay out their treasures. Eric Toensmeier offered some of his unique perennial vegetable seeds representing some of the varieties available through his first year seed business, The Perennial Vegetable Seed Company. The idea for the business arose when Eric had difficulty sourcing the cultivars he needed for his perennial polycultures and forest gardens. His catalogue offers a unique selection of perennial vegetables, one of the only catalogues of its type. He offers twenty cultivars for sale this year and intends to expand the catalogue to include new and interesting perennial vegetables as they become available. Two plants of special interest offered this year include the wild leek or ramps, and the Good King Henry Spinach. Next year's catalogue will include a perennial kale that Eric brought over from England. To find out more, contact Eric Toensmeier at The Perennial Vegetable Seed Co., Box 608, Belchertown, MA 01007; phone: (413) 552-4167. For more information about new and interesting permaculture garden ideas keep your eyes peeled for Eric's and Dave Jacke's upcoming book release: Edible Forest Gardens - A Delicious and Practical Ecology. Printing will commence early next year.

Also attending the conference, Tom Weldon of the historic Bidwell House in Monterrey, Massachusetts brought a fascinating collection of heirloom seeds. Tom started saving seeds in 1991 while head gardener at the Hancock Shaker Village. To grow an authentically Shaker garden Tom hunted down heirloom varieties that Shakers grew. Today Tom runs the historic Bidwell House and modestly claims to preside over "one of the best historical gardens in New England." The garden, about one fifth acre in size and divided into four quadrants, presents a walk through the history of American vegetable gardens. One section presents Native American plants up to the year 1917. Features of this area include beans, corn and squash. On another quadrant grow plants common to the early 19th century. Among the plants in this section Tom favors the Caribe potato so named because it shipped well on ocean journeys. From the late 19th - early 20th century quadrant Tom named the well-recognized Nantes carrot and the rare and unusual Vine Peach pickling melon as particularly noteworthy. The last quadrant represents the modern garden from which Tom chose the Rose de Berne tomato as a favorite and which he acquired from Lawrence Hollander of the Eastern Native Seed Conservancy. Visitors are welcome at Bidwell House. A tour of the gardens is free while a fee is charged for house tours. Tom may be contacted by phone at (413) 528-6888, or by mail at P.O. Box 653, Monterrey, MA 01245.

Attendees at the conference milled among these tables and others sharing and trading seeds.

Another presenter at the conference, Nedda Jastremski, a recent graduate of Hampshire College, wrote her thesis on the topic: Seeds of Sustainability: Cultivating Our Agricultural Heritage. In the thesis Nedda looked at seed saving from the historical perspective researching the development of crop varieties from pilgrim times and interviewing seed savers. She sent me this quote from that work: "Our work is profound. When we participate in the cycle of plant regeneration we are renewing much more than an actual plant; we are renewing the humble tradition of agriculture as an art. When we replant the seeds from our ancestors we carry on their stories, their families, their labor and love grown in backyard gardens, small farms, and fertile river valleys. Our cultural and biological diversity converge within the seed. With seed saving we draw upon the collected wisdom of people of all cultures, all lands who have nurtured renewing relationships that sustain and continue to feed their communities. This is our agricultural heritage."

The thesis can be found at the Hampshire College library. Last year Nedda grew 55 heirloom tomato varieties at the Hampshire College Farm. She particularly remarked on the cultivar Indian Moon as a favorite with its rich yellow glow and a texture "that melts in your mouth." Also while at Hampshire Nedda helped revive a red popcorn cultivar developed by Richard Werner, the original owner of the college property. Richard Werner was 83 years old when Nedda met him. He described how he had grown a white popcorn and discovered a red ear amongst the white at harvest. He grew out the seed from the red corn every year till he had a nearly pure strain. Every now and then a white ear appears. He had not grown out his popcorn for several years when Nedda met him. Nedda pointed to the experience of reviving this heirloom popcorn as a profound experience for her and expressed the hope that Mr. Werner's Red popcorn will continue its life on the Hampshire College farm.

Other discussion at the conference emphasized the threat to our seed supply with the influx of biotechnology. Speakers presented seed saving as active resistance against the biotech problem and seed saving as the most positive response accessible to us as farmers and gardeners. The idea of starting a backyard breeding project to develop and preserve locally adapted varieties particularly appealed to people. Sara Weil and Nedda Jastremski presented informational talks regarding biotechnology in our food supply today and touched on some of the more outrageous and insidious developments - such as the "Terminator" technology which makes seed saving impossible by rendering second generation seeds sterile. Most disturbing of all, US taxpayer dollars bankrolled this research when the USDA collaborated with Delta and Pine Land Company. Recently Monsanto bought Delta Pine Land which therefore now gives them control of the patent. Farmers in developing countries and others who rely on seed saving in their farming practices suddenly will lose this essential autonomy. Under the dominating influence of the new seed company giants (like Monsanto and Dupont which have recently shed their chemical divisions and emerged in new clothing as the largest "life-science" companies) many genetically engineered seeds and products soon will be virtually unavoidable. Over 45 million acres of genetically engineered crops were grown last year in the US alone. Speakers impressed upon the audience the risks of releasing these poorly tested and poorly understood genetically modified organisms into the environment. Attention also focused on the "revolving door" between the EPA, the USDA and the "life-science" companies leading to unacceptable conflicts of interest in the regulatory agencies.

Finally the audience divided into two groups and concentrated energies for the remainder of the time on workshops illuminating the fundamentals of seed saving. Nedda Jastremski and Tom Weldon led the two workshops designed for the inexperienced and more experienced seed savers.

The seed saving conference is just the beginning! People are invited to join the Pioneer Valley Seed Savers. The newly formed group will offer three workshops this year, the first scheduled for 16 June to take place at the home of Dvora Cohen in Ashfield. Look for our table at the NOFA summer conference. For more information, call David Fisher at (413) 369-2469.

N.B.: The name, Pioneer Valley Seed Savers, is pending review by the group and may be changed

Special Supplement on Beneficial Insects

Beneficial Insects: The Big Picture

By Kimberly A. Stoner, Ph.D.
Connecticut Agricultural Experiment Station and
NOFA/CT

Insects are everywhere, except in the oceans. On land and in fresh water, they feed on nearly every kind of plant and animal, play a role in the decomposition of all sorts of organic matter, and graze on fungi, algae, and bacterial slime.

Into this world of insects, humankind has emerged. Humans look at a world of buzzing, flying, crawling diversity, and we make value judgements. We don't want insects feeding on us, living in our houses, reducing the yield of our food plants, transmitting disease to us or our animals or plants, damaging the ornamental plants we grow in our yards, or even just annoying us excessively with their presence. Those insects we call pests.

So, what are beneficial insects? Because there is so much diversity among insects and their roles in the ecosystem, there are different ways insects are beneficial to humans. One group beneficial to people worldwide, but seldom considered in our culture, are insects eaten by humans. I worked briefly for the Africa bureau of the U.S. Agency for International Development. Everywhere I traveled in Africa, as soon as I mentioned that I was an entomologist, people would tell me what kinds of insects they ate. One of the insect problems in Africa at that time was a series of outbreaks of locusts around the continent. USAID was sending huge planes to spray the locust swarms with malathion. At the same time, an expert on insects as food wrote to ask us: "Why aren't you harvesting the locusts instead? People all over Africa and the Middle East have traditionally eaten locusts. If you aren't going to harvest them as human food, at least you could use them as feed for chickens!"

In our culture, the most directly beneficial insects are those that produce a product or service useful to us, such as the honey bee. In addition to producing honey and wax, honey bees provide a critical service — pollination of crop plants. Honey bees are subject to their own pests, especially tracheal

picture by ARS, USDA

The parasitoid wasp, *Pediobius* attacking a Mexican bean beetle larva. This wasp does not overwinter and is re-introduced each year.

and varroa mites, which have been responsible for a drastic reduction in their free-living populations. The decline of these domesticated, introduced bees has stimulated interest in other pollinators.

There are about 700 species of bees in the eastern United States, some of which are excellent pollinators of certain crops. If you grow squash, for example, you have probably seen or heard squash bees, the native pollinators adapted to these American plants. Both the males and females work the flowers in the morning, and when the flowers close up at mid-day, the males often stay inside and will buzz energetically when the tightly closed flower is disturbed. A different group of native bees, the bumblebees, are better pollinators than honey bees for certain plants, including tomatoes and peppers. Wild bees in agricultural environments are limited by the use of insecticides, but also by the destruction of nesting sites as brush and woods are cleared and soil is plowed. Many other groups of insects — flies, wasps, butterflies, and moths — are also important pollinators of both cultivated and wild, native plant species.

Other insects beneficial to humans belong to the complex biological communities that break down organic matter and incorporate it into soil. While you probably recognize the importance of the big, obvious soil animals (earthworms) in building soil, how often do you think about the hundreds of thousands of springtails in a cubic meter of soil? The truth is, scientists haven't given them much thought or attention either. The soil biota, right under our feet and crucial to our survival, is one of the least understood biological communities on earth. It is clear, however, that the insects and other soil animals begin the process of digestion and decomposition of organic matter and do much of the physical work of breaking big chunks of it into tiny pieces more accessible to microbes. A vigorous soil fauna helps to sustain a vigorous soil microflora.

But, when you mention the phrase "beneficial insects," a few people will think of honey bees and other pollinators, almost no one will think of insects as food or as builders of soil, but everyone will think of the natural enemies of our pests. As the saying goes, the enemy of my enemy is my friend.

In the Absence of Enemies

A key factor in making a particular organism an important pest is an "enemy-free space." The classic example is an insect or a plant introduced into this country from some other part of the world. It has been estimated that 40% of the insect pests on crops and 73% of the weeds of cultivated crops in the U.S. are species that originated somewhere else. Often these insects and plants arrived here without the natural enemies adapted to them in their original homes. In the absence of these enemies, the imported cabbageworm, the European corn borer, the Japanese beetle, and numerous other foreign insects and plants burst onto the scene as major pests soon after they arrived, and multiplied and spread rapidly.

There are other ways for potential pests to find enemy-free space. We humans frequently create an environment empty of biological diversity, and any

insect or plant which can adapt to that environment has a fantastic opportunity to multiply beyond natural bounds. One example is a greenhouse. Plants started in a clean, empty greenhouse thrive until the first pests (whiteflies, for example) arrive. Then, the whiteflies multiply unchecked until their enemies arrive naturally or are introduced.

Annual crops grown on a large scale using pesticides are full of enemy-free spaces. Bare, freshly tilled soil provides the weeds adapted to that environment a chance to grow without competitors or herbivores in place. Tillage and crop rotation can help to disrupt the life cycles of insect pests, but they may also disrupt the natural enemies of those pests. Large scale monoculture of a single crop variety interferes with the many species of insect natural enemies that need nectar or pollen at some stage in their life cycle. The plants in a monoculture will all flower at the same time, and until then, the natural enemies will have to spend much of their time looking for flowers elsewhere. And, of course, the use of broad-spectrum insecticides kills nearly all insect natural enemies and creates an enemy-free space for the hundreds of species of insect pests resistant to insecticides.

Classical Biological Control — Introducing Natural Enemies to a New Home

Although natural enemies of insect pests had been described and studied for hundreds of years, and a few attempts to move them to new places or increase their numbers had been tried, biological control had its first big, splashy success when a lady beetle, called the vedalia beetle, was introduced to California citrus orchards to control an insect pest of foreign origin, the cottony cushion scale, in 1888. Because Charles V. Riley knew that the cottony cushion scale was not a major pest in Australia, its home country, he sent Albert Kobele there to search for natural enemies to bring to California. This is an example of what is called "classical biological control," the introduction of new natural enemies to an environment where they do not exist. In classical biological control, the goals are 1.) to select an effective, appropriate natural enemy of the pest, 2.) to establish the new natural enemy permanently, and 3.) to determine what effect the new natural enemy has on pest populations.

drawing by Tracy LaProvidenza

The multicolored Asian lady beetle is beneficial as a predator of aphids, but it is a nuisance pest when it overwinters inside houses.

There has been debate for many years about whether it is possible to determine which natural enemies will establish, be effective, and be limited in their effects to the target pests. Critics of classical biological control have pointed out that it makes a permanent change in the ecosystem, so we have to use extreme caution. There have been problems, particularly with generalist predators introduced as biological control agents. Predatory snails, for example, have often been introduced on islands to control a pest snail, but then go on to decimate the rare, native snail species. Or vertebrate predators, like ferrets, snakes, or even housecats are introduced to kill rats and mice and go on to kill a wide variety of other mammals and ground-nesting (and even tree-nesting) birds. There are also some examples of parasitoids (a parasitoid is a parasite that kills its host) that were released against one pest, but that attack a wide range of other insects. Compsilura concinnata, a parasitoid released for control of the gypsy moth, also attacks hundreds of other species of forest caterpillars.

Caterpillar of the imported cabbageworm. Although imported cabbageworms have many natural enemies, these enemies may be disrupted by the annual cropping cycle.

On the other hand, there is a substantial, undeniable record of successful, permanent biological control of many pests. The vedalia beetle, together with a fly parasitoid of the cottony cushion scale, has kept the scale population below economically important levels since the 1890's, although DDT and other broad-spectrum insecticides have interfered with the natural enemies periodically. The alfalfa weevil, formerly a major pest of alfalfa in the Northeast, now rarely causes economic damage since the establishment of a series of introduced parasitoids. The casava mealybug was a major threat to the most important food crop of millions of subsistence farmers in Africa until it was brought under classical biological control in the 1980's.

Insect natural enemies have also been used successfully in the classical biological control of weeds. In Australia, the prickly pear cactus had taken over millions of acres of land before the Cactoblastis moth was introduced against it in the 1920's. Within six years, the cactus population dramatically collapsed. In the U.S., the introduction of plant-feeding beetles reduced the Klamath weed, which was a serious pest of rangeland in California, to an uncommon plant.

Natural enemies of pests in annual cropping systems have been introduced and established, but have not been as successful as in less frequently disturbed systems, like orchards, rangelands, or forest. An example is *Cotesia glomerata*, a parasitoid wasp brought from Europe in 1883 to attack imported cabbageworm larvae. Probably every organic gardener or farmer has seen the mass of little yellow fuzzy pupal cases formed by this wasp, next to the dead body of the caterpillar host. Each spring, the rate of parasitism of the imported cabbageworm starts out low, but by the fall, in the absence of insecticides, it reaches 60-75%. Because the imported cabbageworms get a head start on their natural enemies each year, many growers of brassica crops still need to use *Bacillus thuringiensis* or other methods to control imported cabbageworm.

Helping Natural Enemies Along — Conservation, Inoculative Release, and Inundative Release

Conservation - So, in situations where the natural enemies of key pests are already present here, what can be done to make them work better? There are a few general principles of natural enemy conservation: 1.) Avoid the use of broad-spectrum pesticides, including botanical insecticides, as much as possible, 2.) Make sure supplemental foods (pollen, nectar, honeydew, or other food sources) are available through the season, 3.) Provide shelter for overwintering and inactive periods, and 4.) Plan crop placement and field activities in order to allow the natural enemies to travel between crops or from crops to overwintering sites.

In order to make the best use of these principles, you should know the specific needs of the natural enemy throughout its life cycle. Unfortunately, these needs are not known in detail for many common natural enemies of insect pests. For example, most insect natural enemies feed on pollen, nectar, or honeydew to some degree as adults. But the size, shape, and structure of these insects vary tremendously, and not all flowers are equally accessible to all natural enemies or provide equally well for their needs. Another way to provide supplementary food is by applying it directly onto the plants. Spraying a sugar solution, for example, can attract some species of lady beetles and parasitoids of aphids. Adding a source of amino acids, such as protein hydrolysate, to a sugar spray has been shown in some crops to attract lacewings. Applying pollen directly to the plants can increase the survival and rate of development of some predatory mites.

Similarly, in order to provide shelter or accommodate the movement of natural enemies, you would need to know the life cycle in detail. Some parasitoids overwinter in the crop field in the soil or in plant residues, and tillage reduces their survival, while other natural enemies, many lady beetles, for example, need patches of forest or other non-crop habitat for overwintering.

