Neonicotinoid Insecticides and Honeybee Problems

Several possible causes of the ongoing demise of honeybees have been suggested, but there has been little agreement among experts about the relative importance of those causes. Exposure of bees to neonicotinoid insecticides keeps coming up, most recently in a study conducted in Indiana. Below is a report on that study, excerpted from a Purdue University news release dated January 11, 2012, written by Brian Wallheimer.

Honeybee populations have been in serious decline for years, and Purdue University scientists might have identified one of the factors that cause bee deaths around agricultural fields.

Analyses of bees found dead in and around hives from several apiaries over two years in Indiana showed the presence of neonicotinoid insecticides, which are commonly used to coat corn and soybean seeds before planting. The research showed that those insecticides were present at high concentrations in waste talc that is exhausted from farm machinery during planting.

The insecticides clothianidin and thiamethoxam were also found at low levels in the soil—up to two years after treated seed was planted—on nearby dandelion flowers and in corn pollen gathered by the bees, according to the findings released in the [online] journal *PLoS One* this month.

“We know that these insecticides are highly toxic to bees; we found them in each sample of dead and dying bees,” said Christian Krupke, associate professor of entomology and a co-author of the findings.

The United States is losing about one-third of its honeybees each year, according to Greg Hunt, a Purdue professor of behavioral genetics, honeybee specialist, and co-author of the findings. Hunt said no one factor is to blame, though scientists believe that others, such as mites and insecticides, are all working against the bees...

“Like death by a thousand cuts for these bees,” Hunt said.

Krupke and Hunt reported that bee deaths in 2010 and 2011 were occurring at planting time in hives near agricultural fields. Toxicological screenings performed by Brian Eitzer, a co-author of the study from the Connecticut Agricultural Experiment Station, for an array of pesticides showed that the neonicotinoids used to treat corn and soybean seed were present in each sample of affected bees. Krupke said other bees at those hives exhibited tremors, uncoordinated movement, and convulsions, all signs of insecticide poisoning.

Seeds of most annual crops are coated with neonicotinoid insecticides for protection after planting. All corn seed and about half of all soybean seed is treated. The coatings are sticky, and in order to keep seeds flowing freely in the vacuum systems used in planters, they are mixed with talc. Excess talc: used in the process is released during planting and routine planter cleaning procedures.

“Given the rates of corn planting and talc usage, we are blowing large amounts of contaminated talc into the environment. The dust is quite light and appears to be quite mobile,” Krupke said.

Krupke said the corn pollen that bees were bringing back to hives later in the year tested positive for neonicotinoids at levels roughly below 100 parts per billion.

“That’s enough to kill bees if sufficient amounts are consumed, but it is not acutely toxic,” he said.

On the other hand, the exhausted talc showed extremely high levels of the insecticides—up to about 700,000 times the lethal contact dose for a bee.

“Whatever was on the seed was being exhausted into the environment,” Krupke said. “This material is so concentrated that even small amounts landing on flowering plants around a field can kill foragers or be transported to the hive in contaminated pollen. This might be why we found these insecticides in pollen that the bees had collected and brought back to their hives.”

Krupke suggested that efforts could be made to limit or eliminate talc emissions during planting.

“That’s the first target for corrective action,” he said. “It stands out as being an enormous source of potential environmental contamination, not just for honeybees, but for any insects living in or near these fields. The fact that these compounds can persist for months or years means that plants growing in these soils can take up these compounds in leaf tissue or pollen.”

Although corn and soybean production does not require insect pollinators, that is not the case for most plants that provide food. Krupke said protecting bees benefits agriculture, since most fruit, nut, and vegetable crops depend upon honeybees for pollination. The U.S. Department of Agriculture estimates the value of honeybees to commercial agriculture at $15 billion to $20 billion annually.

Hunt said he would continue to study the sublethal effects of neonicotinoids. He said for bees that do not die from the insecticide there could be other effects, such as loss of homing ability or less resistance to disease or mites.

“I think we need to stop and try to understand the risks associated with these insecticides,” Hunt said...
Burpee Home Gardens® “High-Nutrition” Vegetables

This spring, the Ball Horticultural Company is distributing a retail line of “high-nutrition” vegetable plants with the Burpee Home Gardens® brand name. The “BOOST Antioxidant Collection” includes the following varieties containing higher concentrations of certain nutrients than “other home garden varieties” in trials conducted by BHC.

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Variety</th>
<th>Nutrient concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>cucumber</td>
<td>‘Gold Standard’</td>
<td>500% more beta carotene</td>
</tr>
<tr>
<td>pepper</td>
<td>‘Sweet Heat’</td>
<td>65% more vitamin C</td>
</tr>
<tr>
<td>salad mix</td>
<td>“Healing Hands”</td>
<td>20% more lutein</td>
</tr>
<tr>
<td>tomato</td>
<td>‘Power Pops’</td>
<td>40% more lycopene</td>
</tr>
<tr>
<td>tomato</td>
<td>‘Solar Power’</td>
<td>300% more beta carotene</td>
</tr>
</tbody>
</table>

An ad for the Collection in a green industry trade journal reads as follows: “BOOST meets consumers’ craving for higher nutrition ... has built-in marketing ... and will build the biggest buzz in vegetable gardening in years!” Hyperbole aside, we are happy to see nutrition finally being touted after a long history of appearance and taste being the primary qualities referred to in the marketing of vegetable bedding plants. It will be interesting to see whether the BOOST collection is successful with consumers. For more information, visit http://ballhort.com.

Also of note: a “No GMO” symbol is prominently displayed in the BOOST Collection advertisement.

New Guides for Vegetable Growers

University of California’s Division of Agriculture and Natural Resources recently published two books to aid vegetable growers. From DANR descriptions of the books:

Cover Cropping for Vegetable Production is perhaps the most comprehensive science-based book on cover cropping available to growers, while Organic Vegetable Production Manual provides detailed information on how to farm vegetables organically, addressing the essential topics for success ...

... The [cover cropping] handbook describes primary cover crop species and includes photos, seeding details, winter vigor descriptions, [and information on] nitrogen fixation and scavenging, weed suppression, and nematode resistance.

Organic Vegetable Production is a valuable resource for established organic farmers and a must-read for those considering organic practices. Chapters cover a range of topics, including business and marketing plans, economic performance, soil fertility management, managing weeds and diseases, postharvest handling, and organic certification and registration in California.

The list price of Cover Cropping for Vegetable Production (ANR Publication #3517) is $25.00; the list price for Organic Vegetable Production Manual (ANR Publication #3509) is also $25.00. To order, call 800-994-8849 or 510-665-2195 or visit the web site http://anrcatalog.ucdavis.edu.

