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Proceedings of the Northeast Farmer to Farmer Information Exchange

Apple Meeting
1992 and 1993

edited by Margaret Christie

Northeast Organic Farming Association
University of Massachusetts Cooperative Extension System

with the support of the
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Introduction

The Northeast Farmer to Farmer Information Exchange

The Northeast Farmer to Farmer Information Exchange, a project of the Northeast Organic Farming Association and the University of Massachusetts, held two-day meetings of small groups of farmers in the winters of 1992 and 1993 with the support of the USDA's Sustainable Agriculture Research and Education Program. Each group focused on one of five commodities for which there are significant barriers to organic production in the Northeast: apples, sweet corn, greenhouse bedding plants, livestock herd health, or strawberries. All of the participating farmers were interested in management methods which can be used on organic farms, but many of them are not organic growers and do not intend to use only organic methods.

At the request of the farmer participants, resource people were also invited to attend. These included researchers, faculty, IPM specialists and Extension agents from land grant universities, professional organic farming technical advisors, representatives of state departments of agriculture, and farmers recommended by others because of their experience and knowledge. Each meeting had a facilitator who assisted farmers in setting and following an agenda and moderated the discussions. Resource people sometimes made informal presentations but primarily were participants in discussions.

The Farmer to Farmer Information Exchange gave participating growers, and others reading these proceedings, a chance to become very familiar with the farming practices of a group of farmers. Farmers have an enormous amount of experiential knowledge about growing crops, raising livestock, marketing, managing labor, and all other aspects of running their farms. Farmers trying to grow crops using new or unusual methods may have experimented with techniques that few others have tried. In most cases, the results of these informal experiments never leave the farm to be shared with the larger agricultural community. Through these meetings and the written proceedings, the experiences of both farmers and researchers working on these crops can build upon each other.

A wide variety of activities has been generated by the meetings. Several growers in the sweet corn group set up trials in insect and weed control on their farms, with the help of Ruth Hazzard, Vegetable IPM Specialist at the University of Massachusetts and co-coordinator of the Farmer to Farmer project. At the urging of growers in the strawberry meeting, the Strawberry IPM Program at the University of Massachusetts did a scouting workshop in Vermont, at the farm of one of the Farmer to Farmer growers. Due to the interest of many of the livestock producers in alternative herd health remedies, a two-day homeopathy workshop was organized in Vermont. Several of the groups are continuing to meet in 1994, although the funding support from the USDA has ended.

These proceedings are a summary of the information provided by growers and resource people at the 1992 and 1993 meetings. They include discussion of specific production methods, marketing, and philosophy, and are intended to make available the expertise that was shared at the meetings to a wider group of farmers, researchers, and other interested people. They are not intended to provide complete information on how to produce these crops, nor to discuss only those production practices which have been verified by the research community. Additional sources of information on production and research-based information can be found in the list of sources at the back of the proceedings.

Participating Institutions

The Northeast Organic Farming Association

The Northeast Organic Farming Association (NOFA, formerly the Natural Organic Farmers Association) provides education and services for farmers, gardeners, consumers, and others interested in organic agriculture. NOFA has chapters in seven states: Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. The activities of state chapters vary, and include such things as organic certification, conferences, farm field days, country fairs, and cooperative purchase of farm and gardening supplies. Together, the state chapters hold an annual summer conference, publish a bimonthly newsletter, *The Natural Farmer*, and engage in regional projects such as this one. Information on becoming a NOFA member is provided on the inside back cover.

University of Massachusetts Vegetable IPM Program

The University of Massachusetts Cooperative Extension System conducts Integrated Pest Management (IPM) Programs in many commodities, including three that were part of this project: vegetables (including sweet corn), strawberries and apples. The purpose of these programs is to assist farmers in reducing pesticide use in their crops, and to develop alternative pest management methods such as biological and cultural controls. Increasingly, IPM programs seek to integrate all aspects of crop and pest management into whole systems, and to direct research efforts into "bio-intensive" methods, many of which are compatible with organic farming practices. Farmers have always played a key role in using, evaluating and helping to develop IPM methods; this project provided further opportunities to build links between IPM programs and organic farmers across New England, and to understand how both researchers and farmers can benefit from direct information exchange.

Sustainable Agriculture Research and Education Program

Mandated by Congress in the 1985 Farm Bill and first funded in 1988, the Sustainable Agriculture Research and Education Program (SARE, formerly LISA) funds research in sustainable agriculture. The program encourages projects in which several institutions cooperate, including non-profit groups and other non-university institutions. In addition, the program promotes farmer involvement in planning and carrying out research, and in 1993 began giving "mini-grants" directly to farmers. In 1993, the Northeast Region SARE Program awarded grants to 35 farmers, totalling $94,347, and 13 projects of research and education institutions, totalling $1.3 million. Further information about the Northeast Region SARE Program can be obtained from:

Northeast Region SARE
Hills Building
University of Vermont
Burlington, VT 05405-0082
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Acknowledgments

The proposal for the Northeast Farmer to Farmer Information Exchange was developed by Margaret Christie, Alex Stone, and Enid Wonnacott at the request of the Northeast Organic Farming Association (NOFA) Interstate Council. Input for the proposal came from a range of farmers and researchers who attended planning meetings and a pilot meeting of the Apple Growers Group organized by Alex Stone. Several Extension personnel, including Ruth Hazzard of the University of Massachusetts Vegetable IPM Program, Dan Cooley, Sonia Schloemann, and Arthur Tuttle of the University of Massachusetts Apple and Strawberry IPM Programs, and Vern Grubinger of University of Vermont Cooperative Extension, provided input and agreed to help with the project.

Funding from the Northeast Sustainable Agriculture Research and Education program allowed the project to begin in 1991. Meetings were held in the winters of 1992 and 1993. Margaret Christie and Ruth Hazzard coordinated the project, while Enid Wonnacott and Alex Stone acted as workshop coordinators and helped to provide project direction. Ed McGlew managed the money and complicated billing procedures, and the NOFA Council, under the leadership of Bill Duesing, provided valuable oversight. Margaret Christie did the final editing and layout of the proceedings, and Jack Kittredge accomplished their printing and distribution.

A number of additional people helped to make the project successful. Thanks are due to the researchers who agreed to attend the meetings, particularly to those noted above, who helped to plan and facilitate the sessions and provide research and training help requested by growers between meetings. The cooks at Rowe Camp and Conference Center kept us exceptionally well fed at our meetings. Most especially, we want to thank the participating growers, who were willing to share both their successes and failures. Not only did they supply the bulk of the information presented here, review the proceedings, and provide useful editing suggestions and corrections, but their enthusiasm and humor made for wonderful meetings. Although much of the information presented at the meetings is available here, the pleasure of the company of the grower groups is impossible to reproduce on paper.

Organic and Low Spray Apple Production in the Northeast

Integrated pest management programs have succeeded in reducing the use of chemical inputs on apples in most Northeastern states. Organic apple production, however, is rare in the region. Due primarily to the difficulty of controlling plum curculio, some growers who might otherwise manage their apples organically choose to use Imidan, a synthetic insecticide prohibited by organic standards, to control curculio. A small but growing group of growers produce low spray apples. Their exact definitions of low spray vary, but generally these growers use considerably fewer pesticides than the average IPM orchardist. Some differ from organic growers only in their use of one to three Imidan sprays in May and June to control curculio. Others use a few applications of sterol inhibitor fungicides rather than repeated sulfur applications to control apple scab. The growers attending the apple Farmer to Farmer meetings range in their production practices all along this spectrum, but all share a desire to reduce their reliance on any pesticides, whether botanical or synthetic, and to increase their use of biological and cultural controls of apple pests.

The growers assembled for the 1992 meeting agreed to suspend discussion or justification of their particular growing philosophy, and instead to focus on specific techniques or methods. They set aside an evening for discussion of a marketplace definition which might be used by growers who are not organic but who use a greatly reduced quantity of pesticide to manage their apples.