Inoculative Release - In situations where the natural enemies have not been conserved, (and in situations where they can not be conserved, such as when a parasitoid does not overwinter here) an inoculative release could be made to re-introduce the natural enemy locally. An example is a parasitoid, *Pediobius foveolatus*, of Mexican bean beetles. This wasp overwintered in the larval stage of its host in the country it came from, but the Mexican bean beetle always overwinters as an adult. Thus, in order to use this wasp for biological control, it has to be released again each year. Fortunately there are private companies and government laboratories that keep colonies of this wasp going, so that it can be obtained from them and released.

In the case of *Pediobius foveolatus*, there is substantial labor involved in keeping the beneficial insects going, so there are only a few sources. But for many natural enemies, you might be able to do your own inoculative releases locally, if you are a keen observer, and your friends and neighbors are willing to have an exchange. For example, there is a ground beetle, *Lebia grandis*, which is both a parasitoid (as a larva) and a predator (as an adult) of the Colorado potato beetle. Because these beetles are so specialized, I think they occur only on farms that have been growing potatoes (or horsenettle) for several years. In my travels to organic farms, I saw these beetles, showed them to the farmer, and asked if I could take a few. I took them home and put them among the potatoes in my community garden. I saw them regularly after that for a few years (until the garden was moved). This is a beetle that is not commercially available, so the only way to get them is to find them, bring them home, and try to provide a habitat they will like.

Inundative Release - Inundative releases differ from inoculative releases mostly as a matter of strategy. An inoculative release usually consists of one or a few releases of relatively low numbers of natural enemies when the target pest population is still fairly small. The goal is to establish the natural enemy for the season, let it reproduce on its own, and have it continue to exert control on the pest population. Inundative releases, as the name suggests, flood the area with natural enemies. Although the natural enemies may multiply on their own, an inundative release strategy doesn't depend on it. It is very much like using the natural enemies as a biological pesticide. A common example of inundative release is the use

of insect-attacking nematodes against various insects, like grubs in lawns. The use of microbial insecticides is sometimes an inundative release of living organisms (the new products with the fungus *Beauveria bassiana*, for example) and sometimes the actual microbes are dead, and the chemicals they have produced are used to kill the insects (products from *Bacillus thuringiensis* to kill caterpillars, for example).

The nematodes and microbes used inundatively are generally relatively cheap. Living insects are usually much more expensive to produce, store, and ship, so there are few cases in which it makes economic sense to use insect natural enemies inundatively.

One place in which insect natural enemies are released, as either inoculative or inundative releases, is in greenhouses. Greenhouses are a special case because they are small areas that can be enclosed to limit the escape of the natural enemies, with relatively controlled environments, and, often, very high value crops. They are also a special case because the worldwide ornamental greenhouse trade has produced strains of several insect species very resistant to insecticides and has moved them on plant materials through greenhouses all over the world. The greenhouse growers in the Netherlands in the 1970's recognized that it was increasingly difficult to control one of their major pests, the greenhouse whitefly, and that there was an alternative to insecticides, a parasitoid discovered in the 1920's, *Encarsia formosa*. Once the system was set up for producing and using one insect natural enemy, the growers realized that using insecticides against other insect pests would interfere with this system, so they and their suppliers had to continue to find natural enemies against each new pest as it appeared.

Biological Control: A Way to Step Off the Insecticide Treadmill

This experience of the greenhouses growers illustrates an effect of using biological control. Once you have established biological control of a key pest — whether by introduction of a new natural enemy, by inoculatively releasing the enemy, or by recognizing the importance of naturally occuring enemies in a favorable environment — you have an incentive to preserve and maintain that biological control agent. Even when releasing an enemy inundatively, you need some awareness of whether pesticide residues or later sprays might interfere with the success of the expensive purchased natural enemy.

Many entomologists, as well as many organic farmers, realized long ago that there is a pesticide treadmill or a pesticide addiction — using pesticides against one pest killed off the natural enemies of other pests, while selecting pests for resistance to the pesticide. Thus, more applications of different pesticides with different active ingredients are continually required by the system, once this treadmill begins to roll.

Stepping off the treadmill can be a tricky transition. Biological control methods that have little effect on natural enemies — *Bacillus thuringiensis* substituted for an insecticide against a caterpillar pest, for example — can help to re-establish a diverse fauna of natural enemies to assist the grower in managing pest outbreaks.

An example of this in vegetables in the Northeast is the work of Ruth Hazzard of the University of Massachusetts in substituting Bt for insecticides against the European corn borer and a mixture of Bt and oil dropped into the ear for additional insecticide sprays against corn earworm. Controlling these two key pests with non-toxic methods opens the door to a diversity of naturally occurring natural enemies to return to the sweet corn field — lady beetles, lacewings, predatory bugs, and parasitoids introduced years ago against the corn borer. This "biointensive Integrated Pest Management" system may be further improved by inoculative release of new natural enemies, such as the parasitoid of European corn borer eggs, *Trichogramma ostriniae*.

Another example from the Northeast is the classical biological control of the alfalfa weevil. The resulting reduction in insecticide use has made alfalfa a haven for a diversity of beneficial insects.

drawing by Tracy LaProvidenza

Natural enemies of the tarnished plant bug (pictured here as an adult) have been introduced to try to bring this species under biological control.

It has also made possible the current work of Dr. Bill Day of the USDA, introducing a new natural enemy of the tarnished plant bug, a pest that feeds in alfalfa as well as in vegetable and berry fields, where it does serious economic damage.

Even though there has been biological control research conducted here for over 100 years, we are still at the beginning of a movement toward understanding and using biological control in agriculture in the Northeast. Practical methods to increase the effectiveness of our naturally occurring biological control agents are needed. At the same time, organic farmers and gardeners and entomologists need to work together to make sure that the tools for transition to a system based on biological control remain available and effective. Those tools include *Bacillus thuringiensis* strains for use against caterpillars and Colorado potato beetles, and several strains of insect-attacking nematodes. Other tools may become available and important as research and development progresses.

I have been trying to make scientists working in biological control aware of the interests and needs of organic farmers and gardeners, and organic growers aware of the possibilities of learning about and using biological control. These two groups could be allies in creating non-toxic methods of managing insect pests that help biological diversity and complexity to flourish in agriculture.

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Beneficials in the Organic Greenhouse:

Long Wind Farm

by Jack Kittredge

Half the way up into Vermont seems like an unlikely place to grow organic tomatoes - the season is short, the soils are thin, and it's a long way to urban markets. Even if you raise them in a greenhouse year-round, you fight heating bills and snow loads which may not beset your competition. Yet raising the best tasting and highest quality tomatoes is what Dave Chapman has devoted his life to in Thetford, Vermont.

"We used to have a farmstand," Dave recalls. "We had a reasonable location for it. This is an affluent area - Dartmouth College is 10 miles away. The mania people had for our tomatoes was something! They would come and line up before we opened. People got really mad at me when I closed it. We had great food and I loved it. But I personally was a husk. I was burned out. When I started having kids I cut back from 80 hours a week to 60."

Chapman was looking for a way to stay in farming but manage a reasonable personal life. He had been to Europe with Eliot Coleman and Paul Harlow to tour organic farms. They were sent by the Working Land Fund to learn about compost and soil biology, but what they learned about was equipment - better harvesting equipment, weed flamers, more energy efficient greenhouses. All the farms the group visited in Holland were heavily capitalized and pretty successful. They weren't that much larger scale than NOFA farms, but their management had been perfected, and they had beautiful crops which tasted delicious.

"I remember the first talk I gave back here," Dave continues. "There was a lot of anger. What we saw was a lot of heavily capitalized, fairly specialized operations. I gave the talk about Holland. But when we showed the slides people were confused and angry. They said: 'This is what we went into farming to get away from!' They didn't want to run a business, borrow money. I understand that. I didn't go into this to make money either! I realized farming was economically challenging. But it's hard to sustain losing money every year in your business."

So Dave put in his first big greenhouse - 1/3 of an acre - 5 years ago. Then 2 years ago he put another acre under glass. It is all standard vegetable greenhouse technology. The whole structure came from Holland. Chapman went through a competitive bidding process but the Dutch easily beat the Americans because they have a specialized business and came over with everything, even their own concrete posts. The house went up fast but Dave is very happy with it.

Dave has always liked buffalo tomatoes, even in the days when he was growing them in a tunnel. Now he grows the seedlings in a seperate greenhouse and transplants them into the big house in December. Harvest begins in March. Picking continues throughout the year until the next December. As fruit is taken from a vine it is lowered and the new fruiting section allowed to climb and grow. By the end of the year each plant is 13 months old and as much as 30 feet long.

His greenhouse is right along the Connecticut River and Chapman feels the growing climate would be a whole lot better if it were up on a hill. A lot of fog settles in the valley, which means less light. But even more importantly, it means diseases like botrytis. In his organic system such problems have to be solved with prevention - with controlling the climate, pruning and watering techniques.

The Long Wind Farm greenhouse environment is constantly monitored and a computer program governs such management decisions as watering times, opening of roof vents and controlling mixing valves for the different heating zones. Heating is important even in a month like July because, surprisingly, it cools the place down. If you apply heat in the morning it gets the plants active and growing. That means they transpire, and the evaporation cools the greenhouse.

"If they just sat there in the morning," Dave explains, "you would get high temperatures, high humidity, and botrytis. The plant would be stagnant and not taking up nutrients and water. With the advent of computers in greenhouses controlling aspects of the growing situation, yields have doubled. The strategies are elaborate and change throughout the year given various factors. But the principle is you want the plant to grow. Not to sit there, but to grow.

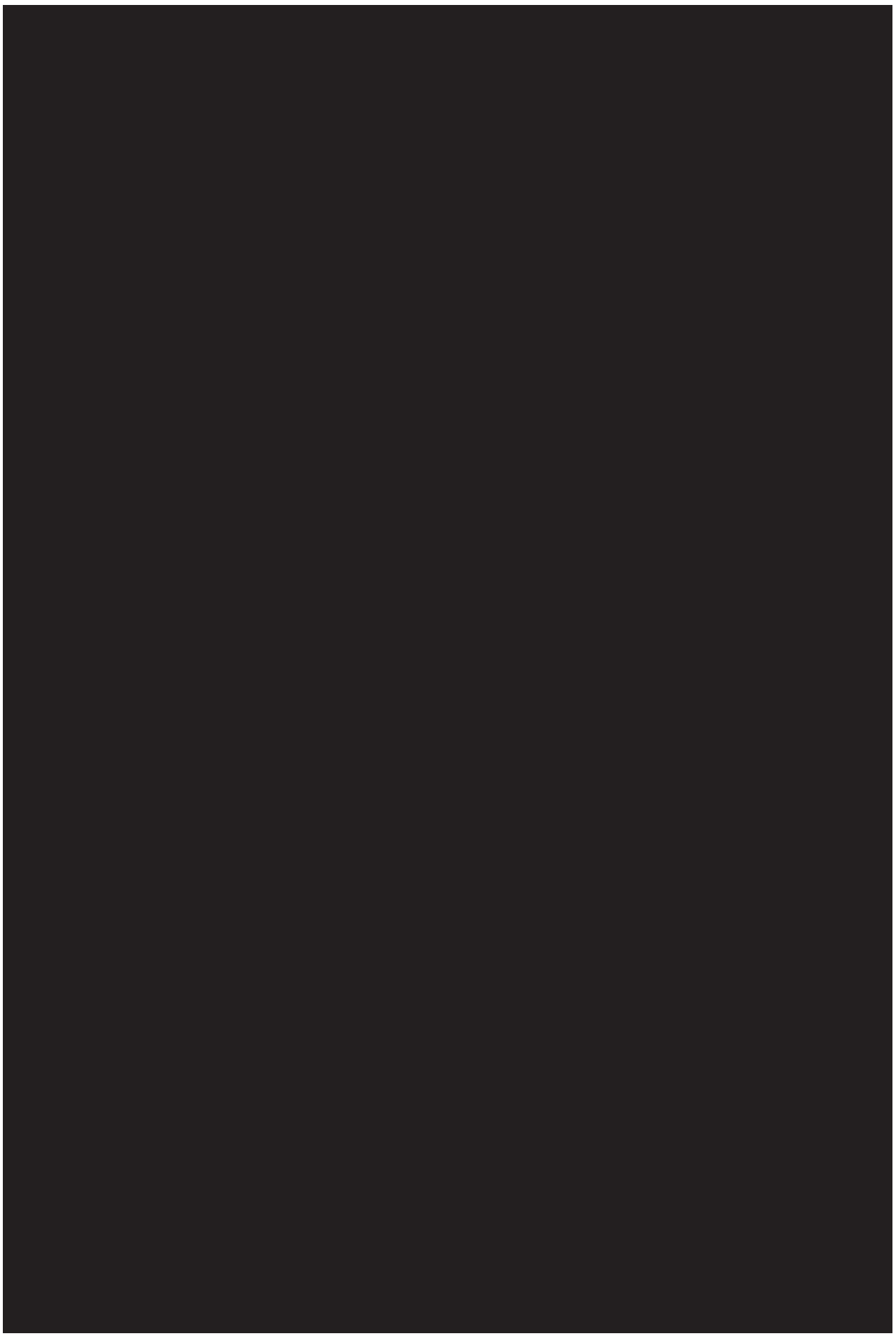


photo by Jack Kittredge

Chapman shows off a box of his finest! Note the strings supporting the tomatoes hanging from the greenhouse superstructure.

"We get from 5 to 8 pounds of tomatoes per square foot per year," continues Dave. "I don't think anyone organic is doing a whole lot better than us. The hydroponic guys, though, at 8 pounds would just about be going out of business. The best ones in the world are getting 12 - double us."

Since tomatoes are hungry feeders, such yields require healthy soil. In Long Wind's case the soil is about 50% compost. New compost is added constantly, throughout the year. It is bucket loaded into boxes, which are put on carts that slide on rails between the rows. The compost is applied from the boxes by hand each time, an inch deep. Chapman makes his own compost. He buys in a lot of local cow manure and sometimes a semi load of Canadian straw. Last year he tried some hen manure. After building the piles, Dave has someone come in with a scarab to turn them.

"A year ago," he relates, "I was favoring the Austrian compost guru, Lubke. In that system they turn it a lot, monitor it incessantly for CO2, oxygen, moisture, all the nitrates and ammonia. They make good compost, but there's a lot of question whether all that turning is necessary. They'll turn it daily for the first 2 weeks. Their

concept is that you want to create certain microbial populations there. You can never let it go anerobic, never let the CO2 build up to too high a level. They use an innoculant which they say don't bother to use unless you manage it by their system, because it won't survive. Their stuff is finished in 6 weeks."

Currently, however, Chapman is working with Will Brinton for compost help. Will's contention is that Lubke is wrong. With all that turning you're losing nitrogen, destroying crumb structure, and wasting energy. Will says go for the long, slow cook.

But good soil is not enough for Dave. "I've had lettuce growing side by side," he says. One lettuce had no tarnished plant bug while the one next to it, which was a week older, was covered with it. Why? I was always of the opinion before I started growing in greenhouses that an insect problem just manifested a soil problem. Now I think it may be more complex. It could be a climatic problem or a light problem. Perhaps the right bacteria is absent from the skin of the plant."

Dave can't freeze insects out in his system, as many organic growers can. He'd have to drain all the pipes and even so wouldn't get a hard freeze because there is too much glass and solar heat coming in every day. One benefit of nor freezing, of course, is that while he doesn't freeze out the bad guys, he doesn't freeze out the good guys either.

In fact, Long Wind Farm relies heavily on 'the good guys' to control 'the bad guys'. "It's easy to find white fly problems," Chapman sighs. "This gray moldy stuff is whitefly shit. They'll suck the sap and kill the plants if we don't control it. But if you look here you'll see parasitized whiteflys. Everything that is black is good. The adult Encarsia are too small to see, but they find the whiteflys and lay an egg inside them. If the egg turns black, that means it is parasitizing the white fly. When it hatches, another Encarsia will emerge and find another white fly to parasitize."

Dave figures you have to keep releasing Encarsia because the cost of failure is too high. He has lost entire greenhouses to white fly. He also has problems with aphids, spider mites, russet mites and thrips. There is no biological predator for russet mites, but spider mites have Phytosiulus persimilis and Ambiyseius fallacis mites. With thrips, the problem isn't that bad. For aphids there is Aphidius, different strains of it, and Aphidoletes aphidimyza. The Aphidius are what work well for him. He tends to have problems with them in the winter and early spring.