Green Times (for the Northwest)

Washington State University’s College of Agricultural, Human, and Natural Resources has started publishing a free monthly electronic newsletter, Green Times, devoted to organic/sustainable growing. To start a subscription to the newsletter, visit the web site http://bit.ly/greentimes. From a WSU news release dated November 1, 2011:

Dan Bernardo, dean of CAHNRS, said the new publication would fill an important niche in the regional agricultural community by publishing current research news and profiles of farmers and other regional industry professionals, publicizing events, and acting as a focal point for the burgeoning regional organic community....

WSU was the first university in the United States to offer a science-based, four-year major in organic agriculture. WSU also developed the first online certificate program in organic agriculture, enabling food-system professionals to retool their skills to meet the demands of a changing and growing market for organic food...

Taking Thousand Cankers Disease Very Seriously in Ohio

Ohio State University Extension, Ohio Division of Forestry, and Ohio Department of Agriculture recently co-produced a wallet-size card showing the symptoms of thousand cankers disease (TCD) of walnuts, even though the disease has not yet been identified in Ohio. With an estimated $1.2 billion worth of black walnut timber in Ohio, and reports of TCD in Tennessee, Virginia, and eastern Pennsylvania, Ohio state officials are trying to make sure of a rapid response if and when TCD arrives.

TCD is due to the fungus Geosmithia morbida, which is spread by walnut twig beetles. Until recently, the disease was a problem only in the West, where it resulted in the deaths of many imported eastern black walnut trees. Persian (English), Arizona, and California walnuts can also be adversely affected by the fungus. To learn more, visit www.thousandcankers.com.

Recommended for the South: Louisiana Super Plants

Recommendations of the Louisiana Super Plants program, which began in fall 2010, are made by a committee of Louisiana State University AgCenter personnel. Each Super Plant has been subjected to “at least two years of rigorous evaluations and ... [has] a proven track record under north and south Louisiana growing conditions. Louisiana Super Plants must prove hardy across the state....[They] must be easily produced and available for all nursery and landscape industry wholesalers and retailers to market and sell.” The final selections are made “based on observations made in replicated plots and demonstration trials across the state.”

Here is a complete list of all Louisiana Super Plants chosen to date:

- **Fall 2010:**
  - ‘Amazon’ series dianthus
  - ‘Camelot’ series foxglove
  - ‘Bishi Gashira’ camellia

- **Spring 2011:**
  - ‘Serenia’ series angelonia
  - ‘Butterfly’ series pentas
  - ‘Shosu Creek’ vitex
  - ‘Footproof’ gardenia

- **Fall 2011:**
  - ‘Swan’ series columbine
  - ‘Redbor’ kale
  - ‘Shiloh’s Dream’ rose
  - southern sugar maple
Removal of Lead from Soil by Plants

Researchers have used a field farm in Nova Scotia contaminated by lead due to applications of lead arsenate insecticide to determine the potential of various plants for removing lead from soil. The field’s lead concentration is around 100 parts per million (ppm), whereas the typical lead concentrations in farm fields range from five to 30 ppm. The researchers tested 10 plant species, including several economically valuable plants that are related to wild plants already known to have potential as efficient removers of lead from soil: Alyssum (Alyssum maritimum subsp. Benthamii, synon.-Ludalaria maritime), Black mustard (Brassica nigra), clary sage (Salvia sclarea), garden sage (Salvia officinalis), Indian mustard (Brassica juncea), Swiss chard (Beta vulgaris), thorn apple (Datura innoxia), white mustard (Sinapsis alba) and Glaucium flavum, and zonal geranium (Pelargonium × hortorum).

All of the species were direct-seeded individually in pots containing soil from the lead-contaminated field, then thinned to the same number of seedlings in each pot. Soluble NPK fertilizer was applied. Aboveground parts of all plants were harvested 78 days after seeding. Highest lead concentrations at harvest were found in clary sage, Alyssum, and white mustard; lowest accumulations were found in Swiss chard, thorn apple, and geranium. The researchers rated clary sage, Alyssum, and Indian mustard as having the greatest potential for lead phyto-remediation.

Reference: Regina Bracy, Allen D. Owings, and Dan Gill, “Super Plants: Boost Louisiana Economy,” Louisiana Agriculture 54(2), Summer 2011, 24-25. (Louisiana Agricultural Experiment Station, P.O. Box 25100, Baton Rouge, LA 70894-5100.)

Guide to Growing American Chestnuts

That’s not a misprint. There are now enough starts of the native American chestnut (Castanea dentata)—which was almost entirely wiped out by blight—becoming available from The American Chestnut Foundation, 160 Zillicoa St., Suite D, Asheville, NC 28801, to warrant publication of a primer on how to plant and care for them.

The following is excerpted from “Urban Horticulture: Reconnecting People and Their Landscapes,” by Judy Scott, which originally appeared in the Fall 2011 issue of Oregon’s Agricultural Progress, published by Oregon State University, Agricultural Experiment Station, 422 Kerr Administration Bldg., Corvallis, OR 97331-2199.

Urban Horticulture for the 21st Century in Oregon

The following is excerpted from “Urban Horticulture: Reconnecting People and Their Landscapes,” by Judy Scott, which originally appeared in the Fall 2011 issue of Oregon’s Agricultural Progress, published by Oregon State University, Agricultural Experiment Station, 422 Kerr Administration Bldg., Corvallis, OR 97331-2199.

We expect today’s urban landscapes to do more than what was asked of victory gardens or back-to-nature lifestyles decades ago. City plants must flourish without chemicals or additional water; squeeze into small spaces, feed the hungry, and soften the edges of concrete and asphalt.

Terry Moore’s urban horticulture story began eight years ago on Olson Rd. in Garden Home, a Portland suburb where she lives. “Olson Rd. was to be widened and 450 trees cut down,” she said, “and there was nothing we could do about it.” The street was slated to become a three-lane truck route, bringing more traffic and exhaust to the three neighborhoods it connects.

Although the trees would have to come down and the street widened, the Garden Home Crossing Committee requested flowers and shrubs, not asphalt and concrete, in the new medians and public right-of-way. The manager of the Olson project offered to work with the Garden Home community, but they would have to contribute time and money to create the landscape.

Planners started ringing, and soon neighbors were organizing to buy plants, raise money to put in irrigation, and do the work. The Oregon State University Extension office in Washington County helped with funding under an agreement with the county. OSU Master Gardeners Mary Reece and Sally McCormick advised how to design the gardens with native plants that could thrive in Portland weather.

Shay proved effective at “pull and destroy” against blackberry and English ivy. It was a community adventure. The daffodils and flowering bushes are now well established in flowerbeds along Olson Rd., tended throughout the year by volunteers. “So often people build a fence against the street and live behind it,” Moore said. “This street connects me with the people of my community, and the landscaping creates a safer street.”