Participants in the Apple Farmer to Farmer Group

Farmers

John Bemis and his brother, Gordon, have been growing vegetables, apples, and small fruits at Hutchins Farm in Concord, MA, for 19 years. They produce 35 acres of certified organic vegetables, strawberries, and blueberries, and have 10 acres of low spray apples. About half of his apples are disease resistant, but he notes that marketing some disease resistant cultivars has proved very difficult. John controls scab with sulfur and uses a couple of sprays of Imidan to control plum curculio. Hutchins Farm produce is all sold retail, most through their farmstand. They sell cider and cider/carrot juice, as well. In 1992 they produced 3000 bushels of apples.

Brian Caldwell and Twinkle Griggs have been farming since 1978, and now produce certified organic vegetables, lamb, apples, raspberries and chestnuts in West Danby, New York. They manage an acre and a half of apples which were planted 8 or 9 years ago about 5 miles from their home farm. Brian says that apples are one of the things he enjoys most on the farm, and in 1992 he planted an acre of trees on his home farm, surrounded by plums and shadbush as an experimental plum curculio trap crop. Hemlock Grove Farm produce is sold primarily through the Ithaca Farmers market and the Finger Lakes Organic (FLO) wholesale coop, as well as to restaurants.

Nick Cowles manages 80 acres of apples at Shelburne Orchards in Shelburne, VT. He grew up on the farm and has been farming for 25 years. He sells both ecological and organic apples to stores in the Burlington, VT area. Nick has primarily McIntosh, Red Delicious, and

Empires. Nick has managed part of his orchard organically for 5 years, and has been certified by Vermont Organic Farmers for 3 years. He relies primarily on THAT flowable sulfur for scab control, but occasionally uses a sterol inhibitor fungicide in the non-organic sections of the orchard. He has used various botanicals to control plum curculio, but has been dissatisfied with the results, and is now working to control curculio on the border of the orchard. The organic section of the orchard is in the center, surrounded by a buffer area in which Imidan is not used. Nick has controlled apple maggot fly since 1985 with (baited?) traps placed in the border row, clustered on the edge of the orchard where pressure is heaviest. He is able to get very high levels of apple maggot fly control by hanging 85 traps in the border row.

Chris Edmonds uses integrated pest management (IPM) to manage 50 acres at Alasa Farms, and 20 acres on his family's farm, Rockland Fruit Farm, in North Rose, New York. He has been farming for 18 years. Most of his apples are sold wholesale, with some pick-your-own, but he has recently begun to sell a small quantity of low spray Paula Reds through a community supported agriculture project. Chris has put in some Liberties on his home farm, and has experimented with planting into plastic to manage weeds with reduced use of herbicide.

Jim Gallot manages a 29 acre orchard in the Champlain Valley of Vermont. About half of the trees are McIntosh, one quarter are Cortlands, one quarter Empires, along with some disease resistant cultivars. Pruning and insect control were inadequate before Jim took over in 1991, and he has had to do a lot of heavy pruning to reclaim the trees. The orchard has excellent air drainage and a heavy clay soil; Jim has put in drainage tiles. Jim intended to manage one 5 acre block organically, but decided after the 1992 Farmer to Farmer meeting to use Imidan for plum curculio control, while otherwise managing the block organically. The farm also has a herd of beef cattle. Jim has a master's and a PhD in apple breeding from the Department of Pomology at Cornell, has worked as a Extension Specialist on pecans, peaches, and home horticulture in Oklahoma, and as the manager of the Shoreham Cooperative apple storage and packing facility.

Colin High planted a high density orchard of 100 dwarf and semi-dwarf Liberty, Prima, and Redfree apples in 1987. His certified organic farm is in Lyme, NH, where he also works as Coordinator of the Sustainable Agriculture Program at Dartmouth College. His trees are not yet in full production, and he has had significant crop losses to plum curculio, but he is determined to manage his orchard organically.

Bill Jamieson is the Agricultural Coordinator at a rehabilitation center for head injured patients, where farm work is used as an activity and work adjustment training program. Bill has been farming for 45 years, first in dairy and now on this diversified farm. He has 800 apples, mostly Cortlands and McIntosh, which have been certified organic for 3 years but have produced very poorly due to problems with plum curculio.

Don MacLean grows apples and strawberries at Thompson-Finch Farm in Ancram, NY, in the Hudson Valley. He has an acre of 10 year old apples, including McIntosh, Macoun, Yellow Delicious, Idared, Rome, and others. Don's strawberries are certified organic and for six years he managed his apples organically, but, frustrated by extremely low crops, he began using Imidan to control plum curculio in 1991. He had a very good crop in 1992, and plans to plant more apples if his results in the next couple of years are equally

satisfying. Don feels that to maintain a pick your own market he needs to consistently produce a crop which is cosmetically adequate to satisfy customers who choose his orchard because of its location, not their growing practices. Nonetheless, he feels that educating consumers about his methods is an important aspect of building a market; in 1992 his pick your own customers turned his educational posters into a treasure hunt, searching for an example of each of the insect injuries pictured.

Marilyn and Steve **Meyerhans** own two orchards 18 miles apart in Skowhegan, Maine. In the home orchard, which she bought in 1970, there is a wide range of varieties and ages. The other block of 24 acres was all planted in one year, and they have trouble with pollination in that block because it's mostly McIntosh and Red Delicious, which don't bloom at the same time. They produce 20,000 bushels a year, selling 40% retail, 40% through local wholesale, and 20% through J.P. Sullivan. In 1990, Marilyn managed one 4 acre block organically. The previous year, they hadn't sprayed the block because of hail damage, and it seemed a good opportunity to try organic management. Codling moth was their biggest problem in that block, but Marilyn found that they needed to do something in that block almost every day all season. The logistics were difficult; they didn't want to buy a second sprayer for this experimental block, but were also unwilling to use the quantities of bleach necessary for frequent and thorough cleaning.

Michael Phillips and David Craxton began leasing the Lost Nation Cider Mill in 1992. Before that, they grew vegetables, and Michael has been working on orchards in Vermont and New Zealand for years. Lost Nation has a water-powered, 100 year old cider mill, which they promote as a place to visit on fall weekends. They have 2.5 acres of certified organic apples at the mill, and Michael has another acre of young trees at home. They are grafting 500 more trees to plant in 1995. In addition to their own apples, they buy in conventional apples from Maine for sale for fresh eating and for cider making. In their first year of managing the orchard and mill, they have worked hard to promote the business in the local area, emphasizing the importance of agriculture to the local economy and community.

Elizabeth Ryan and Peter Zimmerman of Breezy Hill Orchard in Staatsburg, New York, manage 25 acres with 35 varieties of apple on them. Most plantings are 25 to 30 years old, but they have a new planting of disease resistant varieties. Elizabeth and Peter term their apples "ecological"; they use organic ground management (no herbicides or chemical fertilizers) and a limited pesticide program for insect and disease pests. They use a Rubigan/Captan scab and summer disease program and a few applications of Imidan aimed at plum curculio and apple maggot fly. Breezy Hill Orchard apples and pears are marketed as fresh apples and as a variety of apple products such as sauce, preserves and cider made in their commercial kitchen. Most of their apples are sold at Greenmarkets in New York City; they go to two markets each week from March through November.

Alan Surprenant and Dvora Cohen planted 60 apples of 25 varieties, mostly disease resistant, on 2 acres in the Apple Valley of Ashfield, MA in 1990. Alan worked for 5 years spraying, pruning, and picking in a nearby orchard before planting his orchard. Alan and Dvora manage the orchard biodynamically, and have planned their fruit planting to ripen from early August to late October. This well-spaced harvest will allow them to manage the orchard without needing additional hired labor, and to bring new varieties to farmers' market each week. Alan and Dvora also sell eggs, herbs, and perennials.