"Nothing is easy," he agrees. "This is complicated biology. If you do one thing it may work, but if it doesn't - and you're organic - you're in a bad position. I couldn't be in business without biological controls. Not unless people were willing to pay $8 a pound for tomatoes. You would have much less yield. I can't imagine it without the biologicals. I probably wouldn't have stopped being a tunnel grower. There at least you have a short growing season and you can freeze the house out and kill a lot of things."

photo by Jack Kittredge

The ingenious carts which roll both on the cement floor and over the rails installed between rows of tomatoes.

photo by Jack Kittredge

David points to a whitefly. A better example can be seen on the leaf below and to the left of the one he is pointing at. A whitefly is the white speck to the right of the main vein. Whiteflies parasitized by Encarsia formosa are the gray specks on the same leaf. Although the good guys have won, it will take maybe a month for this plant to be totally clean. By then the incarsia will have hatched and flown to other plants.

Short of tunnel growing, in any kind of concentrated greenhouse growing with heat, you're going to experience these problems, Chapman figures. If you do concentrated production they find you. If you don't do concentrated growing, you're out of business. He didn't have any white flies for 3 or 4 years, but they found him.

Dave spends a lot of money on biological controls, but thinks the prices are fair. He brings in Encarsia every week. It costs probably $8,000 a year. He brings in other controls if he has evident problems. Entomologists are capturing new bugs all the time and reproducing them in captivity. This is a business where the hydroponic growers help the organic ones. Organic growers aren't big enough to support bug producers. But the hydroponic growers create a market demand for biologicals. Nobody likes to spray poisons, plus biologicals often work better. The difference between the types of grower, Chapman feels, is that hydroponic folks have a few things they can do if biologicals fail. There are lots of reasons why that might be - maybe the batch wasn't viable, maybe it's too cool for the Encarsia to fly. maybe the humidity is too high, maybe you're a little too late.

"What we're doing," adds Dave, "is working with very complex factors - which is true of most organic farming. The commodity we use to succeed is information. In chemical agriculture, somebody else has taken the information and put it into a product you can buy. This whole development of biologicals is an exciting thing. A hundred years ago they nuked their greenhouses with really nasty poisons. It was natural stuff like nicotine! Now they're using a tiny tiny fraction of that - even the chemical and hydroponic growers. In the end a lot of the organic principles will be accepted because they work! It's the right way. So much of the alternative was cheap in the short run but not in the long run. A lot of things are moving in the right direction."

Chapman's move into greenhouse growing may have been necesitated by economics, but it did not come cheap. He employs 10 people year round and 20 during the growing season. After his labor cost, debt load comes second, then energy. Vermont has among the highest electrical rates in the country, he figures, probably three times what they are in Pennsylvania. A number of local electric companies, worried about supply, made long term contracts for Hydro Quebec power. But with energy conservation rising and the price of oil falling, the market has gone down since then. People like Dave are paying high rates as a result.

Most of Chapman's tomatoes go to New England consumers, primarily through supermarket chains. He finds that these are surprisingly reliable and cooperative customers. They also sell directly to some grocery stores, but not to many health food stores or natural food distributors.

Although Chapman is one of the largest organic greenhouse tomato growers in the country, he is under intense competitive pressure now. "The numbers looked good about 5 years ago," he recalls. "I was optomistic. But so many people have jumped into it... Now you can get good organic greenhouse tomatoes all over. I gave a talk at Sturbridge at the vegetable growers conference a year ago. There were a hundred people in the room. I asked how many grew greenhouse tomatoes and they all put their hands up!

"Our biggest competition for organic is Canadian greenhouses," Dave continues, "but also Israel and some California. There is also a lot of hydroponic competion from all over - British Columbia, Colorado, Texas, New York, Pennsylvania. They all have big greenhouses and they're all pushing tomatoes into New England. There are tremendous economies of scale and those big places are good at what they do. They have their systems down. I just had three growers visit me last week. One is doing 24 acres of tomatoes under glass in British Columbia, one had 26 acres of peppers, and one had 23 acres of tomatoes - and that was 2 greenhouses. The larger was 18 acres!"

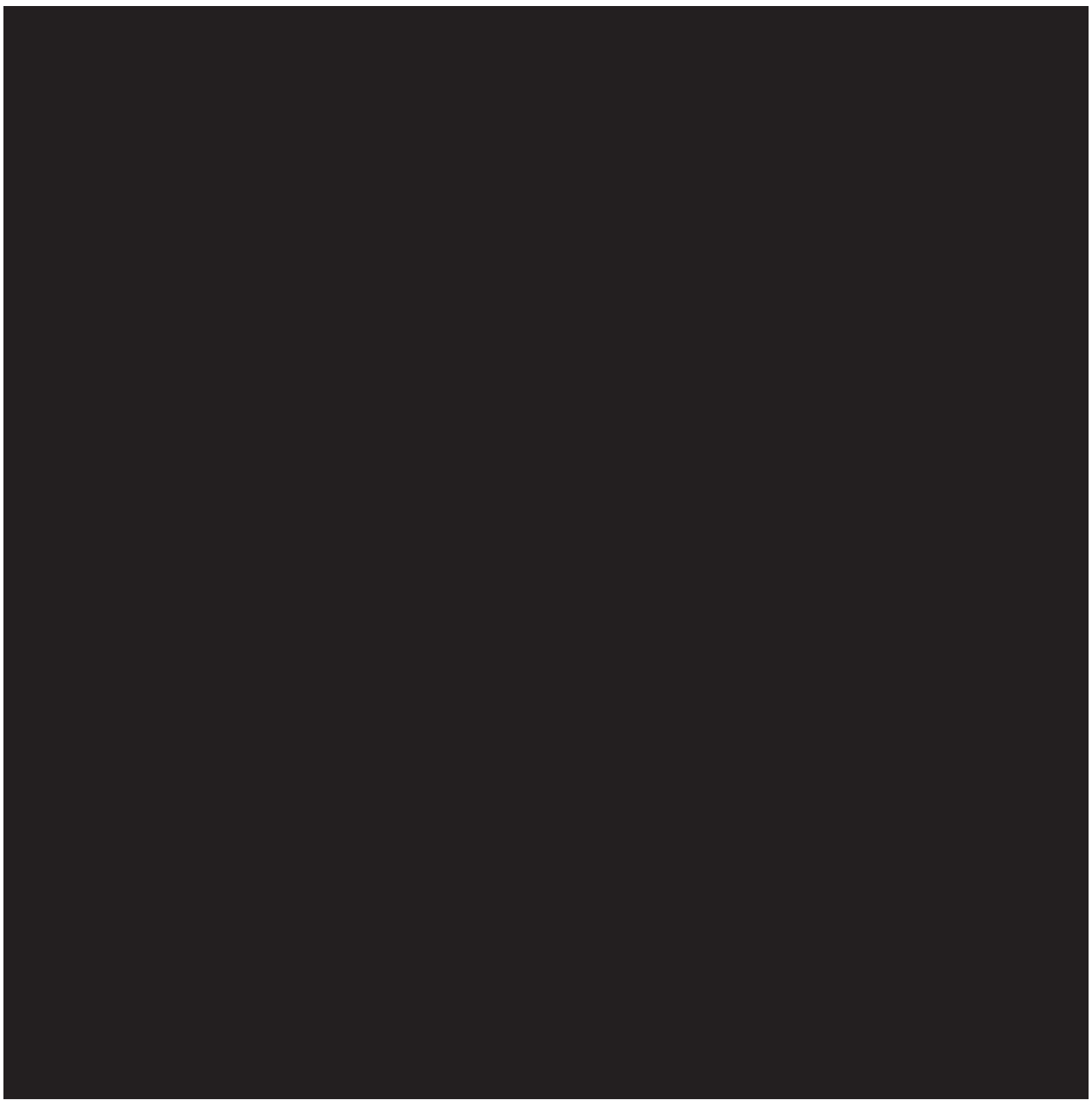
Chapman, moving from 5000 feet to 60,000 feet of tomatoes, found that the growing problems didn't get worse. In a way, he says, they got easier because he learned more and perfected his methods. But the stakes have gone up. In his first greenhouse he had terrible yields and lost money, but it was such a small amount of money!

There are different problems with scale, and different pressures, he observes. "We do some things that are not in accord with the principles of organic agriculture. We're growing a monocrop and we're not rotating. Sometimes we rotate our soil out - take up all the piping, but it's a lot of work. Everything we do is a lot of work.

"You watch people go into farming," Chapman continues. "They love the work, but the economics of it suck. They really do! The number of new farms that are making it is miniscule. They're making it on the $3 an hour labor of the owners. Eliot [Coleman]'s philosophy is never to get so big you have to hire somebody. That's great, but I've seen people do that and not make a living either. I know that in the organic community we're practically bad guys because we're considered so big. But I'm managing now, I get to see my kids.

Biological Control:

An Alternative Way to Reduce Damage by Many Insect Pests of Farm and Garden



credit: USDA-ARS, Newark, DE

Young tarnished plant bug. Both the nymph (shown here) and the adult plant bug suck fluids from buds, flowers, and fruits. This damage causes bud and fruit drop, misshapen fruit ("catfacing") and new leaves, and reduced crop yields.

By William H. Day
USDA Beneficial Insects Research Laboratory,
Newark, DE

When an effective biological control system has been developed for an insect pest of a crop, it is usually regarded as the ideal method. Biological control doesn't involve using chemicals, is safe for both farmers and wildlife, does not add to crop production costs, permanently reduces insect numbers and the resulting crop damage, and doesn't require special procedures by growers.

The roots of biological control in the United States go back to the mid 1800's — when entomology, the study of insects, was in its infancy. Several early entomologists recognized that about half of the important insect pests of our crops had arrived here from Europe along with the early colonists and later immigrants. A few astute entomologists even observed that the same insects were much more damaging here than in their native land, and correctly concluded that this happened because their natural enemies had been left behind. The need for biological control here was greater than in most other parts of the world, because our large number of immigrants had brought many non-native food and ornamental plants (and their insect pests) into North America during 200 years of colonization. However, the actual importation of natural enemies into the United States could not begin at this time, because our country did not yet have an agriculture research system.

Fortunately, events soon were to change. In the late 1880's , the young citrus industry in California was being devastated by a recent immigrant insect, the cottony-cushion scale. Tree damage was so severe that the USDA and the state of California were encouraged to develop a new, cooperative research and extension (information dissemination) system, and to begin foreign explorations for natural enemies. After the original home of the cottony-cushion scale was determined to be in Australia, a ladybug predator and a fly parasite were collected there, and were shipped to California for release. Both beneficial insects quickly established, and within a year they had nearly eradicated the pestiferous scale. Shipments of oranges from the Los Angeles area rebounded from 700 railway cars to 2,000 per year, and biological control was auspiciously born.

During the next 50 years, biological controls were developed for a number of crop-damaging insects. As with any search for new and better solutions to important problems, there were some successes and some failures. The most common difficulty was the inability to permanently establish the needed foreign natural enemies in the U.S.

When World War II started, the foreign explorations in Europe and Asia necessary to find the natural enemies for our many immigrant insect pests had to be interrupted. This event, and the development of improved chemical insecticides after the war, reduced biological control research to a low level for the next 20 years.

Fortunately, this situation gradually changed, starting in the 1960's. Many insects had become resistant to one modern insecticide after another, some insecticides were discovered to cause environmental problems, and several of the "new" insect control methods (sterile males, attractant traps, repellants, etc.) were found to be effective solutions for only a small number of pest insects. Other methods, such as releasing large numbers of laboratory-raised insect parasites or predators, proved to be too expensive for use against most major insect pests, especially those attacking moderate to large acreage crops. At the same time, a few small biological control research teams, especially at the USDA Beneficial Insect Research Laboratory in the northeast, and the University of

credit: New York Agric. Exp. Sta., Geneva.

Normal (left) vs. damaged by tarnished plant bug (right) yields of blackberries. The normal blackberries were produced by plants protected from plant bug feeding with an insecticide, to demonstrate the amount of insect damage on unprotected plants.

California in the southwest, began to solve important insect problems using the long-neglected biological control methods. Parasites introduced from Europe and Asia transformed the alfalfa weevil, pea aphid, cereal leaf beetle, spotted alfalfa aphid, and other pests from major problems to minor or occasional pests.

The resulting savings to agriculture total over $200 million per year, many times the cost of the taxpayer-supported research that produced these advances. The clear financial and environmental benefits of these recent biological control examples have renewed interest in this method among farmers, university and USDA administrators, legislators, and the general public. Because biological control researchers strive to permanently establish new natural enemies to obtain permanent control of the target pest insect, there is no product that can be sold over many future years to pay for the initial research costs. Thus, industry cannot afford to pursue this approach, which is the reason that federal and state governments must support biological control.

The revived support for biological control has recently increased research on additional insect pests by universities and the USDA, and increased the number of colleges where this approach is taught. These advances should produce more useful biological controls in the future, and a greater acceptance of this method in the agricultural sector. There are still many introduced insect pests that need attention, and the number is growing as foreign trade increases. The Russian wheat aphid in the western states, and the Asian long-horned beetle now in Chicago and New York City, are just two recent examples of serious foreign pests that have accidently become established through our growing intercontinental commerce.

Biological control can sometimes also be employed against native insect pests. The tarnished plant bug (TPB) damages a wide variety of crops, such as berries, peaches, apples, lettuce, and beans. However, it has no effective natural enemies on these crops in the U.S., probably because these food plants are not native to North America. In contrast, a close relative, the European tarnished plant bug, is parasitized heavily on crops in western Europe. After we established one of these small European parasitic wasps, *Peristenus digoneutis*, in New Jersey alfalfa, it greatly reduced the TPB in this crop. This beneficial insect has subsequently flown into six additional northeastern states, and is still spreading.

Recently, our cooperators in New Hampshire (Dr. Allen Eaton - see accompanying story, on page 14) and New York (Kelley Tilmon) have found *P. digoneutis* attacking the TPB in strawberry fields. We hope that future research will demonstrate that this wasp can suppress TPB numbers below damage thresholds on strawberries, and also on fruit and vegetable crops. If this occurs, it will be a major breakthrough for fruit and vegetable growers, especially organic farmers and home gardeners.

Although biological control is not a “new” insect control method, it is as effective and appropriate now as it was 110 years ago. If public and legislative support continue, researchers should find permanent, natural solutions to many more of our problems with crop-feeding insects.

credit: USDA-ARS, Newark, DE

An introduced parasite, *Peristenus digoneutis*, attacking tarnished plant bug. The female parasite, a small wasp, injects an egg into a young plant bug. After it hatches, it will kill the plant bug, preventing it from further feeding on crop plants, and from reproducing.

Biological Control of Tarnished Plant Bug in the Northeast

Alan T. Eaton
University of New Hampshire Cooperative Extension
and William H. Day
U.S.D.A Beneficial Insects Research Laboratory, Newark DE

Tarnished plant bug is a serious pest of strawberries in the northeast. It also attacks tree fruit, flowers, alfalfa, and many other crops. The fact that it is a significant pest of alfalfa, and native parasites do not effectively control it in alfalfa, led USDA workers in forage crop biocontrol to search for foreign parasites. At the time that work on this species was begun (1970's) The USDA's European parasite laboratory was in a suburb of Paris. Workers there searched alfalfa fields and noticed a Braconid wasp, *Peristenus digoneutis Loan*. It attacked the European tarnished plant bug, which is a close relative of our pest. The braconid was collected from Northern France and Northern Germany. Before importing the insect to the US, USDA required that it first be determined that the parasite did not attack valuable insects here, and that imported parasites be free of pathogens and hyperparasites. (Hyperparasites are parasites that attack parasites), These hurdles were crossed, and permission was granted to import the braconids. Bill Day successfully established the wasp in Northern New Jersey in 1984. After demonstrating that it was surviving well and showing high parasitism rates in the release sites (fields of alfalfa), Bill began working on expanding its range and establishing colonies in other states. In 1990, Roy Van Driesche began working with Dr. Day, to introduce the parasite to western Massachusetts. He and Jesse McCool released it in Amherst and Deerfield.

photo by Alan Eaton
Dr. Reeves collecting parasitized TPB nymphs in New Jersey.