Urban horticulture is redefining the relationship of people and landscapes, and OSU’s new Oak Creek Center for Urban Horticulture is helping prepare students for this growing market...

[For the Center,]... students and volunteers help produce under three greenhouses-like high tunnels, donating boxes of fruits and vegetables to the Linn Benton Food Share throughout the season. “Students who have never worked in a garden get to experiment with their own plots and greenhouse space,” said Oak Creek manager Al Shy.

It’s also a place to test new urban landscapes, such as the vertical garden Shay is developing for places that lack much horizontal ground... He’s also developing a “green tower,” with seven times more planting space than its footprint, ideal for small backyards in urban areas (to learn more, visit http://groups.hort.oregonstate.edu/ocucc).
Boxwood Blight Alert

The following is excerpted from an e-mail we received last month from Ellen Weeks, University of Massachusetts Extension Landscape, Nursery, and Urban Forestry Program, French Hall, 230 Stoddard Rd., Amherst, MA 01003.

In December 2011, the UMass Extension Plant Diagnostic Lab working with samples collected by Massachusetts Department of Agricultural Resources (MDAR) inspectors positively identified boxwood blight (Cylindrocladium pseudonaviculatum) in Massachusetts. Beginning in early December, MDAR inspectors performed traceback surveys of nurseries and garden centers identified by U.S.D.A. APHIS PPQ as having received boxwood plants from nurseries in Connecticut known to have some boxwood blight-infected plants.

In the mid-1990s, plant pathologists in the United Kingdom first identified the fungal disease. By 2002, boxwood blight was present in New Zealand. How the fungus arrived in the United States is unclear, but within the last year, it has turned up in Virginia, North Carolina, and Connecticut landscapes, garden centers, and nurseries. The most susceptible ... appear to be English (Buxus sempervirens) ‘Suffruticosa’ and American or common boxwood (B. sempervirens), although many ... are susceptible to infection. Asymptomatic but infected plants of resistant varieties can introduce this pathogen to unaffected areas. The fungus colonizes all aboveground portions of the plant.

The most susceptible European boxwood varieties include “Green Mountain,” “Green Tower,” “Green Tower Variegated,” “Green Tower Pagoda,” and “Elegantissima.” Asymptomatic but infected plants of resistant varieties can introduce this pathogen to unaffected areas. The fungus colonizes all aboveground portions of the plant.

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Boxwood Blight is a fungal disease that affects boxwood. Symptoms of boxwood blight include leaf spots. Infected leaves then turn brown-tan, which is often the first symptom observed. As the disease progresses, plants may become defoliated and die. Infected boxwood blights are easily identified by their distinct leaf spots. The fungus colonizes all aboveground portions of the plant.

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Initial symptoms appear as dark- or light-brown circular leaf spots. Infected leaves then turn brown-tan, which is rapidly followed by defoliation. In addition, black lesions often develop on twigs and stems. Plants are not killed by this disease but become so defoliated as to be aesthetically unacceptable. Infected plants introduced into older, well-established plantings will rapidly spread the disease. This disease is spread primarily by water (rain splash, irrigation, runoff, etc.) and by the movement of plant material in the trade. The best management strategy at this point, before more is known about this pathogen, is to not introduce any boxwoods from unverified sources into either the nursery or the landscape.

Winter “Microgardening” Indoors

Below is a recent Mississippi State University news release written by Dr. Gary Bachman (phone 228-546-1099).

Winter can be hard on avid gardeners because cold temperatures prohibit many gardening activities. They might become bored, restless, and perhaps even show irritation at the slightest annoyance. These are classic symptoms of gardening cabin fever. For the active gardener, it only gets worse when all those [seed and plant] catalogs start arriving.

A simple cure is to bring the garden indoors until spring arrives. Many of those incoming catalogs offer indoor gardening options that border on the extravagant, with fancy grow lights, recirculating pumps, and special growing pods. But an indoor garden can be as simple as some fresh microgreens on the windowsill in a pot. In fact, having a microgreens garden in the winter is the perfect way to satify the need to garden and to have delicious and nutritious salads at the same time.

Microgreens are colorful and take as few as seven days to produce a wonderful addition to the dinner table. Asian greens such as bok choy, cole crops such as cabbage or broccoli, or foliage of carrots, radishes, Swiss chard, or beets are often used.
More Bugs after an Unusually Warm Winter? Maybe Not!

HORTIDEAS, February 2012, and diseases can play a larger role than temperatures as populations. Natural events can also have significant effects on insect likelihood to be affected by the fluctuations of weather. Various

The seeds will start to germinate after a couple of days, and most greens will be ready to start harvesting after seven days. Some microgreens, such as beets or basil, take 21 days before they are ready to harvest. Sow seeds weekly to ensure a steady supply of microgreens and to keep your food free of cabin fever. The best way to water your microgreens is to place the container in a saucer, add water to the saucer, and let plants soak up water from the bottom. Because the plants are small, sprawling from the top will beat them down. If you plan to grow more than just a few containers over the winter, consider ordering your seed in bulk quantities to save money. However, buying individual packets from a garden center is a great way to try a variety of microgreens.

So, if you are exhibiting any of the symptoms of gardening cabin fever, try growing some of these fresh microgreens indoors. Not only will you scratch that gardening itch, but you’ll have some tasty salads this winter, too.

More Bugs after an Unusually Warm Winter? Maybe Not!

Researchers have successfully utilized certain wetland plants to take up excess nitrogen and phosphorus (from fertilizer applied to farm fields, garden plots, and turfgrass) in stormwater runoff, thus reducing pollution of streams and rivers. But the plants proven to be effective are generally not readily available to homeowners who want to reduce pollution from their yards and gardens. Recently, experiments conducted at the Louisiana State University’s Hammond Research Station have identified some common ornamentals that are efficient removers of nitrogen and phosphorus from nutrient-polluted water. The ornamentals in the experiments were Australia canna, ‘Golden Fleece’ iris, calla lily, and dwarf papyrus; their performance was compared to that of wetland plants arrow arum, picklecreeve, and bulleugou arrowhead. The table below shows the average results for six experiments, each of which ran for approximately two months and used water polluted with 11.3 parts per million of nitrogen and 3.1 parts per million of phosphorus.

| Plant Total water nutrient reduction uptake (gallons) in water (%) nitrogen phosphorus
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia canna</td>
<td>157</td>
</tr>
<tr>
<td>‘Golden Fleece’ iris</td>
<td>27</td>
</tr>
<tr>
<td>calla lily</td>
<td>30</td>
</tr>
<tr>
<td>dwarf papyrus</td>
<td>74</td>
</tr>
<tr>
<td>arrow arum</td>
<td>34</td>
</tr>
<tr>
<td>picklecreeve</td>
<td>117</td>
</tr>
<tr>
<td>bulleugou arrowhead</td>
<td>78</td>
</tr>
</tbody>
</table>

As shown in the table, the best-performing ornamentals were Australia canna and dwarf papyrus. Both of these and the three wetland plant species were planted in floating islands in a stormwater retention pond. Results suggest that when ornamental plants are used for water treatment, the benefits can be both aesthetic and environmental. The floating systems increased mitigation capacity and provided efficient nitrogen and phosphorus removal for this small treatment structure.