Jeff Zappieri worked on farms for 30 years before buying his orchard 25 miles west of Albany 6 years ago. He has about 550 standard trees, mostly Red Delicious, then McIntosh and Cortland, then Wealthy, Snows, and Kings, and some semi-dwarfs. A lot of the orchard had been let go, and Jeff has been reclaiming it with the help of his sheep, which do a great job clearing out poison ivy and brambles. Jeff has had no problems with sheep under standard trees, and has also used them in a semi-dwarf block. He says a few sheep like apples and stand on their hind legs to get them, but this is rare. The sheep keep the orchard floor clear, eating all the drops. Jeff manages the orchard organically, using sulfur for scab (before putting the sheep into the orchard), trapping out apple maggot fly, and spraying rotenone for curculio in parts of the orchard which do not have sheep. Jeff plans to phase out about half of the standard trees, replacing them with semi-dwarfs.

Resource People

Margaret Christie facilitated the apple group meetings in 1992 and 1993. She was coordinator of the Second-level Apple IPM Project at the University of Massachusetts from 1989 until 1993, and is co-coordinator of the Northeast Farmer to Farmer Information Exchange. She is currently a student in the Rural Sociology Department at the University of Wisconsin, Madison.

Alex Stone initiated a pilot meeting of apple growers interested in organic production practices at the New England Small Farm Institute in 1991. She was one of the designers of the Northeast Farmer to Farmer Information Exchange, and facilitated the apple grower group meeting in 1992. Alex managed an organic market garden in Belchertown, Massachusetts for five years, growing vegetables and annual and perennial bedding plants. She is now working on the use of compost as a disease suppressant in the Plant Pathology Department at Ohio State University.

Gerald Chouinard worked with Stuart Hill at McGill University in Quebec, studying plum curculio behavior. At the time of the 1992 meeting, which he attended, he was working as a consultant to Quebec apple growers.

In 1993 the apple farmer to farmer group was invited to meet at the Rodale Institute Research Center. Growers heard about Rodale's research on organic apple production, toured their orchards, and provided feedback on Rodale's plans for future research on apples. Several people from Rodale joined the meeting:

Don Jantzi has a background in commercial orcharding and now is the field manager at the Rodale.

Ed Lachowski is a researcher at Rodale, working primarily on apples. He does much of the monitoring and spray planning at Rodale's research orchard.

Jeff Moyer is the assistant director for research and the farm manager at Rodale.

Terry Schettini is the Associate Director of Horticulture at Rodale. He is the Coordinator of the Northeast Sustainable Agriculture Research and Education (SARE, formerly LISA) Apple Production Project, a cooperative project of Rodale, Cornell and Rutgers Universities, and the Universities of Massachusetts and Vermont. Terry invited the apple Farmer to Farmer group

to Rodale for the 1993 meeting in order to gain feedback from growers on Rodale's research plan for apples.

Sarah Wolfgang is the Orchard Project Leader at Rodale. She has coordinated Rodale's tests or organic orchard management methods for several years. Sarah notes that the Rodale orchard research is designed to meet the needs of two audiences, the small scale organic practitioner, and local commercial growers who are increasingly interested in alternative methods. Research reports giving results of Rodale's research are available; please see the reference list at the back.

Insect Control

Plum curculio (PC)

Most of the growers participating in our meetings agreed that plum curculio is the biggest obstacle to organic apple management in our region. Several growers manage their apples organically except for the use of Imidan to control curculio. Some found that they could not achieve satisfactory control with botanicals, while others are unwilling to use rotenone to manage curculio. Research on curculio behavior may lead eventually to a non-chemical control, but current options are limited and unsatisfactory.

The majority of participating growers rely on one to three applications of Imidan to control curculio. Most scout their orchards beginning at petal fall or during the end of bloom, looking for curculio injury. Some growers know where curculio first enter their orchard, or which trees are most susceptible, and concentrate their scouting there. A couple of growers begin scouting in their Liberties because they are particularly attractive to curculio.

Nick Cowles has experimented with border row spraying of Imidan in his 80 acre orchard, but has found that spraying only two or three rows around the perimeter is insufficient to control curculio. He has received an exemption from Vermont Organic Farmers, allowing him to produce certified organic apples on one section of the farm and non-organic apples on another. In 1992, he maintained an organic section in the middle of the orchard, surrounded by substantial unsprayed buffer from the portions of the orchard sprayed with Imidan.

Other management techniques which growers use, or have tried, include the following:

Brian Caldwell manages curculio using four to six applications of five percent rotenone. He monitors developing fruit for curculio injury beginning at petal fall, and once curculio have moved in, sprays every five to six days, using a motorized Solo backpack; a hand pump backpack sprayer won't handle rotenone without straining. He sprays rotenone at night since it breaks down in sunlight.

Brian feels that, as a rule of thumb, rotenone reduces curculio injury by 50%: if pressure is such that you would have two stings on every apple, rotenone will reduce it to one. Curculio pressure at his windswept hilltop orchard site is lower than it is at his home five miles away. The limited control provided by rotenone, Brian notes, allows in-orchard reproduction, and second generation curculio is sometimes his most significant problem. Brian markets both apples and cider at the Ithaca Farmer's Market, where they contribute to a varied fall display of winter squash, other fall vegetables, and apples.

Brian is exploring a number of alternatives to complete reliance on rotenone for curculio control. In 1991 and 1992, he released nematodes in the orchard. Moisture is important for their success, and the early summer of 1991 was very dry. In 1992, he saw no curculio injury for a week after petal fall, but then reached 50% injury after only a day's absence from the orchard. He sprayed immediately, but "I expect that if there's that much

injury that early, I'll be clobbered--I know that curc will wipe me out. But it didn't get much worse. I do lots of hand thinning, so I thinned damaged fruit" and removed it from the orchard. Brian suggests a number of possible explanations for the lower than expected injury: a new, possibly fresher and more effective, batch of rotenone; use of Nu-film 17 as a spreader for the first time; or a very confined emergence, making it easier to kill curculio with rotenone. The effect of the nematodes is very difficult to judge.

In 1992, Brian put in a half acre orchard at his home farm, surrounded by a trap crop of plums and shadbush (*Amelanchier* sp.) designed to trap curculio. The perimeter rows of the planting are plums, which enclose a planting of shadbush surrounding the apples. Brian picked varieties of plums and shadbush which are particularly attractive to curculio, and plans to treat the insects on the early-blooming plums with either rotenone or Imidan. Birds eat all the shadbush berries on his farm, so the shadbush will act as an untreated buffer between the sprayed plums and the unsprayed apples.

There was also some discussion of the use of a flamer to kill curculio in June dropped apples. Brian mentioned that people used to rake the drops into the aisle, where they would heat up in the sun and the larvae would be killed. This was greeted with some skepticism; someone suggested that you'd be wise to put some fruit in a frying pan and cook them up on the stove to be sure the larvae were killed before investing in a flamer.

John Bemis returned to the use of Imidan for curculio control after losing most of his crop to curculio while using rotenone. In 1992, however, he read about a variety of bt which is effective against the boll weevil, and wondered if it might also provide some control of curculio, also a weevil. He contacted Ecogen, the manufacturer, and Ron Prokopy, a University of Massachusetts entomologist, who designed a trial supported by Ecogen. Treatments included Foil, the bt product, Neam, a botanical insecticide, and Imidan. Neither alternative treatment provided greater control then the unsprayed control. John is also increasing the population of toads in his orchard after learning from Gerald Chouinard at the 1991 meeting that toads eat curculio. He pays a neighbor per toad, and has considered expanding the program to the Concord public schools.