In 1991 R. Marcel Reeves and Alan Eaton began working with Bill, to introduce the parasite to New Hampshire. The procedures for these releases in New England were basically the same. For The NH releases, they contacted the State Entomologist in the NH Department of Agriculture, and obtained forms to request bringing in the parasitized nymphs. After approval in Concord, USDA officials reviewed and approved the permit. (As before, officials want to screen applications for bringing in new species. They want to prevent importation of potential pests!) Marcel and Alan then visited Bill Day's New Jersey alfalfa plots and used sweep nets to collect thousands of parasitized tarnished plant bug nymphs. With official permits in hand, they transported the parasitized TPB nymphs to New England and released them in alfalfa fields. The three NH releases were on the Merrimack County farm, in Boscawen. Alfalfa fields were selected because the parasite was known to search alfalfa well, and TPB populations can be quite high in the crop. Thousands were released in Boscawen, but the winter of 1991-2 was so severe that most of the alfalfa died. Presumably the parasites did poorly, too. The third NH release was made in 1992 and we hoped for the best. Meanwhile, the parasite survived the Massachusetts introductions and was confirmed there in 1993. At the same time, Bill and his co-workers found that the parasite had spread from northern New Jersey into adjacent New York and Pennsylvania.

Collecting the insects was quite challenging. Alan and Marcel waited until Bill indicated that conditions of TPB population, parasitism rate, and weather were favorable. Then they drove to New Jersey. In hot, dry weather they marched through the waist-high alfalfa, sweeping back and forth with insect nets. Then they sat down and carefully opened up the nets to transfer the fast moving (but delicate) insects. It was crazy — insects were crawling all over arms, legs and necks, trying to get away. Have you ever tried to work with alfalfa plant bugs walking up your neck? You had to collect the correct species as quickly as possible, without harming them, or getting stung by bumble bees you happened to sweep up. You also had to keep track of approximately how many you collected. Then the insects had to be quickly transferred to a cool, shady cooler with fresh alfalfa. The entomologists swept until dark, then drove to a motel. The next day they made the long drive back to New England and carefully released the insects.

Now, eight and nine years after our New England releases, and 15 years after original establishment in the U.S., the parasite is known from parts of 7 states, and has reached the Canadian border in the vicinity of Lake Champlain. The probable range extends from the northern 1/3 of New Jersey and the northeast corner of Pennsylvania, through southeast New York and the Hudson and Champlain Valleys to Quebec. In New England it probably occurs in most of Connecticut, most of Massachusetts (we haven't checked southeast or the Cape Cod counties), and south of the White Mountains in New Hampshire, as well as southern Vermont. We have not sampled much in other parts of Vermont, nor in Maine, so we are unsure if it is present there. Results of last summer's sampling in northern New Hampshire will be known about the time this issue of The Natural Farmer appears in mailboxes.

In New Hampshire, the percentage of tarnished plant bug nymphs that were parasitized by the wasp was much higher than we expected this early in its establishment. One (Strafford) alfalfa field had over 35% parasitism! Three others had over 15% parasitism. We are confident this parasite will spread further north. Some of the spread up to now has been natural (helped by prevailing winds), but doubtless some has been helped by the releases in Massachusetts and New Hampshire.

With the encouraging results from alfalfa in hand, Alan decided to begin checking strawberries in 1998. No one had ever reported this species searching in strawberries, and significant parasitism of TPB nymphs in strawberries would be good news for strawberry growers. (It is common for parasitic insects to search well in certain plants, and not search at all in other plant species.) In 1998 Alan and his student collected hundreds of TPB nymphs from 6 NH strawberry fields. Sweep nets would have ruined the fruit, so instead of using sweep nets, they used white UNH frisbees. By tapping the clusters of immature fruit into the frisbees, the TPB nymphs were dislodged. Then they could be quickly picked up with an aspirator, without harm. Shipped in coolers via overnight mail to Dr. Day's lab, they were held for emergence of the parasites.

Preliminary data are encouraging. With some of the data still not in, we have found the parasite in 4 of the 6 strawberry beds where we collected TPB nymphs. Parasitism was 55% in one site, and we found the parasite in strawberry fields that were

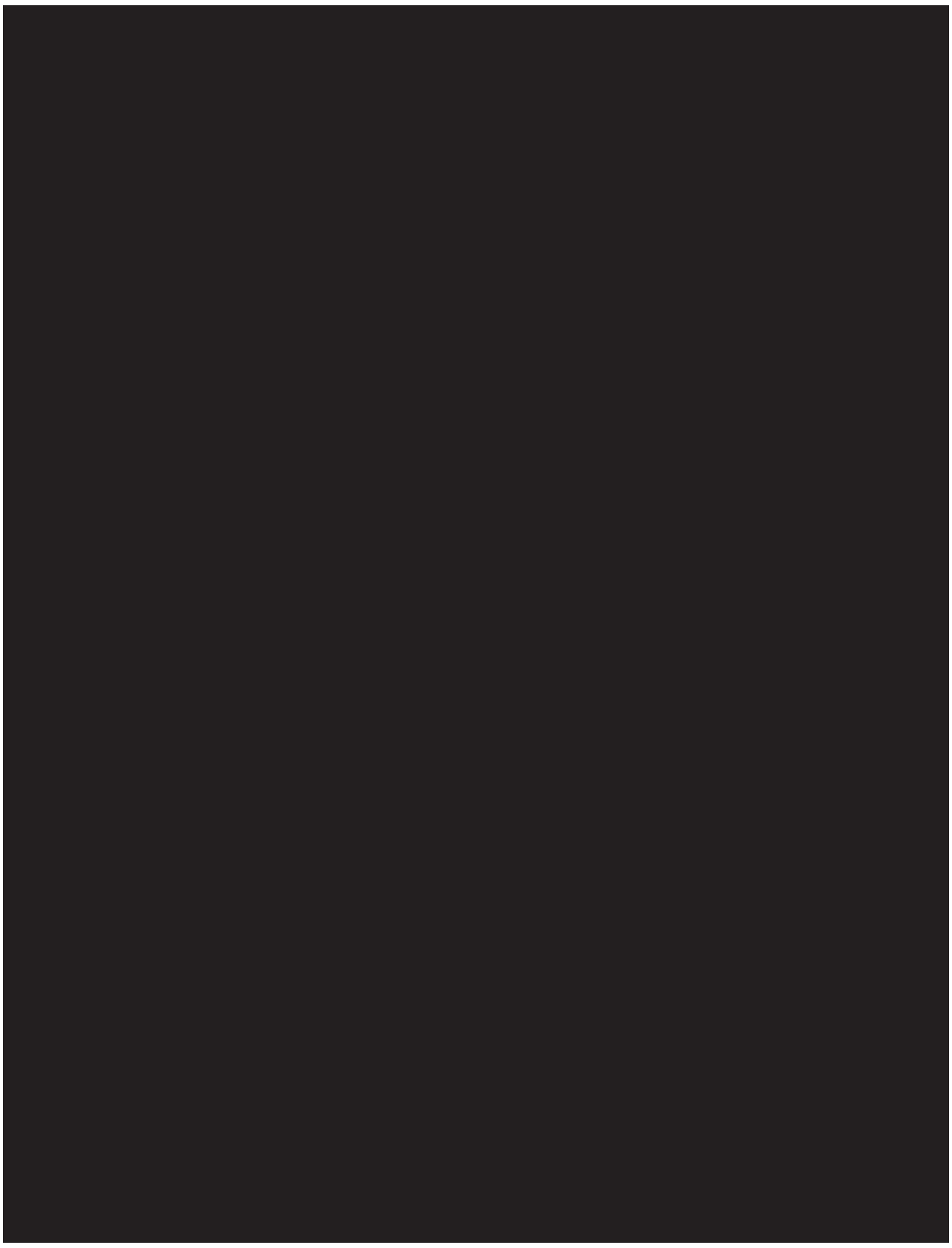


photo by Alan Eaton

Dr. Reeves using an aspirator to collect TPB nymphs from his sweep net.

well removed from the nearest alfalfa. We even recovered some in strawberry beds that had been treated with chemical insecticides. We are now planning our summer activities for 1999, to allow us to learn more. Meanwhile, researchers Kelly Tilmon and Michael Hoffmann of Cornell University are looking at a new way of detecting parasitism by this braconid, using molecular biology techniques.

While the work continued on determining the range and effectiveness of the parasite, Alan began measuring how much TPB damage occurred in NH strawberries. The average incidence for 1997 & 8 was slightly over 7% of the fruits showing injury (some fields showed nearly half of the fruit damaged). Losses were projected to be about $300/Acre. Most of these plantings (16 of the 17 measured in 1998 for example) were not on organic farms. We will see if TPB injury begins to go down in future seasons.

It is our hope that the parasite will become abundant enough to significantly reduce TPB populations here, just as has occurred in northern NJ alfalfa fields. Recent years' data in apple orchards suggest that TPB damage has been a bit lower in New England, but it is too soon to be sure if the trend is real, or what the cause(s) may be. Unfortunately, we haven't been measuring damage in strawberries long enough to see if this is happening there. Eventually we may see less damage to our strawberries, apples, peaches, flowers and other crops. Perhaps tarnished plant bugs won't be as significant a threat to strawberry growers in the future. Then we could all enjoy the fruits of our labors, so to speak.

Known and possible spread of *Peristenus digoneutis*, as of June 1997. The circled date shows the location and year when this parasite was first found to be established in North America. Uncircled dates show when the parasite was first collected in the county. Years within the range line depict the probable dispersion by that year.

The Metamorphosis of a Biocontrol Business

by Mike Cherim

photo courtesy Mike Cherim

I spend a lot of time looking at people's pests to help them identiufy them.

The Starting Point

I had never even heard of biological pest control - at least not in the sense it is known today - until I got into this industry back in 1992. In fact I knew very little about pest control; any pest control. Back then my company was known as The Green Spot Greenhouse & Nursery and we specialized in the propagation, development and retail marketing of culinary herb plants. Not surprisingly (as herbs are very popular), we were doing pretty well. After all, I had had years of experience growing herbs for my family's own use in our vast herb and vegetable gardens. When I started the herb business, I simply erected a greenhouse and grew more than usual.

Now you're probably wondering how on earth I was able to grow herbs successfully without a good, working knowledge of pest control. (Just lucky, I guess.) Well, I can think of two valid reasons for this: many culinary herbs are not prone to pests; and Mother Nature did the dirty work for me. You know what they say - ignorance is bliss. I used the same techniques I had always used: manure for fertilizer, flick bugs off of plants, fight weeds by hand (always), etc. Not very scientific or professional, but effective all the same. Ah, ignorance was my savior. However, I didn't even know that at the time. So, trying to be a smart, proactive businessman, I contacted the experts to solicit their pest control wisdom. (To protect the "experts" from some degree of embarrassment, I'll refrain from using their names.)

Collectively they said, and I quote, "Whatcha growin'?"
"Herbs," I replied.
Their sage advice: "Herbs, ayuh. Not much ya can spray with herbs ya know."
"Thanks guys. Thanks a lot. I'm outa here."
And so my quest began.

I started poring through books, magazine articles, pamphlets and catalogs. Ironically, they all seemed to say the same thing: "Not much ya can spray with herbs ya know." Until one day when I saw an ad that said that you could "fight bugs with bugs." Well, I thought, that's different; I called the number and asked for more information.

About a week later I received a vaguely descriptive price sheet in the mail. The information was lacking, but the timing was right. I was starting to get some fungus gnats (because I started using soilless media on the advice of another expert - which, of course, as we know but cannot prove, is the main source of fungus gnats in greenhouses). I decided to order some bugs which were supposed to eat fungus gnat larvae.

Two days later they came. It was an extremely cold winter day and the UPS guy came to the door with a cardboard box. In the box was a bottle of frozen vermiculite, a crumpled sheet of newspaper and an invoice for over fifty dollars. I was pretty sure the bugs were dead. I called the supplier and said so. Their reply: "No they're not." I let it go. I figured it was time to see what other suppliers had to offer.

It took a while - it was pre-world wide web - but I found another bug supplier. I asked for a catalog, price list or whatever other information they might be able to provide. To my surprise an entire package of materials arrived in my mailbox. It didn't contain much in the way of technical information, but I now had marketing materials galore and a dealer price list. It was an opportunity, I saw, to start selling biological pest controls to the local market. And all it took was a nice ad in a local newspaper to realize the potential of this new product line. The response was a bit overwhelming.

After one year of selling bugs locally to my greenhouse clientele - and watching my wife and kids go to the beach on hot summer weekends while I was stuck at the greenhouse waiting for customers - I decided enough was enough. The bug business became a full-time (Monday through Friday) avocation. The greenhouse we kept. My wife wanted to use it for starting plants in the spring; I felt it was an ideal test-bed for developing my practical knowledge of my company's new line. The Green Spot, Ltd.'s Department of Bio-Ingenuity was born.

Continuing Growth

Upon entering this unique industry I knew I had to identify its various peculiarities. My first, and probably most important, observation was the difficulty of obtaining decent, nonconflicting information from the various manufactures of the biocontrol products I was going to offer. Not just for my customers, but for myself as well (the worst kind of salesman is an ignorant one). I contacted producer after producer, distributor after distributor, dealer after dealer, and, as I'm fond of saying, the price sheets flowed in with the regularity of the Bay of Fundy's tide. Solid information, however, was eluding me. Finally I hit pay-dirt and found a really informed producer that gave me a disassembled skeleton of facts, strategies and protocols. I assembled the pieces and joined them with the data I had already found. Moreover, in concert with the practical knowledge and customer feedback I gained, I was ready to produce a decent catalog of information - mostly for my company's use while on the telephone with the inquiring minds that called (and call) our office on a regular basis.

Other industry oddities included the fact that we were shipping a product which was potentially difficult to obtain and get to the user in good shape. Unlike other products, biocontrol agents couldn't be simply taken out of inventory and shipped by the Pony Express in a corrugated box - with or without a crumpled sheet of newspaper. However, as I developed close ties to some of the industry's finest producers and biocontrol minds - which, unfortunately for them, did not include the original producer who sold me fifty dollars of frozen bugs, or the distributor which sent us the marketing kit which started it all - I learned how to deal with these problems in an effective and realistic manner.

The catalog of information became very popular (it was also a catalog of products) as most folks who called had questions, not answers. So popular, in fact, that giants such as Amazon.com and Barnes and Noble book stores still sell our 1998 edition of the Green Methods Manual, which is our current apex of effort. It's not a money-maker for anyone - including The Green Spot - but its content fills the industry's information void nicely.

The Way It Works

Other peculiarities had to do with the use of the products and not so much with the marketing of the wares. Unlike conventional, chemical means of controlling pests, biocontrols were (and still are) best applied before the pests rear their ugly heads. This takes a real discipline: a preemptive mind set, not a reactive one. Old dogs, new tricks. You get the picture. And then there's the Latin names. Whew!

Biocontrol isn't just something you up and do. It actually requires some pre-planning. As I guess it should, even before you go out there and spray some unpronounceable chemicals, too. You should devise a strategy or game plan of sorts - nothing scientific, but functional and understandable to the user. And, one of the most important things, you have to scout. No. Not just scout. You have to know your crop. (When I first started writing this paragraph I thought I was describing biocontrol; now, however, I realize I'm talking about all pest control practices.)

It is for these reasons that I felt our marketing materials should be of the informative variety. Not informative as in Infomercial, but in the truer sense of the word. My frustration, at the onset, was due largely to the lack of information. Here I had people [read: vendors] real keen [read: rubbing their hands together] on the idea of my greenhouse and nursery operation [read: customer] trying out this stuff [read: spending money], without providing me with the knowhow to make it all be worthwhile [read: cost-effective and willing to be a repeat customer]. It's not really fair. For chemicals the data was undeniably available for the asking, yet for biocontrol a single datum could be as difficult to extract as a bum tooth. Fortunately, the bug industry seems to be gaining respectability as answers are finally being dispensed to the people with the questions. I hope my company had, through the spirit of competition, a little something

photo courtesy Mike Cherim

Speaking with our customers is often like chatting with good friends.

to do with the turn around. I'd like to think we set a good example, anyway.

I felt that it made good marketing sense to uncover as much dirt on biocontrol as I could... bad dirt as well as good. To be honest and to employ as much intuitive common-sense as possible, as well as the necessary science. Moreover, I felt obligated to my customers. I felt it was [and feel it is] my responsibility to do my very best. From a sales standpoint it was a given. Treat the customer right, and empower him or her with everything necessary to succeed at biocontrol, and they'll come back and tell us of their triumph. They can become repeat customers and reap the bounty of the practice. And, at The Green Spot: we can create jobs, enjoy a prosperous future, and help other customers with our ever-expanding base of knowledge.