The researchers who conducted these experiments recommend canna as a fertilizer pollution mitigation plant “in urban stormwater treatment areas such as vegetation ponds, constructed wetlands, and vegetated waterways. Canna is a noninvasive perennial plant adaptive to wide soil and water conditions. It allocates the majority of its biomass to shoots. It can be harvested regularly and offers consistent removal of biomass along with nitrogen and phosphorus from the treatment system.”

Reference: Van Chen and Regina Bracy; “Plants Remove Nutrients from Runoff,” Louisiana Agriculture 54(4), Fall 2011, 20-21. (Louisiana Agricultural Experiment Station, P.O. Box 25100, Baton Rouge, LA 70894-5100.)
A Link between Fertilization and Pest Susceptibility

The following is excerpted from “Fertilization Affects Constitutive and Wound-Induced Chemical Defenses in Gerbera jamesonii,” by James D. Spiers (Dept. of Horticulture, Auburn University, Auburn, AL 36849), Fred T. Davies, Jr., Chuanjiu He, Terri W. Starman, Scott A. Finlayson, Scott A. Senseny, and Kevin M. Heinz, Journal of Environmental Horticulture 29(4), December 2011, 180-184, published by the Horticultural Research Institute, 1000 Vermont Ave., Suite 300, Washington, DC 20005.

Significance to the nursery industry

Many studies have shown that altering host plant fertilization affects insect feeding and fecundity, however the reason(s) for this is poorly understood. Phenolic compounds have been identified as a group of chemicals closely associated with insect-plant interactions, and a higher phenolic content typically exhibits a negative effect on insect feeding. Additionally, accumulation of jasmonic acid and the subsequent effect as a deterrent to insect feeding is well documented. This research shows that total phenolic and jasmonic acid [JA] content of foliage is affected by fertilization, and low fertility gerbera plants have greater concentrations of these chemical defenses. A basic understanding of the effects of cultural practices such as fertilization on general foliar chemistry of plants will help provide explanations for insect pest outbreaks, and potentially provide mechanisms for enhancing host plant resistance and reducing insecticide applications. This is the first study to evaluate relationships between fertilization and chemical defenses in an ornamental greenhouse crop, and future research is warranted to determine whether other horticultural crops respond similarly.

Introduction

Gerbera (Gerbera jamesonii) is an economically important ornamental crop sold as a bedding plant, cut flower, and/or flowering potted plant. Gerberas, like many herbaceous floriculture crops, are highly susceptible to insect herbivores. There is much evidence suggesting that reducing fertility might increase host plant resistance to insect pests. Nutrition of host plants has been shown to have a direct effect on the fecundity of numerous insect pests, and this research is warranted to determine whether other horticultural crops respond similarly.

Effects of fertilization on total phenolics.

Despite some advances in agronomic crops, no studies to our knowledge have considered interactions between fertilization, JA, and total phenolic content in ornamental crops. The objective of this research was to determine possible effects of fertilization on constitutive defense (i.e., total phenolic content) and induced defense (i.e., JA) mechanisms present in the economically important greenhouse floriculture crop, Gerbera jamesonii.

Results and discussion

Plant growth and leaf elemental analysis. As expected, fertility had a substantial effect on shoot dry mass and leaf elemental analysis. Shoot dry mass of gerberas receiving high fertility... was approximately 2.2-fold higher... Plants receiving low fertility... had substantially lower N, phosphorus (P), potassium (K), and zinc (Zn) compared to high-fertility plants. Based on general recommendations for high-quality gerbera tissue, nutrient levels, low-fertility plants were sufficient for K and Zn, but deficient in N and P.

Effects of fertilization on total phenolics. Fertilization had a substantial effect on total phenolic concentration in gerbera leaf tissue. Physiologically mature leaves of low-fertility plants had approximately a 9-fold higher concentration of total phenolics when compared to high-fertility plants. Increase in total phenolic content in low-fertility gerbera plants demonstrates that allocation to secondary metabolism occurs in response to nutrient availability, in contrast to primary metabolism (e.g., growth), which increases when nutrients are limiting. Similar results were reported in several studies that altered N availability in tomato plants. N stress increased expression of several genes involved in phenolic metabolism and low N resulted in higher levels of phenolics in tomato. In our study, young leaves had higher concentration(s) of phenolics compared...
to older leaves in low fertility plants, which parallels re-
sults reported in nitrogen-deficient tomato plants.

*Effects of fertilization on jasmonic acid accumulation.* Wound-induced JA accumulation was significantly affect-
ed by fertilization. In response to mechanical damage [ap-
plied to leaves with a hemostat], JA accumulation increased more rapidly and accumulation was sustained longer in foliage of low-fertility plants when compared to high-ferti-
tility plants. JA levels peaked 0.5 hour after wounding; and JA accumulation was higher at 0.5 hour and 3 hours after wounding, as compared to high-fertility plants. JA accumulation peaked 1 hour after wounding in high-ferti-
tility plants, but this level was not higher than in low-ferti-
tility plants. Ten hours after wounding, JA concentrations
were not different among low- and high-fertility plants, though levels were still higher than constitutive levels.

There were no differences in constitutive levels of JA be-
tween low- and high-fertility plants, and constitutive lev-
el did not differ based on the time samples were taken.

As previously noted, N deficiency enhanced JA accumu-
lation in maize and cotton, but JA accumulation was re-
duced in low-N tobacco. In the present study, foliage of low-fertility gerbera plants accumulated JA more rapidly and sustained higher levels of JA for a longer period of time than high-fertility plants—similar to responses found in low-N maize and cotton. Previous studies have consis-
tently demonstrated the role of JA as a positive regulator of
herbivore-induced defenses. Hence, enhanced wound-in-
duced JA accumulation observed in low-fertility gerbera
plants indicates that these plants would be better prepared
for defense against phytophagous insects than high-ferti-
licity gerbera plants.

In summary, constitutive (i.e., total phenolic content)
and wound-induced (i.e., JA) chemical defenses were in-
creased in low-fertility gerbera plants compared to high-
fertility plants. Obviously, drastically reducing fertiliza-
tion would not be a feasible option in greenhouse floriculture
crop production, but moderately reducing fertilization
or altering fertilization during certain stages of pro-
duction might be viable options that enhance host plant resistance without reducing marketability. Future research is needed to determine whether optimizing fertilization
can be a useful tool in an integrated pest management (IPM)
system. If fertilization is reduced to a level that increases
host plant resistance while producing marketable crops,
than fertilizer run-off, pesticide usage, and associated chemi-
cal phytotoxicity could be reduced in production systems.