Current Research on Plum Curculio

Gerald Chouinard, an apple researcher from Southern Quebec, attended the 1992 meeting to discuss research he'd done on plum curculio with other researchers from McGill University. In their trials at McGill, Chouinard, Stuart Hill, Charles Vincent and others have used radioactive marking of plum curculios in order to monitor their activities after release. In one study, they released curculios at pink on the ground between 4 trees covered with a field cage. They monitored the location of the insects every 2 hours until 3 weeks after fruit set. They found that the first PC appeared in the trees at bloom, and that during bloom they aggregate at the base of the tree trunk, hidden under bark, rocks, or grass, before entering the tree. However, the insects continue to move back and forth from the ground to the canopy, and are on the ground about 50% of the time. The curculios were not very active; at most, the researchers counted 15 changes of position per 100 insects in one day. When they are active, however, they drop to the ground sometimes even when not startled by humans. Chouinard speculated that they might be trying to avoid birds, obtain moisture, or just be clumsy. Curculios are more active at night, and more of them are found in the canopy between 6 pm and midnight. Sprays aimed at the canopy may be most effective at this time

of day. The American toad may be a significant PC predator, Chouinard said, noting that they had found toads with radiation levels equivalent to 3 curculios. Unsprayed orchards in Quebec might have 6 or 7 curculios per tree.

In response to questions, Chouinard discussed earlier studies done at McGill studying curculio migration to and from the orchard. In that study, curculio migrated into the orchard in the spring from the south, but Chouinard noted that this might not be true in all settings. He explained that the findings from that study might not hold true in all locations, and advised Brian Caldwell to plant a trap crop all the way around his planned orchard, not just on the south and west sides.

There was some discussion of ineffective PC traps. One researcher tried to trap PC in wooden rods with holes drilled in them, a trap which is used to trap other kinds of weevils, but did not find PC in the holes. He also found that PC are not attracted to ultraviolet light. Nick Cowles tried baiting a sticky trap with ground up early apples which he had collected the previous year and frozen, but he didn't catch curculio.

Harvey Reissig, Jan Nyrop, and Richard Straub, researchers in New York, are testing a degree day model to be used to predict cumulative oviposition damage from plum curculio. Researchers hope that this model might allow growers to delay their first spray treatment against plum curculio in some years and to better judge when to stop treating for the insect.

Report on Other Current Research

At the 1993 meeting, Margaret Christie provided a summary of two talks given at the New England Fruit Growers Meetings in January, 1993 by Charles Vincent of McGill University and Ron Prokopy, a University of Massachusetts entomologist, on their research on plum curculio behavior and monitoring.

At the beginning of his talk, Charles Vincent noted that curculio is native only to North America, where natural enemies exist but are insufficient for control, and that curculio overwinters as an adult and has only one generation each year. He also mentioned that tapping is a reliable method of scouting for curculio. Vincent mentioned several questions about curculio behavior and the trials they have conducted to explore these questions.

Is the insect able to select an overwintering site?

Researchers put different types of litter in a grid, and released 4 PC in each section of the grid. They found that all PC in stone and gravel die during the winter, and that the highest survival (95%) was in thick litter.

Vincent explained that PC migrate out of the orchard in the fall because their chances of survival are better in the forest litter. Some do remain in the orchard. They travel less than 200 m to overwinter.

When are PC active?

Researchers determined that PC is more active at night than at other times, especially early in the season, for example at petal fall.

What are the factors that will help predict when PC are active?

There is no clear single factor--temperature and rainfall both are factors.

Pesticidal Control:

They have been testing a border row spray program which consists of a full block spray at pink with a pyrethroid for tarnished plant bug and leafminer, and a border spray (to a depth of 2 standard trees or 3 dwarf or semi-dwarf trees) at petal fall with Guthion or an organophosphate. In 1991 and 1992 trials in 4 orchards they had less than 2.5% PC injury in all but one case. They monitored egg-laying scars and would have treated again if there had been significant new injury.

In these trials they did not treat the woods around the block, but Vincent said they would like to explore that option because PC forage a bit under the trees in the orchard before climbing into the tree.

Researchers at Mcgill have done some work on using nematodes for EAS control. They sprayed the nematodes on bare soil under small trees. Now they would like to explore using nematodes for both PC and EAS.

Ron Prokopy reviewed different types of monitoring at the beginning of his talk: visual traps, such as those used for tarnished plant bug, European apple sawfly, apple maggot fly, and leafminer adults; pheromone traps, used for codling moth and leafrollers; and visual sampling, used for aphids, mites, leafhoppers, and leafminer larvae (Prokopy 1993). He noted several aspects of plum curculio behavior which influence the effectiveness of different types of monitoring for plum curculio. First, curculios start moving into the orchard at pink or bloom, earlier than previously thought. Second, curculios both fly and crawl, and they appear to move onto individual fruit by crawling, not flying. Curculios move back and forth frequently between the ground and the tree canopy, probably by both flying and crawling.

Tapping apple trees to knock the curculios onto the ground or onto a sheet or funnel has been used for years both to monitor and to trap curculio. Ron noted, however, that any curculio already on the ground will be missed. Ron has also tried visual traps of various shapes and sizes with little success. Another researcher, Jean-Pierre Leblanc, had some success hanging Granny Smith apples close to a branch of an apple tree to monitor the earliest egg-laying, but when Prokopy tried this is several Massachusetts orchards in 2 different years he found that birds, not curculio, attacked the apples. Prokopy noted that because PC crawl onto fruit, they can withdraw as soon as they touch tangletrap on a trap. Monitoring for egg-laying scars is another way of assessing plum curculio activity. Except when the scars are fresh, however, it's hard to tell how old they are, making it difficult to know, for instance, whether spray materials have been applied since the scar was made. In addition, curculio can act very fast, doing significant damage overnight.

Prokopy has done trials which indicate that odor is more important than color or appearance to curculios trying to locate host trees. In current trials, he is working with a chemist to try to determine which portion of the apple scent is attractive to PC. They are comparing the components of apple and plum scents to determine what they have in common. The odor will than be used in combination with a trap. Prokopy plans to test a trap used for boll weevils, a relative of curculio, and a funnel trap placed on the ground and baited with odor.

In response to grower questions, Prokopy noted that apple sap is attractive to curculio, and that trees pruned at pink or in bloom will be more attractive. He agreed that PC often attack the largest fruit first, but said that after the first stings they don't seem to discriminate based on size.

Codling Moth

Although codling moth pressure varies throughout the region, several growers call this pest their number two insect problem, after plum curculio. Several participants are exploring mating disruption techniques, and most are using pheromone traps and degree day calculations to time applications of spray material.

Pesticides

Although research done in Massachusetts suggests that Imidan applications against plum curculio combined with removal of unmanaged host trees within 100 yards of the orchard can provide effective codling moth control, some growers in other states are concerned that their Imidan applications are too early to control codling moth. Growers in New York and Vermont noted that when they trap male codling moth and use degree day calculations to time the hatch, these indicate that the codling moth larvae are vulnerable after first cover, too late to be effected by Imidan sprays aimed at curculio. In addition, of course, growers who are not using Imidan or who hope to eliminate it also need to find some other way of managing codling moth.

Since codling moth larvae burrow into the fruit, they are susceptible to pesticides only shortly after they hatch. Many of the farmer to farmer participants time male flight using pheromone traps and monitor daily temperature in order to calculate when codling moth eggs will hatch and young larvae will be vulnerable to sprays. Some growers, however, were confused by different methods of making these calculations. Michael Phillips, for example, found that one publication claimed that codling moth mating flights don't occur when nighttime temperatures are below 62° F. In northern New Hampshire, he didn't get a 62° night until June 19th. According to calculations based on another publication, egg hatch should have begun on June 19th.