Who's Doing It?

I thought the certified organic set would be the bulk of our customer base when I first started The Green Spot's Department of Bio-Ingenuity. That, however, proved to be in error. The largest following came from the conventional greenhouse growers, initially. I thought it was ironic at first. Later I came to realize that nobody likes to spray. Basically it could be said that many of our customers are nothing more than a bunch of hard-working business people who love their jobs in horticulture and are just trying to make ends meet with the least possible hassles and expense.

Also ranking in high numbers in our database are interiorscapers. It really isn't surprising. These folks install and maintain plants, shrubs and trees in buildings; and go figure, these buildings often have people in them - many of which may not like the idea of pesticides in the building (most don't think about it, though, unless they can smell them). Interiorscapers are also limited to a certain extent in the selection of chemicals registered for use in public buildings. It's one of the EPA's many ways of looking out for the masses. Biocontrols are exempt.

Colleges and universities, public institutions, botanical gardens, zoos, amusement parks and museums make up another very large portion of our database. For some pretty obvious reasons. The rest is brought together with the likes of vast-acreage farmers, certified organic growers and home gardeners. About one-fifth of our customers are right here with us in New England. And contrary to what some folks may think, New England growers embrace biocontrol and IPM with the same zeal that I see around the country.

And How Are We Doing?

Our customer-retention rate is extremely high - I'm talkin' as high as ninety-percent. It might be due to our early positioning as a company in the know - the one with the info. It might be due to other factors. Biocontrol and IPM being so heavily in the news certainly must have a huge impact. It could be attributed to any number of things which make any company a good company. I always want to treat my customers as I like to be treated when I'm about to spend some of my hard-earned money (even if I'm not spending it at the time, say I'm just looking for help). You know, that Golden Rule thing. I must confess - and I can probably speak for others - I'm a frustrated consumer nowadays. If I hear "...in an ongoing effort to improve customer service we have created a brand new menu from which you may choose... yah-da, yah-da, da," on the telephone one more time I think I'll scream. In an ongoing effort to improve things? I wish they'd just pick up the phone!

Another strong possibility our customers keep coming back for more is they have the success that makes sense without having to consider intangible factors such as "it's good for the earth" or other "environmental and health stuff," not that these factors don't bear significance, but without tangible successes, the latter means little to the business person. I'm talking about the I-can-do-this-and-still-pay-the-help type success. Labor savings has always been a big plus for biocontrol. The act of spraying can be very expensive. Releasing biological agents is much less demanding on the clock; it can turn hours into minutes.

I figure eighty-some-odd percent of our customers report generally positive results. Not all the time. They all seem to have their ups and downs. And remember the remaining twenty-some-odd percent. Are they complete and dismal failures? No. Many, actually most, keep pluggin' right along. Some, right now, are coping with the failure of the chemicals they went back to when biocontrols supposedly let them down. Some people shouldn't be growers - it's not in the cards for them. Only about thirty-some-odd percent of our customers report consistently exceptional results. It's like they're charmed or something. The rest are in the middle-ground: successful enough to see the point of it all.

The Biocontrol Future

As was said before: information is paramount and the industry is rushing in to fill what's left of the void. Bug people from coast-to-coast are really starting to meet the needs of their customers'. And because of this, more and more people will be able to enjoy the very-obvious and not-so-obvious benefits of these biocontrol and IPM practices, or green methods as I've always liked to call them. The biocontrol industry didn't create the market so it stands to reason that some sectors seem a little slow to open up and make this practice a user friendly one (or, perhaps, even take the time to understand it themselves), especially since so many people are screaming for it. Expect huge industry improvements in the next five to ten years.

Consumers' knowledge is building; which is a result of the work of communication's networks, and political and environmental organizations around the world - their urgent and pleading messages are being heard, slightly, but more clearly than ever before. And in reaction to this knowledge-building, the consumers are absorbed into the very masses, however small in reality, which are in protest. Their numbers build, and forced into submission are powerful entities like the Environmental Protection Agency. The EPA then initiates and directs legislation responsive to the outcries of said masses. In other words they begin revoking the approved usage registrations of materials currently in favor but which are suspected of causing irreparable damage to people, wildlife and the environment which allows our existence. For many folks this is not happening quickly enough, but it is in the works. For those of you who were lost at this paragraph and think it is not factual, I understand your disbelief and frustration, and I believe we do take a step back for two steps forward but, nevertheless, it is progress.

As pests become more resistant and chemicals become more ineffectual, the list of grower-approved materials dwindles, the need for alternatives proportionally swells. Chemicals, pathogenic fungi and bacteria, some botanicals, as well as other things - including biological agents - become new and improved. I'm glad to see that many chemicals manufacturers, regardless of their true motive(s) [read: money], are already embracing the popularity of beneficials (perhaps even confirming the need) as is exhibited in much of their advertising: "safe on beneficials," etc., etc. Now all we need are to have any resistant-to-change growers out there to either start learning the new tricks coming their way or get back to basics like squashing bugs by hand. This is not just my opinion, though. They're going to have to adapt as the conventional knock'em dead chemicals are becoming the disallowed alternative or last resort items, and the alternatives become conventional.

A Bug Guy's Thoughts

Change has been happening since mankind's beginning, especially so in the twentieth century. The reaction to the automobile was probably negative in the minds of many, at first. They were clumsy, dirty and noisy - "Durn them newfangled contraptions. Whar's muh hoss 'n' buggy?" Would you have said that? I probably would have, at first, anyway. I easily slipped into biocontrol as a grower as I had no bad growing habits or preconceived notions - yet. Remember, I was blissfully ignorant to it all, and it's a good thing 'cause I'm fairly resistant to change. I know, because it bothers me that some rich guy named Bill has decided that I have to suffer through another computer and software upgrade because they didn't make it good enough the first time... every three years! I was perfectly content with Version A, now I can't live without Version B. But do I really have to spend another five grand on Version C?! I'm too young to upgrade. Change, forgive me for saying, sucks. But the new stuff is so cool.

Remember the rotary dial phone? Oops! I'm sorry, you still have one. I did not know. You will go with a push-button phone someday. E-mail, computers, etc., etc., etc., you will, you all will. We have to, we all have to, eventually. Death, taxes and change - all are inevitable. WWWhat are you waiting for? Biocontrol and integrated pest management? Some day, perhaps, you will do that too. Upgrade today! Constantly having to learn. The benefit? Some of the new things are better than the old things. (More than likely, someone probably said this of chemical pesticides when they made their first appearance.) Even though this thinking has taken us back a couple of times, the general movement might just yet be forward. Though we should be careful not to repeat our stupid mistakes of yesterday (the way some of the new agri-technology seems to be doing).

Summary

Learn biocontrol and IPM today so you can teach your kids tomorrow - empower them. Embrace the change so it doesn't run you over and leave you with nothing you can spray when you need help. Rotate your crops. Learn the internet. Use cover crops. Learn words like biorational (it comes out of a sprayer). Someday you'll put the chemicals next to the 8-track tapes and buggy whips.

The future of biocontrol looks pretty good. The beneficials have been tested and approved by the USDA to prevent the occurrence of our good bugs becoming bad bugs - so we don't make stupid assumptions, again. The consumer wants this stuff, and so do many growers (with more wanting it every day). The chemical companies are developing new stuff all the time which is safer for everything. Biocontrol companies are candidly making their products more approachable, and successful because of it. The future looks real good, and if we can survive the recent past and present, we may be a part of it.

Well. Gotta go water the computer, sonny.

New Jersey Department of Agriculture's Biological Pest Control Program

By Bob Chianese

Since the 1930s, the New Jersey Department of Agriculture (NJDA) has used beneficial insects to help control the state's pest insect and weed problems. Within NJDA's Division of Plant Industry, the Bureau of Biological Pest Control works toward several goals by raising and field-releasing beneficial insects. These goals include:
* reducing plant pest damage to agricultural crops and forests;
* protecting natural and renewable resources;
* testing new biological control technologies; and
* developing and improving techniques used to raise large quantities of beneficial insects so that biological control programs can be implemented and expanded.

One obvious benefit of biological control is that it reduces pesticide applications, thereby reducing the amount of chemicals accumulating in groundwater and soil and avoiding the development of resistance to the pesticide by the targeted pest.

Other benefits that are not as obvious include long-term or permanent control of a pest by establishing a natural predator. Moreover, the beneficial insects released by NJDA attack a specific pest species, unlike many less selective chemical controls which often affect a wide variety of insects, both friend and foe. Biological controls almost always save the landowner money by reducing the cost of insect and weed pest controls.

Many of New Jersey's pest problems are the result of the introduction of foreign pest species into the United States. Many of these species were not considered a problem in the country of origin because they were kept under control by a complex of natural enemies. Free of predation by their natural foes, these imported pests can multiply unhindered.

USDA's Agriculture Research Service and other researchers have the challenging responsibility of identifying the pest's natural enemies, determining which species show the most promise for controlling the pest in the United States and bringing those beneficial insects to this country to be released against the pest.

These foreign beneficial insects are carefully screened before introduction into this country to ensure that they themselves will not become pests. After the beneficial insects have been approved for release into the United States, NJDA can request those that are parasites and predators of specific pests found here in the Garden State. NJDA staff at the beneficial insect laboratory develop mass rearing techniques to increase the population of beneficial insects and field-release them at the appropriate time against the pest population.

photo courtesy NJDA

***Pediobius foveolatus*, larval parasite of Mexican Bean Beetle**

NJDA's current biological control programs include a cooperative project with the New Jersey Department of Environmental Protection (NJDEP) raising two leaf-feeding beetles that eat purple loosestrife, an exotic, aggressive, fresh water wetland plant which is displacing the state's native plants. The disruption of the wetlands ecosystem, in turn, affects the survival of many animals dependent on that ecosystem. Under the Natural Resource Conservation Service's Wildlife Habitat Incentive Program, coordinated with NJDEP, NJDA's beneficial insect laboratory will release the beetles in threatened habitat that is home to endangered bog turtles.

Another NJDA beneficial insect program involves the laboratory production of a ladybug imported from Japan which is being released in the state's natural hemlock stands to control an Asian insect pest, the hemlock woolly adelgid, that is killing the hemlock trees. Biological control is the only practical way of controlling this pest in natural stands.

Because NJDA's beneficial insect laboratory has developed a successful mass rearing technique and is the only laboratory mass producing the beneficial beetle, NJDA has entered into a cooperative agreement with the USDA Forest Service to supply the ladybug to other northeastern states. In exchange, the Forest Service will supply funding support to NJDA's hemlock program.

Two other biological control programs include production of two parasites and a small predator beetle that eat euonymus scale, a pest that feeds on a variety of ornamental euonymus plants, and production of a small wasp which kills Mexican bean beetle (MBB), a pest of soybeans, snapbeans, and lima beans.

The MBB control program is so successful that it has all but eliminated the need for chemical treatment of over 100,000 acres of soybeans. It has also considerably reduced the amount of pesticides required for treatment of the pest in snap and lima beans. This program, partially funded by the New Jersey Soybean Board, saves soybean growers over $300,000 a year in pesticide application costs and has eliminated the need for the annual application of approximately 80,000 pounds of pesticide. Unfortunately, the MBB parasite cannot survive New Jersey winters so it must be maintained in the laboratory throughout the year and released each summer.

The laboratory has established the predatory beetle, that eats euonymus scale, in the southern part of New Jersey, but the parasites have not been recovered. Evaluation of the beetle release sites has demonstrated the beetles' ability to reduce the pest population to a tolerable level. Future releases of both the predator and parasites will be made in Central and North Jersey in an effort to establish the species throughout the state.

NJDA is trying to assess public interest in purchasing the bean beetle parasite, euonymus scale predator beetle and beetles that feed on purple loosestrife, all of which will be available to the public in the future. For additional information, contact Robert Chianese at 609-530-4192. Funds generated from the sale of these beneficial insects will support NJDA programs.

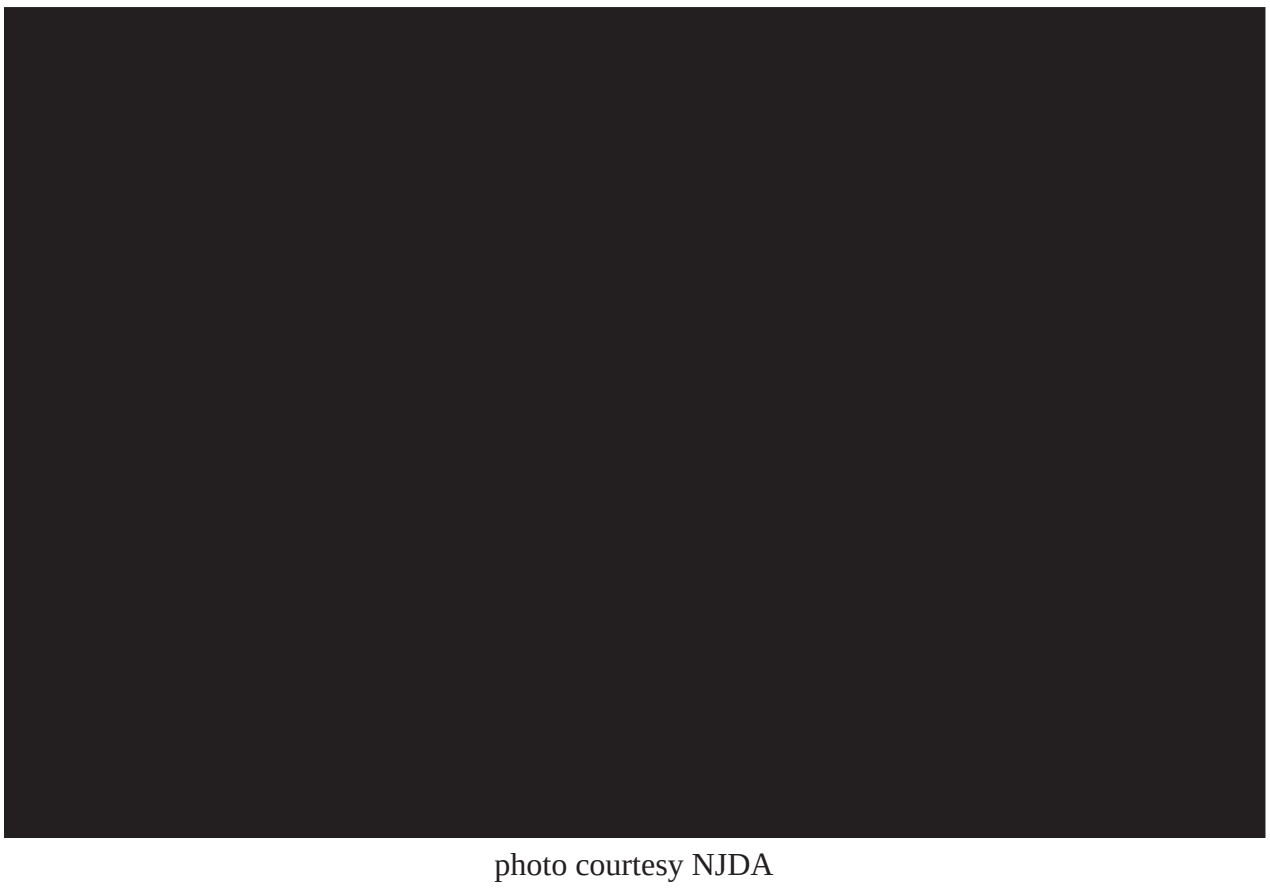


photo courtesy NJDA

Collecting *Cybocephalus*

Perennial Insectary Plants in Agroecosystems

by Eric Toensmeier

Beneficial insects are an increasingly important biological pest control in organic and Integrated Pest Management (IPM) systems. Many large-scale commercial operations spend money to have beneficials shipped in. It is possible to greatly increase the population of beneficial insects in your farm or garden by planting certain kinds of flowers which are attractive to them. Many of these plants are either common wildflowers or potential low-maintenance, perennial crops. These species are known as insectary plants.

"Benefical insects" here refers to two types of insects. Predatory Insects catch and eat pests. Syriphid flies, also known as hover flies, are an example. Their larvae devour large numbers of aphids. Parisitoid Insects lay their eggs in the eggs, larvae, or adults of pests. When the parisitoid's eggs hatch, the young devour the pest. One well known group of parisitoids are the tiny wasps of the genus Trichogramma, which lay their eggs in caterpillars.