**Controversial Dye-Infused Ornamentals**

Plants with artificially tinted flowers are here, and some
professional growers are upset about it, warning that breeders
won’t be able to compete with the consumer appeal of striking
flowers that have been sold in the U.S. generated relatively lit-
tle debate; it was a recent article in the trade journal *Florist
Business Grower* (known to old-fashioned growers as the *Florio*
that now thrives in several cemeteries in Meridian, Missis-
sippi—could well be linked to the final resting places of
several members of a royal Gypsy family.

Graveyards can be a good place to scout for plant species,
which is what Mississippi State University graduate stu-
dent Lucas Majure was doing in 2007 when he found an
unknown sedge. He asked botanist Charles Bryson (phone
662-648-5259), who works at the ARS’s Crop Production
Systems Research Unit in Stoneville, Mississippi, to help
identify the mystery plant.

Bryson always keeps an eye out for the appearance of
new and potentially invasive plants. After months of search-
ing, he was able to confirm that the plant is blue sedge
(*Carex breviculmis*), a native of Asia and Australia and pre-
viously unknown in North America.

Bryson checked out three possible routes of introduc-
tion—plains, trains, and automobiles. He didn’t find the
sedge along highways or around military airfields in the
area. He found it growing along railroad tracks, but only
around campgrounds used by vagrants and other tran-
sients. And he found it in or around four cemeteries in
Meridian, including Rose Hill Cemetery, where the Queen
of the Gypsies was buried in 1915. The King of the Gypsies
was later buried alongside his queen, and the cemetery be-
came a draw for visitors from all over the world.

Given the plant’s restricted and distinctive distribution in the
region, Bryson thinks that global travelers introduced the
sedge into Mississippi, possibly via seeds trapped in
the clothing or by leaving plants or soil at the gravesites of
the Gypsies. Gypsy caravans might have spread plant material from the first introduction site to the
other cemeteries via contaminated clothing and lawn care
equipment.

Blue sedge is clearly a survivor, since it can even grow in
sidewalk cracks. At two sites where it is established, it now
exhibits “weesy” characteristics and reproduces and spreads
profusely....

Bryson and Majure published their findings in the *Jour-
nal of the Botanical Research Institute of Texas*
and Bryson
is keeping an eye on the plant. “It’s considered a weed in
Asia, and I think it has the potential to become problemat-
ic in fruit and nut crops,” Bryson says. “So we could be
looking at another headache for the lawn and turf world.”

*KSU-Atwood™* Pawpaw Being Propagated Commercially

The first native North American pawpaw variety released by
the Kentucky State University Horticulture Program (home of the U.S.D.A. National Clonal Germplasm Repository for
*Asimina* species) is now being propagated for commercial sale by five nurseries (in Kentucky, Tennessee, Arkansas, Michigan, and
Oregon); visit the web site www.pawpaw.kysu.edu for a list of
the nurseries.

*KSU-Atwood™* (previously named ‘KSU-U-2’) has a “unique mango-banana-pineapple-like flavor” and is capable of quite
high yields, based on trials conducted in central Kentucky. Av-
erage fruit size is large, and trees tend to have larger branch
angles than some other promising pawpaw cultivars, allowing
high fruit loads without breakage. Pest problems have been
minimal, and disease problems have been minor, but fruit can
split in wet years.

Reference: Kirk W. Pomper (Kentucky State University, Frank-
fort, KY 40601-2352); Sheri B. Crabtree, and Jeremiah D. Lowe,
“The North American Pawpaw Variety: ‘KSU-Atwood’,” *Jour-
nal of the American Pomological Society* 65(4), October 2011,
218-221. (American Pomological Society, 102 Tyson Bldg., Uni-
versity Park, PA 16802.)
Acelepryn® Insecticide Has Remarkably Low Toxicity

We recently became aware of DuPont™’s Acelepryn® (which is labeled for use only by commercial applicators) via an Ohio State University news release (dated January 24, 2012) written by Martha Filipic, from which we excerpt below.

“There’s concern about exposure to pesticides,” said [Dave] Shetlar of OSU Extension [phone 614-292-3762], also known as the “Bug Doc.” “Residents are calling for minimizing use of pesticides, and when they are needed, to use the least toxic available. With insecticides, we have some new technology that allows us to meet those expectations.”

“There is a ... new class of insecticides, anthranilic diamides. DuPont™ is the first company to develop one of these insecticides, under the trade name Acelepryn®. Anthranilic diamides affect how calcium works in the muscle tissue of insects and other arthropods, including centipedes and white grubs, giving the bugs severe muscle cramps—effectively undermining their life cycles. Since calcium is used so much differently in humans and other mammals, anthranilic diamides are the least toxic type of insecticides available—“practically nontoxic,” Shetlar said. In addition, ... [This is] one great on caterpillars. And we can apply it any time from the first week of April and get season-long billbug, white grub, and caterpillar control.”

Although the product was initially much more expensive than the alternatives, the price is coming down, he added...

Emergency Overview

This product has no known adverse effect on human health.

This product is toxic to: Aquatic invertebrates

Potential Health Effects

This section includes potential acute adverse effects which could occur if this material is not used according to the label.

Eye: May cause: transient irritation with discomfort. Carcinogenicity: None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA as a carcinogen. ...

First Aid Measures

Skin contact: The material is not likely to be hazardous by skin contact, but cleansing the skin after use is advisable. Eye contact: No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary. Inhalation: No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary. Ingestion: No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary. Handling (Personal): Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE immediately if material gets inside. Wash thoroughly and put on clean clothing. Storage: Do not contaminate water, other pesticides, fertilizer, food, or feed in storage. Store product in original container only in a location inaccessible to children and pets. Store in a cool, dry place. Do not store in or around the home. Keep out of the reach of children....

Engineering controls: use only with adequate ventilation.

Personal protective equipment

Skin and body protection: Applicators and other handlers must wear:

- Long sleeved shirt and long pants
- Shoes plus socks

Applicators and other handlers of the diluted material must wear: shirt, pants, socks, and shoes.

Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Long sleeved shirt and long pants
- Shoes plus socks

Protective measures: Follow manufacturer’s directions for cleaning and maintaining PPE. If no such instructions for wearable exist, use detergent and hot water. Keep and wash PPE separately from laundry...