Michael was also frustrated by the variability of state pesticide registrations. He had planned to use ryania, the botanical insecticide considered to be most effective against codling moth, until he discovered that ryania was not registered in New Hampshire. Michael substituted dipel, and did not have codling moth problems, but thinks their absence might have been due more to the cold weather than the dipel, which many people consider to be difficult to use effectively against codling moth. In 1993, he worked with the state and distributors to ensure that the registration fees for materials he wants to use will be paid and the registrations will go through in time. He's found this a slow and time-consuming process.

Brian Caldwell and Don MacLean both use ryania against codling moth. Brian applied 2 sprays of ryania, totaling 4 lbs, ending on July 16th in 1992. He applies ryania with his last curculio spray, and again 18 days later. Brian has also removed all host trees within 200 yards of the orchard. Don hangs two monitoring traps for codling moth, and waits 5-7 days after getting high trap captures before spraying. He found that emergence

was late in 1992, but that he finally caught a lot of male moths on the first really warm night in June. The Rodale Institute has also used ryania against codling moth, and found it effective in one year but not in the next. Triple plus also varied in effectiveness, and rotenone was ineffective both years they tried it.

Several sources suggest that it is difficult to use bt against codling moth, possibly because they may not eat enough of the treated apple surface to be effected before burrowing into the interior. Two growers mentioned, however, that in years when they used bt to control large gypsy moth populations, they did not have codling moth problems.

Mating Disruption

There was a lot of interest among the participants in mating disruption techniques for codling moth, in which the orchard is saturated with the pheromone used by male codling moths to find females. This technique is still being tested by the manufacturers and universities and the material has been available on only a limited basis under an Experimental Use Permit. Several growers at the meetings had talked directly to Consep, a manufacturer of the pheromone dispensers used, in efforts to obtain the dispensers. In 1992, Consep would not sell the dispensers to growers with small acreage because of concern that this technique will not be effective on acreage so small that females can mate outside the treated orchard and then enter to lay their eggs. A Consep representative, however, told one grower that they did successful trials in one acre blocks in Michigan, but are concerned that their success was due to very low codling moth pressure. In 1993, they will be working with smaller acreage in the Northeast, and several growers at the meeting will use the technique.

There was some discussion of the logistics of using the pheromone dispensers, which are twisted onto the tree like plastic bag twist ties. At Rodale, they hung the dispensers on the trellis wire, but then learned that the pheromone photodegrades, so that the dispensers should be concealed by some foliage. The pheromone also tends to sink, so growers noted that it should be hung high in the tree. There was some concern that the technique will be less effective in dwarf plantings because the pheromone sinks and most mating activity takes place higher up. There was concern about accidentally removing dispensers while summer pruning, and about how to remove them at the end of the season. One grower suggested giving u-pick customers some money off for each dispenser they bring in.

The participants also discussed how long the pheromone will last, and when it needs to be reapplied. Jim Gallot, in northern Vermont, feels his codling moth pressure is low enough, and the season short enough, that he can use one application of pheromone, but other growers felt they need to put it out twice. Don MacLean has decided to apply pheromone twice in 1993 since it is only supposed to last 60 days. In 1991, Nick Cowles managed codling moth with only one application of mating disruption pheromone by using ryania to control the first generation of codling moth. Since it's much harder to time spray applications against the second generation, but the pheromone is more expensive than the ryania, he felt this was a good combination of techniques. In 1990, Nick lost 80-85% of his crop to codling moth and plum curculio, but in 1991, his fruit had no codling moth injury, despite early trap captures of 60-80 per trap.

The Rodale Institute has also used a combination of techniques to control codling moth. The manufacturer of the pheromone they used in 1991 and 1992 felt that they needed

to reduce the population with other methods before the mating disruption would be effective. They have used trunk wraps and bt in combination with mating disruption. They tried both burlap and corrugated cardboard trunk wraps, and found cardboard, wrapped around the trunk and held on by wire, to be more effective. The larvae crawl into the corrugations to pupate.

Leafrollers

There was not much discussion of other lepidopteran pests at the meetings in 1992 and 1993. Brian Caldwell manages leafrollers with two sprays of Dipel 2X (*bacillus thuringienis*), applied with scab sprays before bloom. In New York, resistance to insecticides in some leafroller species has increased so much that trials show Dipel to be as effective as synthetic pesticides which used to be more powerful.

Apple Maggot Fly

A number of the growers in the group use red sticky sphere traps to control apple maggot fly (AMF). Don MacLean made traps out of white rubber baseballs which he bought by the case from a five and dime store supply catalogue. He dipped them in red paint and added an aluminum wire hook. In 1993, Don switched from trapping every tree to placing unbaited traps in the outside 2-3 rows of trees. This provided good control of apple maggot, but Don is considering baiting the traps in the future. There was some discussion of the possibility of build-up of within-orchard populations of apple maggot fly if unbaited traps are used, since flies which do not cross the border rows would not be caught.

Nick Cowles found that apple maggot fly immigration into his orchard is concentrated in one location. In 1986, his first year of trapping for apple maggot fly, Nick hung 10 baited traps in his 70 acre orchard, then monitored the traps for fly captures. When he found a "hot spot," he placed many more traps there. In subsequent years, he has hung up 60 baited traps in the corner of the orchard where the flies primarily enter, and few around the rest of the orchard, and has achieved a high percentage of clean fruit. Cowles has had help from University of Vermont Extension in hanging and monitoring his traps and fruit.

Jim Gallot baits his traps with dispensers made by Consep, which are sticky on one side and can be wrapped around the hook of the trap. He notes that if you wrap them the long way they're more likely to stay on all summer. Jim found that he could find wild apple trees near his orchard by searching near places where his trap captures were high. Growers commented that the traps stimulate discussion of pest control methods with u-pick or farmstand customers.

Positioning the apple maggot fly traps to make them most visible and attractive to the flies is important. Traps should be positioned on the outside of the tree canopy, at head height or higher if possible, because the flies move towards the top of the tree. The trap should not be hidden in the foliage, because sunlight shining on the trap will make it more visible to flies. Apple maggot flies move around in the tree by hopping from leaf to fruit, so some fruit and foliage should be within a foot of the trap if possible. Removing foliage which might blow or grow into the trap avoids making the trees into a sticky mess.

AMF traps often become coated with flies and other insects, covering up the sticky. Insects are removed from Prokopy's traps once a month or more during the season in order to maintain their stickiness. In some cases, it may be necessary to reapply sticky to the traps during the season. The need for mid-season cleaning or reapplication of sticky may vary with AMF pressure; in addition, the number of non-target pests caught on the traps is different in different locations. Traps in the University of Massachusetts trials are hung from wires with a loop twisted in the end, which allows easy removal during the season.

There was considerable discussion of how to apply and remove sticky from the traps. John Bemis melted the sticky and dipped the traps into it, but Ron Prokopy, when he visited John's farm, didn't think there was enough sticky on the traps. In Prokopy's trials, tangletrap is applied with metal cake spatulas. Some growers have experimented with covering the traps with plastic bags and covering the bags with sticky. In the fall, the bags can be discarded. Jim Gallot is pleased with brush-on tangletrap.

In general, traps are easier to clean in the fall than if they are stored sticky over the winter and cleaned in the spring. Some growers use vegetable oil, then wash the traps with detergent. This method seemed most effective if the traps were soaked in the oil for several hours. Others use paint thinner or Livos, a citrus solvent, to clean the traps. At the University of Massachusetts, where Ron Prokopy's second-level IPM trials use about 1000 traps each year, traps are scraped each spring with scrapers cut from old plastic milk jugs, with one rounded edge to match the curved trap. The traps don't get perfectly clean, but they don't really need to be. Just before reapplying sticky, the hook is cleaned with a solvent, since it's the part of the trap you need to touch. Using vise grips to hold the trap's hook makes it easier to clean or restick many traps, and to remove the trap from the tree during the season to check trap captures, to clean off insects and debris, or to reapply sticky.