Many beneficial insects need nectar from flowers to fuel their search for prey. Unlike bees and butterflies, however, their mouthparts are not built to get nectar from most flowers - instead, they are built for eating other insects. They are only able to visit certain kinds of flowers, which have adpoted a strategy of generalist pollination. In other words, these flowers are able to be pollinated by a wide variety of insects lacking specialized pollinator mouthparts.

Foremost among these flowers are those in the Apiaceae, or carrot/parsley family. They used to be known as the Umbelliferae, because they have flowers in umbels, clusters of smaller flowers. Queen Anne's Lace is a classic (biennial) example of this family. The Apiaceae are unsurpassed in value to beneficial insects. This family also features many edible, medicial, and ornamental plants, such common crops as dill, carrots, parsnips, celery, parsley, cilantro, and many more. Unfortunately, there are also some species which are deadly poisinous, and they all are very difficult to tell from one another.

The Asteraceae, or Composite family, are also important to beneficials. Many other plants are as well, including many mints and flowering onions - this is an area in need of much research. We have prepared a listing of species that through research or personal observation are known to attract beneficials.

You can use the chart below to make sure you always have some insectary plants blooming. This will ensure a steady population of predators and parasitoids. There are many more insectary species - in fact, the Asteraceae and Apiaceae are among the largest plant families in the world. Consider planting strips or islands of low-maintenance insectary plants scattered throughout your yard, garden, or orchard. Many of the plants listed below also have commerical value, as food crops, medicinals, culinary herbs, or cut flowers. Existing populations of insectary plants like goldenrods or asters can be managed to provide food for beneficials. The challenge lies in finding early-blooming insectary species (the chart lists a number of these early-flowering species).

Insectary plants are an important strategy for perennial polycultures, (mixed plantings of perennials and woody plants). Rows or clumps of insectary species in fruit and nut orchards could support higher populations of benefical insects, while also providing a commercial crop themselves. When also interplanted with nitrogen fixing perennials, mineral accumulating plants, and weed-suppressing groundcovers, fertilizer, weed control, and pest control, a diverse and productive agroecosystem can be created.

This article is adapted from the forthcoming Edible Forest Gardens; A Delicious and Practical Ecology, which goes into much greater detail on design for ecological pest management and lists many more species.

Perennial, Cold-Hardy Insectary Plants with Flowering Times

genus & species	common	flowering	family	other uses
Achillea millefolium	Yarrow	June-Sept	Aster	medicinal
Allium tuberosum	Garlic Chives	July-Aug	Onion	edible, cut flower
Antennaria spp.	Pussy Toes	April-June	Aster	groundcover
Anthriscus sylvestris	Woodland Chervil	May-Aug	Parsley	edible
Aster spp.	Asters	Aug-Oct	Aster	native wildflowers
Ceanothus americana	New Jersey Tea	June	Buckthorn	nitrogen fixer
Chrysogonum virginianum	Green and Gold	April-June	Aster	native groundcover
Coreopsis spp.	Coreopsis, Tickseed	June-Sept	Aster	groundcover
Cornus stolonifera	Red Osier Dogwood	May-June	Dogwood	native ornamental
Cryprotaenia canadensis	Honewort	June-Sept	Parsley	native wild edible
Cryptotaenia japonica	Mitsuba	June-Sept	Parsley	culinary
Echinacea purpurea	Purple Coneflower	July-Oct	Aster	medicinal
Eupatorium perfoliatum	Boneset	July-Sept	Aster	medicinal
Eupatorium purpureum	Joe Pye Weed	July-Sept	Aster	medicinal
Foeniculum vulgare	Fennell	July-Sept	Parsley	culinary
Gaillardia spp.	Blanket Flower	June-Aug	Aster	ornamental
Helianthus spp.	Perennial Sunflowers	Aug-Oct	Aster	native wildflowers
Helianthus tuberosum	Jerusalem Artichoke	Sept-Oct	Aster	edible tubers, cult.
Inula helenium	Elecampagne	July-Sept	Aster	medicinal
Levisticum officinale	Lovage	May-July	Parsley	culinary, medicinal
Mentha spp.	Mints	July-Sept	Mint	culinary, medicinal
Myrrhis odorata	Sweet Cicely	June-Aug	Parsley	culinary
Origanum vulgare	Oregano	July-Sept	Mint	culinary
Panax quinquefolium	American Ginseng	April-July	Ginseng	medicinal
Pycnanthemum spp.	Mountain Mint	June-July	Mint	tea
Sambucus canadensis	Elderberry	June-July	Honeysuckle	cooked fruit, flower tea
Senecio spp.	Ragwort, Groundsel	April-June	Aster	medicinal
Solidago spp.	Goldenrods	Aug-Oct	Aster	wildflower
Solidago odora	Sweet Goldenrod	July-Oct	Aster	delicious tea
Tanacetum parthenium	Feverfew	July-Sept	Aster	medicinal
Thymus spp.	Thyme	June-July	Mint	culinary
Tussilago farfara	Coltsfoot	April-May	Aster	medicinal
Viburnum trilobum	Highbush Cranberry	May-June	Honeysuckle	fruit (poor), ornamental
Zizia aptera	Heart Leaved Alexanders	April-June	Parsely	native wildflower

Hutchins Farm

by Jack Kittredge

The gentle climate of Boston, moderated by closeness to the ocean, extends a few miles northwest to the historic town of Concord. There, practically in the shadow of Old North Bridge where the yeoman farmers of New England began the Revolutionary War, John and Gordon Bemis operate Hutchins Farm. Yeoman are almost as rare hereabouts as redcoats now, but the Bemis brothers grew up with farming in their blood.

"My mother's grandfather bought this place a hundred years ago", says Gordon. "He was a minister who was getting ready to retire, so he bought this farm. My grandfather ran it as a dairy farm. My father didn't want to continue, so my grandfather eventually quit when dairies had to go to cement floors.

photo by Jack Kittredge

Gordon Bemis shows the protective packaging in which the *encarsia* are shipped

"My brother and I got interested in farming after we were in college and headed toward other careers. My brother was in architecture school. I was bound for civil engineering."

photo by Jack Kittredge

***Encarsia* come in egg cases attached to small cards which are to be hung among the tomatoes**

Hutchins Farm raises and sells a full line of organic vegetables and fruit at one of the best known farmstands in the area. As is true of most farmstand operations in the northeast, one of the most important crops is tomatoes. Because of their climate, Hutchins gets early tomatoes, but Bemis needs to assure a steady supply of ripe tomatoes throughout the season to keep his customers coming.

photo by Jack Kittredge

Here Gordon separates the cards

In order to harvest tomatoes from early June until field tomatoes ripen at the end of July, the brothers rely on their greenhouses. Ground heat runs beneath the beds to warm the soil, and early varieties like Buffalo and Cobra are planted.

But when you raise crops — especially tropical ones like tomatoes — in the same spot year after year, you tempt nature. Lots of critters are vying for those sweet, energy-rich juices besides homo sapiens.

"We had a real disaster with white flies 3 or 4 years ago", recalls Bemis. "I sprayed some Safers soap, but they just got worse. When we finished with them in July, it was just a disgusting gray mess in here. So I went to Mike Cherim (owner of The Green Spot, a biocontrol distributorship)."

Mike got Gordon started on a regular program of releases of *Encarsia formosa* to parasitize the white fly eggs. Ever since, the problem has been under control.

photo by Jack Kittredge

Bruce Bickford mists the bedding plants so the lady bugs will be drawn out to drink.

"After that one infestation", Gordon says, "I got these and they just handle it all! Now we do releases on a contract basis. *Encarsia* were released here 2 weeks ago, in late June. I don't need this one, but its easier to arrange them ahead."

The insects come in a special package. There are eggs on each of several cards, which are separated and hung among the leaves. They begin to hatch right away. An *Encarsia* release cysts about $18, and occurs 5 or 6 times a year – a small price, Bemis believes, for the peace of mind they provide.

In addition to the summer vegetables, Hutchins Farm does a reasonable spring business in seedlings and potted herbs, flowers and perennials. Aphids in the greenhouse is the big problem with these. Safers soap has been an effective control for aphids, but Bruce Bickford, farm manager, also releases lady bugs from February through April.

photo by Jack Kittredge

Bruce opens the refrigerated bag of lady bugs.

"We keep a really close eye on the greenhouse in February and March," he stresses, "for any kind of problems in the propagation house. We just buy some lady bugs in advance and hold them in the refrigerator. When a problem arises you stick them out and they go to work. They're ready to lay eggs and they just devour! They spread out and go to work on green aphids - fantastic. We get the first ones in February, the last ones might be in April."

Lady bugs come in a little cloth bag and are stored in the refrigerator. They can be released just by shaking the bag over the plants. Bruce mists the plants first and the lady bugs are so thirsty they come right out to drink. One bag costs $15 and last two months, starting in the beginning of February and used as needed.

Bickford does his releases in the evening, since he found that lady bugs tend to get distracted by the light and could fly away, out the (unscreened) greenhouse vents. He has had some luck getting the creatures to breed. In that case the plants are protected until May. He has to tell customers to ignore the larvae on the plants, however. While they don't look as attractive as the adults, he reminds them, larvae are the ones who can really eat!

The Bemis brothers have used other species besides lady bugs and *encarsia*. They use nematodes to control fungus gnats and are pretty happy with them, although Gordon thinks cultural practices – not leaving things damp and controlling the time of day of watering – work the best. They have also used *trichogramma* in the field, with some success, for corn ear worm and European corn borer. They are not happy with what lacewings have been able to do for them, but highly praise bumblebees for pollination.

photo by Jack Kittredge

To release lady bugs, simply sprinkle them over the plants.

"Before the bumblebees," says Gordon, "I just shook the tomatoes for pollination. But we had some problems and with the bumblebees I'd say we get a 50% increase in fruit quality. Poor pollination leads to poor quality. When bumblebees pollinate a blossom they really tear it to shreds. You can see they really got it!"

Like a Bump on a Log

By Mike Cherim

Scale insects can give woody ornamental growers and interiorscapers a real headache. Not only are they difficult to control, they defy it by being difficult to initially diagnose. In fact certain plants, due to the characteristics of their bark, look like they have certain scale insects even when they do not.

Scale insects cover a large grouping of insects from the order *Hemiptera* and sub-order *Homoptera* (just like aphids and whiteflies). The scale sub-order is divided into three distinct families: *Coccidae*, *Diaspididae* and *Pseudocoddidae*, commonly known as soft-scales, armored scales and mealybugs, respectively.

Soft scales, in general, are large (up to 1/8 inch). The females are covered – in their adult stage – with a hard body covering (which leads many people to believe they are armored scales). They produce honeydew - a sticky, sugary excrement which may attract ants. Ants will harvest the honeydew and provide some protection to the scales from natural enemies. Although the adult males are winged, they are rarely seen. The females, on the other hand, are seen as "bumps" which often resemble bark features in color and shape. Individuals in the immature "crawler" stage are often hidden by the female's cover, but are usually more mobile as they seek out their final feeding spot. The crawlers of many species are mostly yellowish in color and upon close inspection have working legs. It is common to notice the sheen of the dried honeydew first – before the ants are even noticed.

Armored scales, in general, are very small (down to .2mm). They, too, like their soft cousins, are covered by a tough cover. The males are winged and rarely seen, and the crawlers are similar to the soft scales, just a lot smaller. One big difference is that armored scales produce no honeydew. This makes them even more difficult to detect.

Mealybugs are distinctly different from other scale insects in that they lack the hard covering. The adult males are also winged and rarely seen, and the crawlers are very similar to those of soft scales. Mealybugs also produce a lot of honeydew and attract ants, but otherwise they are, to most people, not even considered a scale insect. Mealybugs are covered with a waxy coat which, like their cousins' hard coverings, provide protection. Like many other scales, the eggs of many mealybug species are protected – often by a waxy, cottony substance instead of a shell. Some give live birth, like aphids.

Control of most scale insects can be very difficult because of all the protective features characteristic of scales. Chemicals must be formulated to penetrate the hard coverings or repellant wax. Some scales have toxins in their saliva which will cause leaves to curl around them, protecting them even more. Parasitic biological controls can be difficult to use for scales because many are species-specific (so you must know exactly what you're dealing with.) Horticultural oils can be used successfully if thoroughly applied so as to coat and smother the insects. Use caution, though, as horticultural oils, especially when applied heavily, can cause phytotoxicity in many plants.

So what's the best cure? Detect scales early by scouting properly; hand apply oils and such; locate the more susceptible crawlers and use soap and other physical products on them; use predatory biological controls which care less about species and are more opportunistic; keep your plants clean and healthy; and put your plants outside whenever possible to allow Mother Nature to take care of Her own.

Ask the Green Spot…

The Grower's Question: When should predators be introduced? Is it too late after an insect population has appeared? – a New Hampshire greenhouse grower

The Green Spot's Answer: Predators, as the name suggests, prey on smaller or less capable, tasty organisms. (For example, a ladybug is a predator that feeds on aphids.) Taking this into account, it is in the predator's best interest to have prey available when released into a situation. Therefore it is not too late. It is, however, often in the grower's best interest to release very early on in the infestation. Don't wait until the pest populations are massive. It may be too late to effectively and economically turn the situation around. This logic applies not only to biological pest control, but to any form of control, including that obtained by chemicals.

Parasitoids (parasitic mini-wasps, etc.), on the other hand, since they respond more favorably to smaller infestations, are often best used just prior to the expected onset of a pest population. They are used preventively and during periods of very light infestation (or to supplement any predators on site), and should not be used, or expected, to turn around high pest numbers. Their "too late" comes much sooner than that of predators.

Questions submitted for publication should be addressed to:
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All questions will be answered, if not in a column, then by phone, so put your name, company, and phone number in the submission. Call 603-942-8925 for details.

Using Parasitic Nematodes to fight Cutworms at Berry Hill Farm

by Caroline Robinson

In April of 1993, we planted four rows of fall raspberries, each row being 250 feet in length. The planting consisted of approximately 1000 canes, spaced about 18" apart, in a three-foot wide row with hard fescue grass in the aisles. The hard fescue is an excellent row grass for brambles because it is allelopathic (repels sucking insects), is extremely competitive with weeds, and does not spread rhyzomes (does not travel).

During that summer the plants were watered faithfully and fed with blood meal. We mulched the entire bed with a layer of horse bedding and another of wood chips, and went into the winter confident that the root stock would spread below ground and send up plenty of new shoots the following spring.

In March of 1994 we added a layer of seaweed to the mulch, on a nurseryman's theory that raspberries like "the more mulch the better". In April they got 4 ounces/plant of ProStart, and we entered May confident that they were ready to sprout scads of healthy shoots.

But that year, according to Stan Swier, UNH Cooperative Extension Entomologist, a massive influx of black cutworm moths flew in from the South on the warm April winds and deposited eggs either in the mulch or on the nearby fescue aisles. The eggs must have found perfect conditions in these richly mulched rows because by early June, when the larvae were between 1 and 2 inches long, they devoured all of our new shoots before the shoots had even emerged from the ground. All that did emerge were stalks with no leaf buds.

Once the problem was identified, we were advised to rake off all the mulch and destroy it. This in itself was a massive, difficult and unpleasant job. The process further injured the shoots because the seaweed had hardened into a continuous crust. But it did expose many white cutworm grubs and helped to solidify our diagnosis of the problem. Stan, who has much experience with cutworms in golf course settings, recommended that we try an application of beneficial nematodes to parasitize the grubs. At that point we were ready to try anything short of chemicals.

Beneficial nematodes are microscopic, translucent roundworms, about the size of dust mites, which feed on a variety of garden pests. The list of hosts covers some 250 species, among which are the larvae or pupae of cutworms, sod webworms, mole crickets, citrus root weevils, strawberry root weevils, black vine weevil, iris borers, cabbage root maggots, billbugs, fly maggots, gnat larvae, termites, wireworms, Japanese and Oriental beetles, and some species of thrips' pupae, all of which travel close to the lawn and garden surface. Beneficial nematodes do not harm plants or healthy earthworms. They are extremely useful to the organic grower because, being exempt from EPA registration, they are classified as a beneficial organism, not a pesticide. In addition, they are resistant to many chemicals and have the ability to survive in soil temperatures of 32-90½F. Growers treating their soil chemically for root-knot nematode cannot use the beneficial nematodes, as they will be killed along with the target population.