Toxicological information

Inhalation: 4h LC50: greater than 2 mg/l, rat

Dermal LD50: greater than 5,000 mg/kg, rat

Oral LD50: greater than 5,000 mg/kg, rat

Skin irritation: No skin irritation, rabbit

Eye irritation: No eye irritation, rabbit

Sensitization: Animal test did not cause sensitization by skin contact, mouse ...

Carcinogenicity: Animal testing did not show any carcinogenic effects.

Mutagenicity: Did not cause genetic damage in animals.

Did not cause genetic damage in cultured mammalian cells. Did not cause genetic damage in cultured bacterial cells.

Reproductive toxicity: Animal testing showed no reproductive toxicity.

Teratogenicity: Animal testing showed no developmental toxicity....

Additional ecological information: Environmental hazards: Do not apply directly to water. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinseout. Do not apply where/when conditions favor runoff. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas....

We are certainly not enthusiastic about synthetic pesticides such as Acelepryn® (active ingredient chlorantraniliprole, also known as 3-bromo-N-[4-chloro-2-methyl-6-[methyl-(aminocar-bonyl)phenyl]-1-(3-chloro-2-pyridinyl)-1H-pyrazole-5-carbox- amide). And we realize that just because Acelepryn®’s MSDS says that “This product has no known adverse effect on human health” then there are actually no adverse effects. But we note that, at least according to the product’s MSDS, it has remarkably low toxicity. In fact, if any of our neighbors decided that they had to have a professional yard-care service apply a synthetic insecticide to reduce populations of insects targeted by Acelepryn®, we would prefer that they specified Acelepryn® rather than other available synthetic insecticides. If the choice is among synthetic insecticides, rather than between synthetic insecticides and alternative management methods not using synthetic insecticides, then we would accept Acelepryn® as (most likely) the least toxic of the synthetics.

So, what are Acelepryn®’s target insects? According to the product label, turf applications may be made for caterpillars (including armyworms, cutworms, and sod webworms), white grubs, European crane fly, billbugs, annual bluegrass weevil, and chinch bugs (suppression only). Foliar applications may be made to outdoor and indoor landscape ornamentals for leaf...
feeding caterpillars; and soil applications may be made for lace bugs, birch leaf-miner, and white grubs. Also, bark applications to may be made to landscape ornamentals for clearwing borers (including peachtree borer).

From the label:

Acelorpryn® insecticide is recommended for integrated pest management programs on turf and landscape ornamentals because it does not directly impact natural arthropod predator and parasitoid populations including ladybird beetles, lacewings, minute pirate bugs, and predatory mites. The feeding behavior of predatory beneficial arthropods will aid in extending natural control of other insect and mite pests and will reduce the possibility of secondary pest outbreaks.

COTA on Pesticide Residues Found in Organic Produce

Late last year, the Canadian Food Inspection Agency (CFIA) reported finding pesticide residues in a considerable percentage of the “organic” produce it had tested, and some mainstream news reports called into question the veracity of certification for organic production. The Canada Organic Trade Association (COTA), “the membership-based trade association for the organic sector in Canada, representing growers, shippers, processors, certifiers, farmers’ associations, distributors, importers, exporters, consultants, retailers, and others in the organic value chain”) offered a quite different interpretation in a news release dated December 8, 2011, from which we excerpt below.

Consumers wishing to avoid chemical pesticide residues in food and water and on farms have a simple choice: organic products. COTA said today. Repeated government samplings in North America and Europe have shown organic produce has much lower pesticide residues when compared to nonorganic.

The CFIA pesticide residue testing results made public last week support the claim that choosing organic reduces consumers’ exposure to unwanted pesticides.

“We see that over 560 residues were found on nonorganic apples, more than 10 times the 52 found on organic apples. That would worry me if I weren’t buying organic,” said Matthew Holmes, Executive Director of COTA. …

“From the types of chemicals we see in this data, it’s clear that this isn’t a case of a farmer abusing the system, but originates from the types of chemicals used on nonorganic products in postharvest situations, such as warehousing and shipping,” Holmes said. …

Holmes adds, “It’s not too surprising that we’re seeing some trace amounts of chemical residues [in organic produce]. We cannot overlook the fact that these chemicals from industrial agriculture are present in our water, air, and soil—that’s why organic agriculture is offering consumers another choice: one that does not contribute to this toxic load in our environment and in our population.”

Online: Invasive Plant Atlas of the United States

This is a collaborative project of the National Park Service, the University of Georgia Center for Invasive Species and Ecosystem Health, the Invasive Plant Atlas of New England, and the Lady Bird Johnson Wildflower Center. “The purpose of the Atlas is to assist users with identification, early detection, prevention, and management of invasive plants. The focus is on non-native invasive plant species impacting natural areas, excluding agricultural and other heavily developed and managed lands.” You can access information on (unfortunately) a large number of invasives at www.invasiveplantatlas.org.

Drosophila suzukii Alert

The following is excerpted from a recent University of Maine news release.

University of Maine Cooperative Extension fruit and pest management specialists monitoring for a particularly destructive non-native fruit fly have discovered its presence at five locations in Maine.

Now they are hurriedly collaborating with counterparts across the country to collect and collaborate on the latest research on the tiny, spotted-wing Asian fruit fly in an effort to protect 2012 crops. The Drosophila suzukii fly poses a serious threat to Maine growers’ blueberries, strawberries, raspberries, and potentially other soft-skinned fruits and possibly even vegetables, according to Jim Dill, Extension educator and pest management specialist in Orono [phone 207-581-3876].

“Our concern is if you get the spotted-wing Drosophila in low-bush blueberries—50,000 acres—it would be disastrous, just devastating to our current Integrated Pest Management program and the crop,” Dill says. “And it’s a question of when.” …

Dill and Extension blueberry researcher Frank Drummond have been monitoring fruit fly traps across the state looking for early detection of the fly that comes from Asia and has spread in the last four years from California to states in the northern and southern United States. They discovered it in September 2011, and Dill says he has trapped them now in five locations in Maine …

The Asian fruit fly is particularly destructive because, unlike common fruit flies, which lay eggs only in overripe, rotting, or fermenting fruit, the spotted-wing Asian fly has a serrated appendage—an ovipositor—used in egg-laying that saws through the soft skin of ripe and unripe fruit to deposit its eggs inside the fruit, according to Dill.

“It’s just as prolific as the vinegar (fruit) fly you find on your bananas, but those guys only attack overripe fruit,” he says. The Asian fruit fly “is now out there attacking unripe fruit hanging on the vines.”

Pesticide sprays are the only known control method, says Dill, but applications are expensive and must be done at least once a week, as opposed to a few times a year as determined through monitoring for current pests. Fall raspberry growers often never spray their fruit at all, and one grower informed Dill that he’ll get out of the business before applying the necessary sprays.

“We’re looking to see if there are any natural controls for it,” Dill says. “We’ve been working for years to try to reduce applying pesticides. It’s going to be expensive if you have to spray every week. Everybody’s now trying to run and do the research.”