Apple maggot fly pressure varies widely, and thus appropriate controls vary as well. In some areas, baiting "hot spots" as Nick Cowles does would fail to provide effective control. Ron Prokopy's trials in Massachusetts orchards have shown that baited traps placed every 5 yards around the perimeter of the orchard can maintain control at levels equivalent to that achieved in nearby sprayed blocks, but that damage increases if traps are placed 10, 20, or 40 yards apart (Christie 1991). In some orchards and for some growers, pressure may be so low that placing traps sufficient for control is an unnecessary expenditure of time and money. Brian Caldwell, for instance, achieves apple maggot fly control through rigorous removal of drops. Some orchards may have such low pressure be so low that interception with traps is not worth the time and expense; hanging a few monitoring traps and spraying in the occasional year when trap captures indicate treatment is necessary may be an attractive management plan for these growers.

The varietal composition of the orchard block will also help to determine what management program is necessary. In recent years, Ron Prokopy has begun experimenting with the use of ammonia as bait for apple maggot fly blocks. Bird feces provide one source of food for apple maggot flies, and Prokopy hopes that the combination of a fruit odor (butyl hexanoate) and a food odor (ammonia) might result in effective control using traps in high pressure orchards with very susceptible varieties such as Red Delicious.

Foliar Insect Pests

Foliar pests were not a major topic of discussion at the meetings in 1992 or 1993. The growers agreed that none of them had major foliar pest problems. Some growers commented that these problems had decreased since they eliminated many sprays; John Bemis, for example, says his foliar problems have almost disappeared since he stopped using manzate and lime sulfur. Others felt that the damage done by foliar pests is insignificant compared to that done by more major pests such as plum curculio. Until they achieve better control of these major pests, they have little time, energy, or money to deal with foliar pests.

Researchers at the University of Massachusetts are investigating the role spiders may play as predators in apple orchards. Their counts have shown that by late summer spiders are far more prevalent in low spray blocks than in orchards managed with conventional (or "first-level") IPM methods (Prokopy 1991a). Perhaps spiders play a role in the low levels of foliar pest problems experienced by growers at the meetings.

Brian Caldwell commented that despite his rotenone- and sulfur-based program, he has not had any mite problems. Joe Kovach, of the Geneva Experiment Station, had mite flare-ups when he managed an orchard block with a botanical-based treatment program; Brian wonders whether the absence of pyrethrin from his program may help to avoid the loss of mite predators and thus to keep mites in check. Brian also points out that an orchard's fertility program may effect the mite population, since trees with high nitrogen levels often have more serious mite problems. Several of the growers at the meeting do not use oil against mites because they do not have mite problems. Avoiding oil, of course, greatly simplifies a sulfur-based scab control program.

Jim Gallot wonders whether he could skip oil on some trees and then treat with soap at tight cluster-pink, hoping to effect leafhopper and tarnished plant bug as well as mites. If it wasn't too warm, he feels soap would be compatible with his sulfur program, but he is concerned about mite problems.

Elizabeth Ryan avoids spraying for leaf-feeding insects. Instead, she picks early, in order to avoid any problems with drop which foliar feeders might exacerbate, as well as to provide her customers with the crisp, flavorful apple they want.

Disease Control

Scab

The most common scab control program among participating growers is based on use of sulfur. Some growers have disease resistant trees, or are putting them in, and some use synthetic fungicides, usually a combination of sterol inhibitors such as Rubigan and protectants like Captan, on all or part of their acreage. Participants are also exploring methods of reducing inoculum in the fall or spring in order to delay or reduce fungicide applications.

Sulfur

Sulfur is used by both fully organic growers and by those that rely on Imidan for plum curculio control. Most are satisfied with the level of scab control they get, or trace scab problems to missed applications or poor coverage. Growers relying on sulfur for scab control watch the weather carefully, spraying when rain is imminent, or has already begun, often during the night.

Most growers relying on sulfur recommend THAT Flowable sulfur, which allows use of much lower rates of elemental sulfur than other formulations. Rates range from 3 pints per acre. Number of applications of sulfur vary with the weather, but growers report spraying sulfur between 9 and 15 times.

Don MacLean began the 1992 season with two applications of copper, at silver tip and green tip. He feels that he has begun his scab control program too late in the past, and plans to use copper again in the future. He made 10 applications of flowable sulfur at 3 pints per acre, including three after primary scab season, ending on August 25th. He continued to spray sulfur during bloom, a practice which he has avoided in the past, and was pleased with his scab control. His only scab problems were due to poor coverage in trees which did not get pruned as planned. which he feels helped him to get good early scab control. Don made two applications of lime sulfur, which has some kickback, because he thought he had missed an infection period and knew that he had some scab problems due to coverage. He says "I wouldn't want to run a whole program on [lime sulfur], but it's nice to have as a back up." Other growers feel that lime sulfur is too phyto-toxic to use. Don used to use a backpack sprayer, but recently built a sprayer which can be used for apples or vegetables from a converted leaf blower. Don sprays early in the morning because he does not have lights for night spraying.

Jim Gallot has a five acre low spray block in his orchard, in which he used sulfur for the first time in 1992. Jim used "Super 6" (6 lbs. sulfur/gal), applying 1 gallon of liquid sulfur per acre per application. He feels that his sulfur program was too conservative, noting that he sprayed in anticipation of rain that never arrived a few times, and that his crop was not too big and he needed it all. He applied sulfur about 15 times, ending in the first week of August. About 30% of his applications were made in the summer, after primary scab season was over. Next year, he plans to reduce both rate and frequency.

Brian Caldwell applied THAT flowable sulfur and Nu-film 17, a spreader-sticker, 9 times, but says that he should have made one more application. Brian sprays every 5-7 days, depending on the weather. If it's warm and there's lots of growth, he stays closer to 5 days, but he tends to try to stretch it to seven. Brian had some secondary scab on his Ida Reds, Goldens and Empires in 1992, and realized when he looked at his records that he did not spray before a big rain on the 6th day after a sulfur application. Brian used 1.5 gallons of THAT for the season, amounting to 10 lbs total sulfur, applied to about an acre of scab-susceptible trees which are not yet full-sized. He sprays with a SOLO mistblower sprayer at 2X. He likes his sprayer because it is so easily directed, but finds that it is inconvenient to keep mixing up tanks. Brian sprays at night.

During the meetings there was considerable discussion of the environmental effects of using sulfur, including its effect on earthworms, soil health and pH, and beneficials. Growers are concerned about reports of sulfur's high environmental toxicity--for example, sulfur was given a higher score than any other material except methoxychlor on the Environmental Impact Quotient recently developed at Cornell University--but also recognize that these reports do not match their own experience. A number of questions were raised. In the past, sulfur was used as a dust, and applied at much higher rates than these growers use. Many old studies on the effects of sulfur are based on the use of sulfur dust. In addition, most evaluations of sulfur are based on label rates, which are higher than those used by most growers. In the Cornell Environmental Impact Quotient system, the sulfur rating is high because it is assumed to be very persistent because it is elemental, and the persistence rating is used to weigh other effects such as that on fish or arthropods. Participants felt that field tests of sulfur's persistence and its effect on beneficial and neutral orchard inhabitants would more accurately indicate its potential damage.

One way to measure the effect of sulfur on the environment is to evaluate its effect on beneficials. Participating growers who use sulfur note that their problems with foliar pests have not increased with use of sulfur (this is not true, however, for lime sulfur). Don MacLean and Brian Caldwell do not spray dormant oil because they have no problems with mites; this, in turn, makes it easier for them to use sulfur because they don't have to worry about its incompatibility with oil.

Several growers have tried using compost teas but found that they were ineffective against scab.

Nick Cowles applies fish emulsion and seaweed with his sulfur, and feels they result in very good leaf health.