There are two varieties of beneficial nematodes commercially available, each of which has its own strategy. *Steinernema carpocapsae=feltiae (Sc)* tends to stay closer to the surface of the soil, waiting to ambush. It stands on its "tail" sensing the surrounding soil for slight variations in temperature, carbon dioxide and methane gas trails left by its host-to-be. Since it doesn't move around, it is best at ambushing mobile grubs. If it locks on a scent, it can travel a short distance and lie in wait or actually leap to it. The *Steinernema* then enters the host larva through an existing orifice such as the mouth, anus, wound or spiracles (little breathing holes on its sides.) Once inside, it sheds its encapsulating protective cuticle and begins feeding, defecating and reproducing. In its fecal material there lives a symbiotic bacterium which poisons the host's blood and kills it within 16-24 hours. If several nematodes enter at one time, they all begin feeding at the same time, and reproduce sexually for several generations before their food supply is exhausted. At this time the grub disintegrates and a whole cloud of nematodes exits the host into the soil, having multiplied to a population of some 200,000 within 7-10 days!

The second variety is *Heterorhabditis heliothidis=bacteriophora (Hb)*. This species is highly mobile and searches out its prey by transporting itself at the rate of about an inch per hour on a film of moisture. When the *Heterorhabditis* finds a larva or pupa, it penetrates its soft sidewall tissue, and proceeds in the same manner as the *Steinernema*, with only a few differences. The *Heterorhabditis* is asexually reproductive, so only one member is required to reproduce. The last generation to parasitize the host does the job in about 10-21 days, and leaves with the same population size as the *Steinernema*, roughly 200,000 strong.

Gardens Alive (812-537-8650) sells their own strain of *Heterorhabditis* called Grub-Away. Their prices range from $13.90 (for a package of 5 million) to $86.75 (for a package of 50 million.) Gardens Alive recommends using 10 million nematodes for 600 square feet.

Green Methods (603-942-8925) recommends using only 1 million per 2,000 square feet, which is a "hugely " lower concentration than recommended by most others, because Green Methods is very confident that their nematodes will arrive alive. They sell both species of nematodes as well as a combination of the two. Their price for the separate species ranges from $11.88 per million to $95.55 for 25 million. For the combination, they charge $11.88 per million to $358.02 for 250 million and up.

In the case of the cutworm problem in our raspberry bed, we elected to use the Green Methods combination approach, as our situation was dire and we were not sure how many or which kinds of grubs were causing the damage. In consultation with Mike Cherim at Green Methods, we decided to treat our rows for eight weeks, with the following program: week 1: *Hb*, week 2: *Sc*, week 3: nothing, week 4: *Hb*, week 5: *Sc*, week 6: nothing, week 7: *Hb*, week 8: *Sc*. We ordered separate packages of 1 million each to treat 2000 square feet. (The packages are kept in the refrigerator until use.)

The nematodes arrive on a sponge, which gets thoroughly soaked in a gallon of room temperature, non-chlorinated water. This produces a gallon of nematode concentrate. The application process is extremely specific. The soil must be very moist before application, because the nematodes travel into the soil on a film of water. (It is therefore ideal to apply them after a good rain.) The easiest way to deliver them is to water them in with a hose-end sprayer from which all screens and filters have been removed. Backpack application is fine for a smaller square footage. The nematodes will die if left in solution more than two hours, so there is an urgency to the whole process. Finally, it is critical to do it in the evening because the nematodes are very sensitive to ultraviolet light. As far as temperature is concerned, if there is a susceptible living host, the nematodes can be released.

RESULTS! The exciting part about using nematodes is the fast results. In our case, within 48 hours we were seeing the emergence of raspberry shoots that had not been chewed. Also, we knew what was happening in the field because we had a jar full of cutworms in the kitchen and had applied some nematodes to them. Sure enough, they were dying and swelling up. It was working. We can say with certainty that without the nematodes we would have lost our entire investment in 1000 mother canes and all their care during the first 12 months.

The main lesson that we learned, aside from the benefits of nematodes, is that it is risky to mulch fall raspberry canes before they have emerged from the soil in the spring. Now we typically wait until the canes are 6" to 1' tall, and strong enough to tolerate being knocked around a bit. At that point we compost them and apply a good thick mulch of straw, which serves beautifully throughout the season to conserve moisture and deprive competing weeds of light.

Aside from the cutworm, the worst pest in our raspberries is the Japanese beetle. During the past three years we have had very effective control with traps placed about 100 feet downwind, and milky spore dust. While Japanese beetles are effectively controlled with nematodes, we have chosen not to use them because of the expense and the complicated application technique.

(With appreciation to Mike Cherim for his detailed descriptions of the *Hb* and *Sc* life cycles.)

Book Reviews

Passport to Gardening: A Sourcebook for the Twenty-First Century Gardener
By Katherine LaLiberté and Ben Watson
Published by Chelsea Green Publishing Company, $24.95

Reviewed by Stan Ingram

Isn't it good to know that for $25 you can purchase one book that will be the only sourcebook you will need to buy on a particular subject for the next 100 years? Ah, America, the deals just keep on coming. In all seriousness, not only has Gardener's Supply put out a book with a catchy title, they have put out a book full of information. To each of us, gardening means different things. To some, a garden is not a garden unless there are vegetables present. To others, it's the beauty of flowers that make the garden. The authors realized that gardens come in many varied types. They tried to include as many forms as possible and they didn't miss much.

Part one starts off with the basics common to most gardens. Chapters cover Building Healthy Soil, Composting, Water-Efficient Gardening, Starting Plants from Seed, Seed Saving, Extending the Season, and end with Pest and Disease Control. Part two deals with edibles in chapters titled The Kitchen Garden, Vegetables, Herbs, and Fruits. Then next part goes into the world of ornamentals. Chapters here deal with Garden Design, Bulbs, Perennial Flowers, Growing Roses, Annual Flowers, and Flowers for Cutting. Part four goes into the world of broader gardening horizons with chapters on Container Gardening, Water Gardening, Gardening Indoors, Growing Under Lights, Growing Orchids, Greenhouse Gardening, and Hydroponic Gardening. Onto part five with a look at Gardening in Harmony with Nature, Backyard Biodiversity, Wildflowers and Native Plants, The Natural Lawn and The Edible Landscape are the chapters covered here. Part six goes into Gardening Beyond Your Own Backyard through Community Gardening, Garden Touring, and Thinking Regionally. The book ends with a list of general resources.

As you can see, the authors tried to cover all the bases and they certainly came up with topics I would have missed. One part of gardening I found absent was the raising of animals. Granted, the book may be geared toward the backyard/home garden, but it would have been nice to add something about animals. The lack of reference to animals does not deter from the usefulness of this book, however. Each chapter has a small blurb from a guest expert which sets the tone for the chapter. Many of these guest experts were familiar faces to me. Their comments helped bring the trees back into view from the forest. Also included in each chapter is a short list of favorite books with a brief one-paragraph description. In acknowledgment to the 21st century, a list of web sites is included. Garden gear helpful to each particular chapter is highlighted. What this book doesn't try to be is an encyclopedia, to cover all information on a particular topic in one volume.

If you are a cut flower gardener and you have been doing it for years, then there is probably nothing new for you in this chapter. If, however, you are a novice in this area then the chart with the popular cut flowers listed along with their growth requirements and bloom times would be helpful as well as the tips on heat treatment, conditioning, and flower arranging. For those of us to whom container gardening is a foreign language, the charts on Optimum Container Volume and Depth along with the Suitability of Common Vegetables for Container Gardening would surely be helpful.

As I said before, the chapters are not designed to answer all your questions on a particular topic. What I found they did was to answer some of the basic questions I had. They gave me a good basis for getting involved in that aspect of gardening, and gave me enough information to get started. I was certainly not left hanging looking for more information. The list of favorite books and references gives me as much in-depth information as I could want. The chapters, I felt, were neither skimpy in their coverage of a topic nor were they overburdensome with information. They did a fine job of satisfying an initial curiosity and pointing one in the right direction for more in-depth study.

Though I have seen some books put out by service or product supply companies which have no qualms about touting their products, this book does not fall into that category. Though many of the pictures under the Garden Gear headings will look familiar to anyone who has received a Gardener's Supply catalog, other suppliers are mentioned. I know I will find many an opportunity to turn to this book. I will also use it to answer questions so I will appear to be the gardener who knows so much about so many things. A well-done effort by the authors.

Vegan Vegetarian Cooking
by Pam Rotella
Printed by Jumbo Jack's Cookbooks, Audubon Media Corporation, 301 Broadway, Audubon, IA 50025
134 pages, $9.95

review by Roberta McQuaid

The inspiration behind this wonderful little cookbook came from the author's brother: he asked her for an example of a health conscious cookbook and so she wrote one. Although the recipes are vegan, vegetarians and meat-eaters alike will find healthy new twists on old, not-so-healthy favorite recipes. As the owner of various cookbooks of this sort I found VEGAN VEGETARIAN COOKING to be particularly appealing because most ingredients are available at a local grocery store. Nothing is more frustrating than to spend more time searching for specialty items than to actually cook the meal. Also, some of the more trendy vegetarian cookbooks forgo the meat but not the fat or salt in their dishes. The recipes herein keep both to a minimum.

The author begins the book with a brief definition of veganism, and provides examples of how her health has improved since dropping meat from her diet. She is simple and to the point about it without making any arguments for conversion, arguments that may have clouded her real goal: to write a good cookbook. A discussion on fresh food, preparation and cooking techniques follows. The author does mention utilizing organic produce where available and searching out local markets for the freshest selections. She proceeds then to the fun part, the recipes!

The recipes are grouped in chapters by categories. The sandwich chapter is packed with interesting ideas for a healthy lunch, including six recipes for imitation hamburgers, one of the things new vegetarians seem to miss the most. The chapter on main dishes includes several Mexican-American entrees without all of the sour cream and cheese — tasty nevertheless. In the holiday section such favorites as pumpkin, apple, pecan, and kiwi lime pie are addressed along with the revered old standbys like mashed potatoes, roasted chestnuts, and stuffing. The salad chapter provides "a variety of salads- leaf, fruit, vegetable, pasta, potato, and green." Particularly appealing to me was the Horseradish Potato Salad, combining the potatoes and horseradish with tomatoes and beets. Yum! The longest chapter is devoted to soup, comfort food in our northern clime. Recipes are provided for legume, broth, tomato, potato, and onion based soups, all a bit easier to make than I ever thought possible. The part of this charming little cookbook that was indispensable for me, however, was the section on spreads, dips, sauces, and dressings. To think, recipes for hummus, salsa, guacamole, 'steak' and barbecue sauce all in one place!

The author has succeeded in her goal of writing a health conscious cookbook. She provides simple recipes for interesting eating, however you eat.

Straight Ahead Organic- A step-by-step guide to growing great vegetables in a less than perfect world
by Shepherd Ogden
published by Chelsea Green, PO Box 428, White River Junction, VT 05001
266 pages, $24.95

Review by Roberta McQuaid

Are you a novice gardener, or one with several years of experience under your belt? Perhaps you tend a postage-stamp size plot of vegetables or manage a hundred acre operation. Whatever your particular situation, Straight Ahead Organic is a worthy read. Shep Ogden's ties to the subject of organic gardening run deep.

His grandfather Sam Ogden was a pioneer in the organic movement, one of a group of authors sounding the alarm that nature's ties to farming and gardening would soon be destroyed by a dependency on chemical fertilizers. His contributions to Organic Gardening magazine and an updated version of an earlier book Step by Step Organic Vegetable Growing made him an inspiration to beginning gardeners. Shep does a terrific job of putting into print 50 years of their combined experience in a manner that expresses his enthusiasm for the subject as it teaches us its basic principles.

Nearly every imaginable topic related to organic vegetable growing is covered, from where to locate the garden, to which tools and equipment to use to cultivate it. Chapter 4, "Caring for the Soil" is especially helpful, giving gardeners a basic understanding of "feed the soil, let the soil feed the plant, and the plant will feed the human". If gardeners grasp the concept that indeed the soil is alive and must be nourished, choices they will make as organic gardeners will make sense.

Short sidebars in each chapter provide wonderful background information on such hot topics as genetic engineering, global warming, and use of pressure treated wood, giving gardeners a broader sense of their mission. These passages mix the author's own opinion and experience with documented research. Part of the reason I believe this book to be such a success is that it doesn't just teach you how to grow vegetables, it affirms your belief in the cause or may inspire you to take up the cause and go organic.

The last chapter is devoted to vegetable profiles, from asparagus to turnips and everything in between. Here again the information presented is invaluable. Each profile begins with roughly when and how to sow the seeds, continues with advice on cultivation, common pests and diseases. Tips for timely harvesting and choosing the varieties that best suit your needs is also included- the carrot Kuroda will surely earn a blue ribbon at the harvest festival, but Nutri-red is high in beta-carotene and best eaten cooked. It is in this section that the reader can take advantage of all the experience Shep has acquired as seedsman (he and his wife Ellen founded Cook's Garden Catalog.)

Straight-Ahead Organic is a wonderful resource, a wealth of information in print. Read it yourself and pass it on to a less experienced friend. They'll thank you for it.

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Calendar

Thursday, June 10: Choosing the Right Hay, evening workshop, Keene, NH ***for more info: 603-357-7278***

Thursday, June 24: Greenhouse and High Tunnel Tomatoes "twilight meeting", Post Mills, VT ***for more info: (802) 257-7967 or verng@sover.net***

Tuesday, July 13: Integrated Pest Management "twilight meeting", Starksboro, VT ***for more info: (802) 257-7967 or verng@sover.net***

Sunday, June 27 – Wednesday, June 30: Keys to the Secrets of Nature, workshop by Dennis Klocek & Gunther Hauk, Spring Valley, NY ***for more info: 914-352-5020 ext. 20***

Wednesday, July 28: Organic Raspberries and Blueberries "twilight meeting", Marlboro, VT ***for more info: (802) 257-7967 or verng@sover.net***

Monday, Aug. 2 – Friday, Aug. 6: Gardening with Children, workshop with Gunther Hauk, Spring Valley, NY ***for more info: 914-352-5020 ext. 20***

Monday, Aug. 2 – Sunday, Aug. 9: Kushi Institute Summer Conference, Westfield, MA ***for more info: 888-547-2663***

Friday, Aug. 13 – Sunday, Aug. 15: 25th NOFA Summer Conference, Hampshire College, Amherst, MA ***for more info: 978-355-2853***

Saturday, Sep. 4: Southern Vermont Garlic & Herb Festival, Wilmington, VT *for more info: 802-368-7147*

Tuesday, Sep. 14: Small-Scale Diversified Horticulture "twilight meeting", West Brattleboro, VT *for more info: (802) 257-7967 or verng@sover.net*

Saturday, Sep. 25: First Annual North Quabbin Garlic & Arts Festival, Orange, MA *for more info: 978-544-7564*

Thursday, Nov. 11 – Saturday, Nov. 13: Northeast CSA Conference, Tamiment, PA *for more info: 212-677-1602*

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You may join NOFA by joining one of the seven state chapters. Contact the person listed below for your state. Dues, which help pay for the important work of the organization, vary from chapter to chapter. Unless noted, membership includes a subscription to The Natural Farmer.

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New Hampshire: Individual: $25, Family: $35, Supporting: $100
c/o White Farm, 150 Clinton St., Concord, NH 03301

New Jersey: Individual: $35, family/organizational: $50, Business/Organization: $100, Low Income: $15* *does not include a subscription to The Natural Farmer 33 Titus Mill Road, Pennington, NJ 08534, (609) 737-6848

New York: Student and Senior (over 65): $15, Student and Senior Family (2 adults): $20, Individual: $25, Farm Listing: $30, 2 adult family: $30 (each additional adult, $5), Business: $35, Patron: $100, Corporate Sponsor: $500, Lifetime: $1000
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Confessions of a Bio-Control Producer

By Brian Spencer, Applied Bio-nomics, Ltd.

photo courtesy Brian Spencer

***Aphidoletes* larvae feeding on aphids**

Biological pest control using “beneficial insects and mites” has been around for thousands of years. The ancient Chinese used parasitic wasps as a biocontrol in their fruit orchards. It is an ancient art, intimately linked to agriculture itself. There is nothing “hi-tech” about it. The business does not need to involve genetic engineering or other controversial procedures. Biological pest control is just another name for “bug farming”.