The flies can be transported in shipments of fruit and vegetables and even blown by strong winds.

“You figure it got to Maine from California in four years,” Dill observes. “Only four years to make its way completely across the U.S.”

Gardening with Southeast Asian Refugees, Revised

Long-time HortIdeas subscriber Kelly Kindscher (who is a Senior Scientist with the Kansas Biological Survey) recently informed us that an updated version of this excellent overview of vegetables found in the gardens of immigrants from Southeast Asia, mentioned in HortIdeas many years ago, is now available free at http://web.ku.edu/~kindscher/publications, along with several other interesting publications written by Kelly from the 1980s to 2011, primarily on prairie botany, conservation, and ethnobotany.
Community Supported Agriculture—A California Case Study

The following is excerpted from “Community Supported Agriculture Is Thriving in the Central Valley,” by Bryan K. Galt, Libby O’Sullivan, Jessica Beckett, and Colleen C. Hiner. California Agriculture 6(1), January-March 2012, 8-14, published by the University of California. It is ©2012 The Regents of the University of California.

Community Supported Agriculture (CSA) connects farmers and the consumers of their products. In the original CSA model, members support a farm by paying in advance, and in return receive a share of the farm’s produce; members also share in production risks, such as a low crop harvest following unfavorable weather...

The first two CSAs in the United States formed in the mid-1980s on the East Coast. By 1994, there were 450 CSAs nationally, and by 2004 the number had nearly quadrupled to 1,700. There were an estimated 3,637 CSAs in the United States in 2009. This rapid expansion left us knowing little about CSA farmers and farms and raised questions about their social, economic, and environmental characteristics....

CSA interviews and survey

We conducted a study of CSAs in 25 counties in California’s Central Valley and its surrounding foothills. The valley’s Mediterranean climate, combined with its irrigation infrastructure, fertile soil, early agrarian capitalism, and technological innovation, have made it world-renowned for agricultural production. In addition to its agricultural focus, we chose this region because we wanted to learn about how CSAs were adapting to the unique context of the Central Valley. Many of the region’s social characteristics—relatively low incomes, high unemployment rates, and conservative politics—differ from those in other regions where CSAs are popular, such as the greater San Francisco Bay Area and Santa Cruz.

As the study progressed, we revised our definition of a CSA to mean an operation that is farm-based and makes regular direct sales of local farm goods to member households. We removed some CSAs that did not meet the revised definition...

Primary data collection occurred from January 2010 to April 2011 and involved two components: a semistructured interview and a survey conducted through an online questionnaire. Seventy-four CSAs were contacted. Fifty-four CSA farmers and two CSA organizers, together representing 55 CSAs, agreed to participate.

Forty-eight of the 54 CSA farmers interviewed completed the survey. We did not request survey responses from the CSA organizers....

Two main types of CSAs

In the interviews, we asked CSA farmers about the prices for their CSA shares, how their CSA delivery systems worked, whether they bought supplemental produce from other farms, and the extent that they used volunteers ... in the survey, we asked about the types of food and other products in their shares, minimum payment periods, and events hosted at the CSAs. As a result, CSA types emerged that differed from our original conception of a CSA—that members shared risk with the farm and paid for a full season up front. None of the CSAs had a formal core member group deciding what to produce, none had mandatory member workdays, and many did not require long minimum payment periods or share production risks with members.

We found two main CSA types: Box model. The box model is a farm subscription. Of the 48 farms that responded to the online survey, 46 used this model. Members pay up front, though the minimum payment period varies from a week to a full season. Payments are made in advance of receiving the product, so a minimum payment period of one month means that the member pays for four boxes before receiving any box. The average minimum payment time was eight weeks, while the median was one month. Box-model CSAs used different distribution systems, including on-farm pickup, neighborhood or institutional drop-off sites, and door-to-door delivery.

The box model had three subtypes. A single-farm box CSA produces the majority of foods in its box; 34 of the 46 box-model farms were this type. Many offered other farms’ produce as occasional additions, or as optional add-ons (such as fruit or eggs) for purchase.

A collaborative box CSA consists of several farms cooperating to market their products and managing the CSA; seven of the 46 box-model farms worked this way. These CSAs sometimes have organizers who are independent of the farms.

A farm-linked aggregator box CSA is a business tightly linked to a single farm that combines the farm’s produce with produce consistently purchased from other farms or a wholesale market. Five of the 46 box-model farms had chosen this approach. Most required no up-front payment and allowed customers to customize the produce in their box. We did not consider nonfarm aggregators to be CSAs and excluded them from our study. Nonfarm aggregators grow nothing themselves ... [but] often call themselves CSAs and place themselves on online CSA listings.

Membership/share model. The membership/share model requires customers to make an up-front membership or share payment. It is rare; only four of the 48 CSAs operated this way. Two of the four CSAs used only the membership model; the other two combined it with the box models by offering member discounts. The membership payment is paid prior to actually picking up the produce. Members give the farmer some amount of money, which becomes credit for use at the farm’s U-pick, farm stand, or farmers’ market stall. Members do not pick up a set amount of produce but are able to pick and choose, and receive a discount by paying in advance....

Innovations in CSAs

These differently arranged enterprises, all called CSAs by their operators, demonstrate a central finding: Much innovation is occurring in how farmers and consumer members connect through a CSA. Farmers have adapted the CSA model to their ambitions for their farms, to innovative products, and to regional conditions....

— Innovations include changing CSA payment and delivery systems so that they are more attractive and accessible to people who are not familiar with the concept and to consumers who cannot afford a large up-front cost, both of which are important realities in the Central Valley. For example, 20% of CSAs in the study had no minimum payment period, allowing week-by-week payments, which extends membership to a broader population, including these hesitant or unable to commit to extended payments....

Economic viability

To understand their economic viability, we asked CSA farmers about gross annual sales and net profits in 2009, the CSA’s contribution to the total economic activity of the...
farm, other marketing channels used, and how the farmers valued their labor. On average, the farmers obtained 58% of gross sales from their CSAs. In general, small-scale farmers were more dependent on their CSA than larger-scale CSA farmers. Most farmers also sell into other channels, including wholesale and direct-marketing venues, especially farmers’ markets. Some farm-linked aggregator box CSAs act as wholesale outlets for small farms with their own CSAs.

Farmers in our study commonly chose the CSA to diversify their income channels. Some had little access to organic wholesale markets, while others wanted to increase sales beyond farmers’ markets and other direct sales. Some newer farmers started with a CSA to help raise needed capital. As motivations for choosing a CSA, most respondents mentioned the advantages of knowing sales volumes in advance and being paid up front, before the growing season begins.