Synthetic Fungicides

Several participating growers use sterol inhibiting fungicides for scab control. These are effective after an infection has occurred, and so the grower has more flexibility in applying them. They are usually applied with a protectant fungicide which will prevent infections during the next 7-10 days, thus reducing the number of spray applications necessary. Sterol inhibitors can be applied at very low rates and are very expensive.

Jim Gallot uses Rubigan, a sterol inhibitor, to manage scab on 24 acres of his orchard. Early in the season he sprays Rubigan with Syllit (previously sold as Cyprex), a protectant,

then switches to Rubigan and sulfur at pink and petal fall. He plans to use sulfur for summer disease control and to prevent any secondary scab because it's inexpensive and eliminates the need for mixing two tanks for his low spray blocks and the rest of the orchard. Jim plans to avoid Captan, another possible protectant, because of its long reentry interval and because he feels he has developed a sensitivity to it.

Chris Edmonds combines Rubigan with manzate to control scab at Alasa Farms. He has one section of relatively scab-resistant Paula Reds which receive only one spray each of Rubigan, Manzate, and Imidan, and are sold as low-spray.

Inoculum Reduction

Several growers expressed interest in methods of scab inoculum reduction through removing leaves from the orchard or encouraging quicker breakdown of leaves and the spores they harbor. Nick Cowles rakes the orchard and applies compost in the fall on top of prunings, then goes through with a Seppi mower and chops up leaves and prunings and mixes them with the compost. Don MacLean's sprayer was built from a leaf blower and can be converted to suck up leaves. He would like to try leaf removal, hoping that in his one acre block it might be possible to be thorough enough to reduce the inoculum significantly. Participants mentioned that inoculum reduction which allowed them to delay their first sulfur application would give them more flexibility in applying oil.

Another idea some participants are interested in exploring is the use of water to release spores on sunny days when it will be impossible for infection to take place. The group discussed possible differences between irrigation on a sunny day and rain, and how those might effect spore release, but noted that universities use water to release spores in order to check spore maturity.

Disease Resistant Trees

Many growers who are replacing trees or putting in new orchards are putting in trees which are resistant to scab and some other diseases. See the appendix for information sources about disease resistant cultivars. Discussion at the Farmer to Farmer Meetings centered around choices of varieties and marketing.

One concern about disease resistant cultivars has been that it is difficult to sell an apple that customers are not familiar with. John Bemis feels that if the apple is good, you don't need a familiar name to market it. John sells almost entirely from a farmstand, and notes that once people start buying from a farmer, they like to keep coming back to buy from you. Some people get really excited about trying new things, but the new variety must be as good or better than the apples they are already eating. Liberties are good enough to entice people away from familiar varieties, but some other disease resistant trees are not. John, for example, took out a block of Jonafree, Freedom, Redfree, and the NY613452 in 1992. He's found that retail sales are very low for these apples, and although they would make good cider, he has enough other varieties elsewhere that are better for cider.

Most growers are pleased with Liberties, and this is the predominant disease resistant cultivar in blocks they are putting in. Chris Edmonds has a new 3 acre block of Liberties, and Jim Gallot is putting in a one-acre block which will be approximately one third Liberty,

one third Redfree, Williams Pride and Prima, one quarter non-disease resistant cultivars to add variety to his stand, with the balance of the block used to test numbered disease resistant selections. John Bemis says his only problem with Liberty is that they don't size up well on 9-111 rootstock. On M-26 they are larger and consistent.

John Bemis also speaks highly of Novamacs, saying they are very productive and consistently sized. He feels that Novamacs and Jonafree are less susceptible to plum curculio, perhaps because they bloom late.

Summer Diseases

Fly speck and sooty blotch are increasing problems for many growers in the Northeast. Some participating growers, particularly those with very good air movement, have few summer disease problems; others count it among their most significant problems.

Several growers who rely on sulfur for scab control continue to spray it during the summer to combat summer diseases and secondary scab. In 1992, Jim Gallot continued to spray sulfur into the summer for these reasons, and had no fly speck or sooty blotch, but because it was a very dry summer, he was not sure their absence could be attributed to sulfur. He orchard has been summer pruned in the last 2 years because he is still restoring it, rather than primarily for disease control. Don MacLean also sprayed sulfur during the summer, but stopped a little early in 1992 and saw some fly speck and sooty blotch. He has found that summer pruning has improved color, size, and incidence of summer diseases.

John Bemis stops spraying sulfur in late June. He notes that he makes a real effort to control primary scab with fairly religious adherence to weather conditions and applying sulfur. He also can rely on getting about two weeks with no rain during the summer, which helps to burn out any secondary scab, so that he rarely sees fruit scab in most sections of the orchard. He does not spray sulfur against secondary scab, but finds that summer diseases are a significant problem in his riverbottom location. Some blocks which are up out of the valley a little and get better air drainage have fewer problems, but despite pruning to keep the centers of the trees very open, the blocks down in the valley get a lot of fly speck and sooty blotch. John has had trouble selling fruit to retailers, even those specializing in organic and low spray produce, due to summer diseases, even when the fruit was very good and looked, he thought, reasonable. Although his program is not completely organic, John is reluctant to return to the use of synthetic fungicides. He says "it's nice to think that you can sell your fruit and it'd be nice to grow stuff that looks great, but I am not prepared to start going back to materials I used to use." John is also unwilling to continue his use of sulfur later into the summer, saying "I'm not convinced that sulfur's a very good material on summer disease, I don't like spraying it, and I think it's got enough detrimental effects elsewhere in the orchard so I'm not anxious to use it much longer." He is interested in the potential of diluted methanol, hydrogen peroxide, and baking soda against summer disease.

Mouse and Vole Control

Two growers reported that they use a string trimmer to cut groundcover in a two foot circle around the base of the tree back to bare ground in the fall. One finds that this treatment in late November, combined with mouse guards, is sufficient to control mice and voles. Another says it allows him to see where the rodents are and to bait the hot spots by putting bait in their tunnels with a long handled spoon. Brian Caldwell uses regular short mowing throughout the season to discourage voles, as well as to help cycle nutrients and reduce grass competition.

Growers were united in their dislike of plastic mouse guards with buttons, finding that they float out of the ground, then get brittle and snap off.

Growers confirmed that M.9 rootstock is particularly attractive to mice. One grower reported losing 170 of 1000 trees with mouseguards to mice in the summer, in a year when late frost had destroyed the crop so the orchard was not being intensively managed. He commented that the restrictions on mouse baiting in some organic certification standards are a problem, because so much is at stake.

Orchard Fertility

One of the questions brought to the 1993 meeting by a couple of growers was how to determine fertility needs. One grower noted that "if you're in the middle of a battle, you don't really think about what you had for dinner. We've been concentrating so much on curculio and scab that we haven't paid much attention to fertility. I think that's a shortcoming. If you're interested in a holistic approach to your orchard, you need to pay attention to fertility."

Most growers think that their orchards are sufficiently vigorous, but they are not sure. Brian Caldwell notes that once the trees are in full production, you don't want to feed them too much. His orchard got a very heavy application of compost eight to ten years ago when he planted it, and he sprinkles soy meal around the base of the trees in some years.

Chris Edmonds feels that adding lots of nitrogen is only important in very high yielding plantings. People getting 700 bushels per acre might go to 900 if did they did a leaf analysis and cranked their nitrogen, but if you're getting 200-300-400 bushels per acre it doesn't make much difference. Chris also notes that orchards without an herbicide strip may benefit from higher levels of organic matter than those using herbicide.

Jim Gallot notes that you can see nitrogen deficiency without a tissue analysis, but he did consult his leaf tissue tests in deciding not to add nitrogen for the next couple of years. He also considered his heavy clay soils and heavy pruning program in making this decision. He feels that leaf analysis is more valuable for detecting other deficiencies, such as potassium.

Michael Phillips did soil tests and tissue analysis in his first year of management, but applied North Country Organics Pro Start 2-3-3 because the orchard had been largely unmanaged for the past 6 years, and he felt intuitively that he needed to do something to get it going.