In the beginning of the twentieth century, biological pest control was a thriving business. (I was recently talking with an older vegetable grower from the Fraser Valley, outside of Vancouver. He remembers waiting at the train station in New Westminster, B.C. with his father, in the 1920’s, for a shipment of parasitic wasps from Eastern Canada.) The development of organophosphate pesticides such as DDT around mid-century, however, lead to a virtual, overnight destruction of the industry. In the 1970’s, due to the development of resistant pests, pesticide overuse and growing public concerns over pesticides and their effects on the environment and humans, the ancient art of biological pest control, rose again, like the Phoenix, out of the ashes.

In 1978, Don Elliott became the first of many entomologists in Canada to advocate the use of biological pest control as an alternative to the use of toxic chemicals. Don, a school teacher by training, and then a forestry entomologist, was originally hired by Agriculture Canada to instruct the B.C. hothouse industry on the use of biological pest control. After a few years, it was apparent that there was a need for someone to produce the biocontrol agents. Ag Canada then offered Don and Marion, his wife and partner, some vacant greenhouses and sheds at their Saanichton site, and, in 1980, Applied Bio-nomics Ltd. was born. Today, 19 years later and armed with our mission statement: “To improve the quality and safety of agricultural products, for humans and the environment, through bio-logical solutions to pest control”, we are a world leader in biological pest control and have been the first to introduce many North American native biocontrols.

In 1989, Don and Marion sold shares of Applied Bio-nomics Ltd. to Plant Products Co. Ltd. and Westgro Sales. The resulting influx of capital allowed Don and Marion to expand the business on our current 5 acre site in North Saanich. Today, we have a staff of 13 full time employees and 8 part time students working in 23 separate greenhouses and numerous outbuildings.

The growth of the new biocontrol industry can be linked to many events. As a true believer in the importance of biological pest control, I would like to believe that the growth started with “Silent Spring” and grew as more concerns about pesticides were realized. But, sadly, that is not the case. In almost every situation, growth in our industry can be directly linked to either the banning of certain chemicals, the publicized poisoning of people or animals, or government regulations designed to protect the environment or workers. The most recent quantum leap in usage came immediately after the worker protection laws were passed a few years ago. Few farmers can afford to be proactive in this economic climate.

Today, in North America, the bulk of the biocontrol industry is made up of numerous, small, family-sized businesses. The constant threat of new and better chemicals with the potential effectiveness of DDT has restricted expansion. The largest insectories are all either European owned, or subsidiaries of European multinationals who produce agricultural chemicals. Recently, the term, “Bio-technology”, has been in vogue within the agricultural community. The biocontrol industry was immediately thrown into this category. Initially, it was exciting to be considered part of the bio-technology field — our banks suddenly showed some interest in us, politicians began to return our phone calls, and we were the life of the party, instead of just the farmers who grow bugs. As the “bio-technology” bandwagon got bigger and bigger, large multinationals embraced the concept, genetic engineering jumped on, and away we went.

About two years ago, however, Applied Bio-nomics Ltd. jumped off the “bio-technology” bandwagon. The decision was made when we had to decide whether or not to support research into a genetic marker for one of our licensed insects. We at Applied Bio-nomics Ltd. are very concerned about genetic engineering, and believe that it may lead to unprecedented hardships for our planet.

Jumping off the bandwagon was a lot harder than we thought. It was moving at quite a speed. I cannot begin to tell you how many databases we have attempted to get out of, usually with less than satisfying results. We are now trying to get far away from this new “Pandora’s Box”, before our fears are realized. While most of our business is currently with the large, commercial greenhouse ranges, we are always aware that new chemicals will be embraced as they arrive on the market place. Over the past 10 years, we have seen our sales of specific biocontrols fluctuate in direct correlation with the introduction of new pesticides. The good news, for us at least, is that the incidence of insect resistance to pesticides is high, and few chemicals can make it through 5 years before resistance is common. We believe that eventually our core business will come from the “sustainable agriculture” movement. Our biggest challenge with many of the practitioners of the “organic” movement is to convince them that we never enjoyed our ride on the “Bio-technology” bandwagon. Our presence on numerous “Bio-technology” databases has many of them very concerned.

Producing biological controls is a rewarding, but frustrating, business. No one is in it for only the money. In fact, very few biocontrols would be developed at all if it weren’t for direct or indirect government assistance, through tax relief, direct grants, fundamental research (eg. Ag Canada and the USDA), and grower-directed research support.

The development of a typical biocontrol is a slow, expensive task. Usually, government researchers in the U.S., Canada, Holland, or England identify a natural enemy of a specific pest or general class of pest. In most cases, with the cooperation of at least one commercial insectory, the government researchers go to the next stage, rearing small quantities of the predator or parasite in order to prove its effectiveness. Successful early trials are what start the ball rolling. Commercial insectories usually pick it up at this point by either reading the publication, entering into a licensing arrangement with the government or university, or by hiring the researcher.

Once the natural enemy is identified and a rearing concept is in place, typically a five year research and commercial development process begins. We have never been able to take a researcher’s rearing process and expand it into a commercial system. The needs of the researcher are considerably different from ours. In small, cage type cultures, the cost of each organism actually produced (as true surplus) is seldom under $1.00 each. Labour is always the most significant cost, although the overhead costs of building, maintaining, and heating a greenhouse cannot be ignored.

As our knowledge and experience increases with the product, we sometimes find that a somewhat regular supply is the result. At this point, field trials must begin. Our field trials are both research and marketing oriented — we need to be able to tell our customers the quantity needed, what the timing and strategies are for introductions, and, ultimately, whether it works well, somewhat, or not at all, and what pesticides can and cannot be used with it.

Application rates and introduction strategies are always a compromise. If insectories had unlimited production and were able to sell the products at extremely low prices, you would buy biocontrols much the same way you can now buy chemical pesticides, that is, in large quantities, as a cure. The reality is, however, that biocontrols are expensive to produce and therefore purchase, and large quantities of surplus biocontrols are rare due to extremely short shelf lives and the typical patterns of demand.
As a general rule, the higher lifeforms (from our perspective) cost more to produce. Beetles require more space and food than mites do. A lot of current research is into artificial diets. As artificial diets are developed, the cost, and availability of many biocontrols will be improved.

Currently, commercial insectories need to rear and maintain large, pure cultures of the target pest. Many growers have found that it can be easy to rear their own beneficials and effectively apply them to their crops, but the real challenge for the commercial insectory is in providing continuous, large quantities of the target pest.

A few years ago, a government researcher in Ontario, Canada published an article that very clearly and efficiently described how anyone could rear *cucumeris*, a predatory mite used mostly against thrips. The article immediately caused a great amount of discussion, with the growers holding it up as proof that the biocontrol producers were charging too much, and the biocontrol producers upset that a government researcher would take such an approach. Our response was to produce a kit, exactly as described in the article. We priced it at the current rate for *cucumeris* plus the cost of the “Rubbermaid” bin, the mixing spoons, and the other equipment. The “kit” hit the market at the beginning of the *cucumeris* season, December, and we sold five of them. The five

growers all had immediate success and quickly doubled their culture, but two weeks later the growers suddenly realized that they needed more food for the culture. They were shocked to find that the cost of the grain mites, which is an alternate food for *cucumeris*, was actually more than the *cucumeris* themselves. By the end of the month we had received back all five of the rearing "kits" and given the customers back their money. None of these local growers complain much about the price of *cucumeris* anymore.

Few farmers are sympathetic to us when we lament about how hard it is to produce large quantities of Whitefly during the winter months, or when the Aphids decide not to reproduce at logarithmic rates in the fall. Most large scale, commercial crashes are due to the pest failing in some way. On our site, we have specific areas of exclusion. Some of our staff cannot have coffee or lunch together in order to prevent contamination. In some sensitive systems, staff have to freeze their clothes during the day as an added defense. Under no circumstance do we allow our spider mite staff to get close to our *P. persimilis* staff, and no one has seen our *A. fallacis* rearer for the past six months.

Many of our products are native to our region. As a result, they tend to have a winter survival skill called diapause. Diapause is different for all organisms, but it can be generally described as a hibernation at one particular stage in the lifecycle during low temperatures, low light intensity and duration, or, as is usual, a combination of all three. In order to maintain or commercially produce diapausing organisms during the winter, high levels of heat and light are required which significantly adds to the cost of production and also increases the chance of system crashes if power outages occur.

Perhaps the greatest challenge to our industry is the need for consistency. Producing 50 weeks of a biocontrol just doesn't cut it! The two weeks that you are out are usually when someone, if not everyone, desperately needs them. Additionally, when there is high demand for a product, everyone producing it is usually at, or near, full capacity. If one of the producers has a crash, the added demand placed on the others usually causes subsequent production difficulties, if not complete crashes.

Biological pest control is an eloquent system. Growers who have had experience with it quickly become at ease with its concepts and practices. There are times when I feel like a confidence trickster or a faith healer. In some cases the bugs that we sell may have little effect. But even in those cases, positive effects and cures are seen. This is because the act of accepting biocontrol has positive effects. When growers decide to switch to biocontrol, the first thing that happens is they stop spraying. In many cases, this first step is all that is needed. Almost immediately, natural predators and parasites will re-enter the garden or farm. Ladybugs and lacewings will be easily seen within one week of the change (unless you used something really bad). Being nomads, they will move throughout your site, laying eggs whenever they stop to feed. They will move on when they have had their fill, always leaving some pests behind, so their offspring will not starve.

This brings us to a fundamental point that must be embraced if you are going to be successful with biocontrols; the presence of the pest is essential. Predators and parasites only work if there is prey available. What we are really trying to achieve is a balance. This balance is not hard to reach, it is in fact, "nature's default". The important question, for you, is; how can you stay in balance and economically farm? If you have healthy plants, you will find that the balance point is within your grasp. The act of stopping the chemicals also stops the chemical injury to the plants.

Ongoing research in Holland is showing that plants in an IPM program (an integration of biological controls with "friendlier chemicals" and improved monitoring) are 15% larger than average. In Alberta, research on cucumbers showed a 20% increase in yield. Healthier plants can fight off pests better. There is growing evidence that pests can actually sense weak plants. In our scheme of things, this is where the biocontrol supplier comes into the picture. If the pendulum is too far in favour of the pest, a commercial biocontrol will supplement the natural controls. In most cases, we recommend a control that is native to your area. These controls are proven performers and will establish in your area, usually permanently. Exotic imports sometimes work faster, but usually don't give you the long-term, cost effective control that you need.

photo courtesy Brian Spencer

Distributing Thrips control - *N. cucumeris*

When a grower comes to us with a pest problem, we usually have a completely different reaction to the problem. When we see Aphids completely covering the tips of young plants, our first reaction is: wow, there sure is a lot of food here for our *Aphidoletes*, this customer will have so many *Aphidoletes* in his greenhouse that he may start to sell them on his own. Typically, there is about a two week lag from the introduction of a predator and the expected control. If you can't afford to be patient, you have a number of options. First; you can spend more time scouting for pests. This is best done with a regular wander throughout the crop. Your experience as a grower will tell you when the pests usually start to show up, but here are a few "rules of thumb".

Spider mites like it hot and dry, if they were a pest last fall, they will have overwintered in, on, or under your structures and will surely return. The bigger the numbers, the longer the period of re-introduction. Hibernating Spider Mites develop a "red phase". The "red phase" typically occurs immediately prior to their hibernation. When the spider mites are red phased, *P. persimilis* does not like to eat them, they are extremely resistant to chemical controls, and many people mistake them for *P. persimilis*. In the spring, the red phased mites come out of the woodwork, to reinfest your crop. Look for spider mites first around the perimeter of your crop, or close to support posts, or any other object that would serve as an overwintering site or a channel for them to move on. All things being equal, look for spider mites to develop in an area where there is a wind or directed fan. The low humidity created by the air movement creates a perfect microclimate.

Aphids can occur at any time. During non-ideal conditions, aphids will develop wings. When the conditions are to the aphids' liking, they loose their wings and multiply asexually, as clones. In this state they can reproduce at incredible rates, and are typically seen in clusters. The presence of ants is a reliable indicator that aphids are active. Ants "farm" the aphids for their sweet excrement known as "honeydew". If you want to get rid of the aphids, you will have to deal with the ants first. We have been witness to ants actively defending aphids by attacking the parasitic wasp, *Aphidius*, and we have seen ants carrying away *Aphidoletes* larvae.

Perhaps the best tool that you can use for early identification of pests such as aphids, whitefly, and thrips is the yellow, sticky card. Regular monitoring of the yellow cards will tell you when the pest first arrives, and give you an indication of the quantity you can expect.

The second thing that you can do, if you can't afford to be patient, is to shift the balance away from the pest. As we have discussed, spider mites like it hot and dry. If you want to make it hard on the spider mites, shift the conditions. Turn off that fan, or redirect it away from the plants. Raise your humidity by misting or flooding the floor. Make sure that the plants are well fed and growing actively. At the plant level, carefully remove the dripping spider mites with a moist paper towel and then burn it! Soap sprays can have a very positive effect at this stage. Make sure that your employees work in the known infested areas at the end of their shift and exit directly in the shortest possible route. Do your clean-up early in the fall, BEFORE you drop the temperature. This will prevent the red phase from developing and not allow the mites time to prepare for your assault. Carefully remove the old plants and use physical barriers such as tanglefoot on posts, or introduce soil level predators such as Hypoaspis mites to feed on the escaping spider mites. Aphids love lush, soft growth. A well-balanced feeding program will reduce the conditions for aphid explosions.

Biocontrols work best after you have completed the above steps. As a general rule, predators work faster than parasites. Usually parasites are used as a preventive step. In the case of whitefly, the parasite *Encarsia formosa* is a proven performer. It works best when regularly released on a continual basis. Every year, at the end of the season, we go out and do a survey of some of our growers. In all of the years that we have been doing this, we rarely find a situation where the regular release program does not result in excellent control throughout the growing season. Invariably, the problems that did occur were due to a delay in the implementation of the program, or a cessation of the program because the pest level appeared too low. Outbreaks of whitefly can be dealt with by the use of predators such as the beetle *Delphastus*. *Delphastus* are tiny black beetles that prefer to feed on whitefly eggs, but also feed on all stages and do not feed on *Encarsia* parasitized scale. Obvious reductions in whitefly numbers will occur only as the adults die off, which is usually in about four weeks.

Thrips are a real challenge. These tiny, fast insects, can cause incredible damage to crops at very low levels. One bite on an orchid bud can translate right through to the flower, with devastating results. To make matters worse, many thrips have complicated lifecycles which make it very hard to focus on a single cure. The western flower thrip lays its' eggs into the leaf tissue, therefore, hiding it from foraging predators. The larvae are quick moving and typically wedge themselves deep into flowers or open buds. In their final pupation, they leave the plant (and the predators) and bury themselves in the soil. Preventative physical controls are all but useless on thrips. A screen tight enough to contain thrips will not allow enough air through it to be useful. There is evidence that screens of any size may have some positive effect, perhaps they visually form a barrier. Fortunately, there are numerous thrips predators that can provide most of you with economical and effective control. *A. cucumeris* is a very inexpensive but effective predator. Regular applications of *A. cucumeris* will usually prevent thrips from getting out of hand. The predatory bug, Orius is native to all of North America and also performs well against thrips. A new predator called *I. Degenerans* provides good thrips control on crops that produce pollen, which it consumes as an alternate food source.

Large pests such as caterpillars and lygus bugs are usually controlled by parasites and birds. While parasites do exist for these larger pests, they are usually too slow to act to prevent significant damage. In Holland, there is research currently being conducted using small insect feeding birds in the greenhouses. The results to date are very positive. Fortunately, moths and lygus bugs are large and easily controlled by inexpensive, wide mesh netting or screens.

There is no doubt that the hardest part of using biocontrols is in the beginning. Just like being told to steer into a skid, or swim with the current, it goes against our basic instincts to embrace a pest infestation. For some crops, biological controls may be impractical. For most crops however, beneficial insect predators and parasites are very logical, bio-logical, in fact.

Summer 1999

photo by Jack Kittredge

Gordon Bemis, of Hutchins Farm, hangs cards containing *Encarsia formosa* eggcases among the tomatoes in his greenhouse in Concord, MA. The *encarsia* will hatch and parasitize whiteflies in the greenhouse.

News, features & articles about organic growing in the Northeast, plus a Special Supplement on

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