Profitability. Regarding profitability, 54% of the respondents indicated that their CSA was profitable, 32% broke even, and 15% operated at a loss.

Gross sales. Another way we looked at economic viability was by asking about gross farm sales from all market channels (including the CSA), which in 2009 ranged from a few thousand dollars to multiple millions, with a median of $85,000. Since CSAs vary greatly in size, standardizing gross sales by farm size was important. The median gross sales per acre were $4,341 for all CSAs in our study, while the mean was $9,084. Those figures for CSA farms are considerably higher than for California agriculture generally—where the mean gross sales per acre is $1,336—and almost all other kinds of organic agriculture in California. When we focused only on crop-oriented CSAs and looked at gross sales per acre, the average for CSAs was $13,354 and the median was $10,089.

Characteristics of CSA farmers

The survey asked for demographic information on up to six farm partners, people who are essential players in farm management or operations.

Education. The CSA farmers that we studied were well educated.

When we asked in the interview about how they learned to farm, only 26% of farmers had completed on-farm apprenticeships or internships, despite the fact that these are offered by many CSAs. Instead, many farmers gained knowledge primarily by learning while doing; 55% said they had learned much of what they knew from farming experience or gardening with family members.

Features of CSA farms

We asked many questions about the CSA farms. We found out that most CSAs in our study were relatively new, in existence for 5.7 years on average. CSA farms shared certain core features, especially a commitment to environmental conservation, agroecology (the application of ecological principles in agriculture), and agrobiodiversity (the support of many organisms within agricultural systems, including those directly related to food production, like crops, and others that exist on or move through the farm, such as predators).

Agroecology; CSA production is generally based on agroecological methods. Two-thirds of CSA farms in our study used green manures for fertilization, a practice abandoned in the 1940s by most farmers in the United States, who now rely on synthetic nitrogen. Eighty-two percent of CSA farmers in our study used animal manures or green manures, compared with 49% of California organic growers, suggesting more commitment among CSA farmers to maintaining on-farm or near-farm nutrient cycles.

Agrobiodiversity. CSA farmers in our study cultivated a tremendous amount of agrobiodiversity, growing 44 crops and raising three types of livestock on average.

Many CSA farms also had land devoted to conservation plantings, such as hedgerows where birds and beneficial insects can live. In the Central Valley, the CSA farmers’ commitment to agrobiodiversity contrasts with the monocultures that dominate the landscape.

Agrobiodiversity is supported by the unique nature of CSAs. Many farmers noted that providing diversity in the box is a key strategy for maintaining CSA members, and that this had translated directly into diversity in crops and varieties on the farm.

Resource use. CSA farmers were conscious of their use of resources, including fossil fuels, farm inputs, packing materials, and electricity. Twenty-two percent had on-farm renewable energy production, mostly solar, considerably higher than the 1.1% average for U.S. farms.

Organic certification. Forty-five percent of CSAs in our study were certified organic, although 87% of farmers reported meeting or exceeding National Organic Program (NOP) standards. CSA farm practices described as “beyond organic” came up consistently. Beyond organic refers to methods that exceed those specified in the NOP and are seen as more true to the original conception of organic. Across both certified organic CSAs and noncertified CSAs who follow the letter of NOP rules but do not call themselves organic, many described their practices that way.

Membership. Membership in the CSA farms that we studied ranged by several orders of magnitude, from more than 10,000 members to fewer than 10. The median CSA membership in 2009 was 60, and the average was 58. In our study, the rapid rise of CSA operations since 2000 was accompanied by an even larger growth in CSA membership. From 1990 to 2010, CSA membership increased by 49 times (4,900%).

Multiple benefits of CSAs

Community Supported Agriculture appeals to an increasing number of people. CSA numbers in our study area grew from a few in the early 1990s to 74 in 2010. Membership growth has similarly exploded: CSA membership in our sample increased from less than 700 in 1990 to almost 33,000 expected members in 2010.

The CSA expansion has been accompanied by innovation in CSA types. The CSA concept appears to be both robust and flexible, and different CSA operations are using it to address different challenges. The diversity of CSA types, and the loose adherence to many of the features of the original concept of CSA, brings into question whether the original model met the needs of the California population. Expanding market opportunities for CSA farmers could involve further adaptations to reach consumers not commonly involved, such as participants in U.S.D.A.’s nutritional assistance programs.

Despite the diversity of types we identified, CSAs in our study retained a number of core characteristics. Namely, the vast majority of CSA farmers in the Central Valley cultivated high levels of agrobiodiversity, were committed to agroecological practices, and embodied an ethic of reducing off-farm resource use. CSA farmers in our study were also dedicated to enhancing the environment on and off their farms and to providing healthy food to their communities. Our study also revealed that CSAs in the Central Valley and surrounding foothills share characteristics with...

Over the years, much has been made—unfortunately, sometimes without pursuing the details very far—of “organic” and “sustainable” and even “biological” orcharding. Now, from an experienced commercial orchardist in New England, comes “holistic” orcharding. It turns out that the last designation just might be the best epithet of all for pointing towards what is to be most sought for in fruit growing, namely an integration of horticultural practices with natural ecological processes. For Michael Phillips uses “holism” in the context of health—the health of everything affected by orcharding, from weather to people who utilize the fruit. So, much of the advice offered in this comprehensive book concerns various ways to facilitate ecosystemic health. Yet there is much here as well on boosting production efficiency—in ways that are consonant with maintaining health. The biggest difference between this book and previous encyclopedic guides to temperate-zone orcharding is the inclusion (in fact, emphasis here on “the big picture” rather than coverage of techniques designed primarily to boost fruit yields and quality). Many such techniques are described in great detail in The Holistic Orchard (and so, this book also contrasts with some predecessors that focus on the big picture but neglect specifics), but they are always related to the fundamental goal of improving and maintaining health, broadly construed. This is one of the rarely successful efforts to see both “the forest and the tree”—that is, how particular methods need to be chosen on a daily basis to foster ongoing health.

With regard to particular fruits, Phillips includes chapters on pome fruits, stone fruits, and berries. He has had great opportunities to evaluate many cultivars, and his comments on the best that he has encountered are alone worth the price of the book for beginning orchardists who need to avoid planting “fruits.” Beginning and established orchardists as well will be wise to take into account the pruning/thinning suggestions. And yes, there are long discussions about organically acceptable pest and disease control methods. Throughout the book, there are many color photos and clear line drawings. Also, there are Appendices with lists of sources of plant materials, orchard supplies and tools, and information resources; more than 30 pages (!) of fine-print notes supplementing the main text; a glossary; a bibliography; and a superb index that makes it easy to use The Holistic Orchard as a ready reference.

This is the book we wish we had before we began planting and grafting apple trees many years ago—it would have helped us greatly in our efforts to promote health on our farm!