John Bemis adds semi-composted chicken manure when the leaves are off the trees, after growth has stopped, to provide nitrogen and to increase leaf and scab spore breakdown. He plans to return to using nutri-cal because he is concerned that he is not getting healthy leaf growth. John feels that fertility has a considerable impact on whether or not trees are annual bearing.

Foliar Feeding

Jim Gallot began foliar feeding when he had an explosion of white apple leafhopper, resulting in lots of leaf stippling and poor leaf color. He applied Thiodan for the leafhopper, then sprayed seaweed. Tree leaves greened up very well, and Jim was very impressed with the seaweed and began to add it to every tank. He found that he did not need to mix the seaweed with warm water, but just put it in the tank when it was half full. As a fringe benefit, the seaweed cleaned out all the scum that had built up inside his spray tank. He does wonder, however, whether foliar feeding might distort the results of leaf tissue testing. His leaf analysis showed adequate potassium levels in the year he applied seaweed, although the previous year they had been low. He's not sure whether the seaweed actually provided sufficient potassium, or just temporarily increased the level because it was still on the surface of the leaves. Jim also applied foliar boron after tissue tests indicated it was low.

Other growers have mixed feelings about foliar feeding. Some apply fish or seaweed regularly with sulfur or other spray materials, while others doubt the efficacy of fish and seaweed products.

Varieties

The following list includes comments on varieties made by growers at the meetings. **Readers should note that the information is far from complete and that these comments may reflect the experience of only one grower.** Results in another location or market might be very different. The *Management Guide for Low-Input Sustainable Apple Production* (see appendix) provides much more information on disease resistant cultivars, and Cooperative Extension Fruit Agents and nurseries can provide information on these and other varieties.

Freedom
- •disease resistant
- •hard to sell

Gala
- •tolerates sulfur regime well
- •sells itself
- •consistently annual bearing

Jonafree
- •disease resistant
- •free of plum curculio for some growers
- •hard to sell

Liberty
- •disease resistant
- •as good or better than familiar varieties; therefore it can sell itself
- •some difficulty getting them to size up, especially on 9-111
- •will be sweeter if it's put into cooler for 2 weeks before selling

Melrose
- •disease resistant
- •very nice late fall apple
- •good keeper
- •not really hardy

Novamac
- •disease resistant
- •very productive
- •very consistent size
- •less susceptible to plum curculio, perhaps because of late blooming
- •good McIntosh substitute

NY 61345-2
- •disease resistant
- •hard to sell

Prima
- •disease resistant
- •one grower is taking most of his out; difficult to market, hard to maintain annual bearing, ripen in early September when space in his stand is at a premium. Replacing with Honey Crisp.

Redfree
- •disease resistant
- •hard to sell

Senchu
- •sister to Fuji, very high sugar, little earlier ripening
- •not yet bearing fully, but those who tried the first few apples combed the block to find more

Marketing

Discussions of marketing were an important part of meetings in 1991 and 1992. Many of the participating growers' practices do not fall neatly into categories such as "organic" or "IPM" and are difficult to convey to customers. In 1991, Don MacLean noted that the health food store which sold his apples also sold an organic apple which had similar blemishes, and customers tended to buy the organic apple. Some participants wanted a common statement of principles which could be displayed at the place of sale, and discussed forming some kind of organization, formal or informal, which might include providing some financial support to researchers who were furthering the participants' goals. After an evening's discussion, Jim Gallot wrote up a statement of principles which he felt all the participants could agree on. The "Toad Code," its name inspired by the toad found by Quebec researchers to have eaten three radioactive curculios, follows:

Toad Code

We pledge that pest control materials used on our farms will be chosen on the basis of the following criteria in an effort to produce a product with the maximum health benefit for our customers:

1) Spray materials will be chosen for the least impact on the environment.
2) Spray applications shall be made on the basis of demonstrable need, and in the minimum amounts necessary to do the job.
3) Spray materials shall be chosen and rates used that will protect and maximize indigenous predators and parasites.
4) All efforts shall be made to control pests with non-spray methods when economically sound and viable methods are available.

We believe a dramatic reduction in chemical usage in apple production is a worthwhile and necessary goal, and will do our utmost on our own farms to practice and promote this goal. A brief accounting of cultural practices and spray schedule will be made available to all persons requesting it.

As a sign of our dedication, we will commit $0.02 per bushel of our apple production towards research to achieve this objective.

Although the Toad Code was not formally adopted, participants described a variety of methods they use to explain their growing practices to their customers. These include:

•John Bemis sells low spray apples and certified organic vegetables at his farm stand. He has literature and signs in the stand explaining exactly how the apples are managed. Because their stand is not open after the vegetable season ends, John is looking into selling gift boxes of apples, and has designed a label saying ""Committed to Growing Quality Apples with Minimal Chemical Use." Inside the box, a paper headed "Rough looking, great tasting apples" further defines their practices, noting that summer diseases and sulfur use cause a rougher surfaced apple.

•Brian Caldwell worried at first about displaying his apples, whose cosmetic quality does not match that of his vegetables, at his Ithaca Farmers Market stand. He's found, however, that apples and cider add a lot to his fall display of vegetables and nuts, and that customers who have bought from him all summer want to continue to buy his apples. Brian grades his apples "select," a great apple, or "utility," a sound apple, with no holes, but some surface curculio damage or russetting. He finds that it's easy to introduce customers to new varieties at farmer's market.

•In 1992, Don MacLean had a large enough crop to open for pick your own for the first time. He notes that most people come to a pick your own orchard because of its location, not its growing methods, and feels that to be successful he must produce a crop which people who don't care about his spray program will buy. To advertise the new pick your own, Don printed peel-off pads of flyers about the farm, including a map and their hours, and put them up with a poster all over the area. He found that many customers arrived with these in their hands.

On the flyers, Don called the farm a minimum spray, IPM orchard. He felt that people recognize the word IPM, although they're not sure what it means, and that he wanted to describe his operation more specifically. On the back of the map, he printed a brief explanation of IPM and minimum spray.

On the farm, Don had a longer explanation of his production practices available for people to take home. In addition, he put up a colorful poster of pictures of injured apples and insect traps that people might find in the orchard. He found that some people used the poster as a treasure hunt, searching for an example of each blemish or trap pictured. The poster made clear that a curculio or plant bug scar does not mean there's a worm in the apple.

•Michael Phillips' marketing efforts in his first year of managing the Lost Nation Cider Mill had several purposes. First, he wanted to establish a fresh identity and build new customers for the business. Second, he wanted to emphasize the importance of local agriculture in his community, and third, he wanted to promote the organic apples and cider produced on his orchard, while supplementing their own fruit with conventional apples bought in from Maine.

Michael and his partner decided to make their cider stand out by designing a new, four color label for the bottle. They also distributed flyers with their label on the front and a map on the back at campgrounds, motels, and roadside stands, and discovered that most of their fall business took place during peak foliage weekends.

Lost Nation's water-powered press is an attraction for family and school groups, and Michael built on this audience through articles in the local paper, coupons, and ads. They sent press releases to the local paper, which used his text and added pictures for a story on the operation. Michael foresees using this tactic again by emphasizing different angles of the farm; next year he plans to write a press release on the many older apple varieties they use for cider. School children visiting the farm each received a coupon describing the operation and offering their families discounts on cider purchases. They found that customers were intrigued by their ad in the local paper, which contained different words each week inside the same frame. Lost Nation also sold farm memberships in order to raise funds to plant more trees. Members receive a newsletter and five gallons of cider from the new planting when it comes in. Although response was limited, they did find it was an opportunity to explain their belief that a farm in the community benefits everyone by providing higher quality food and open space.

Lost Nation organic apples and conventional apples were distinguished in the stand by signs and educational materials. When people asked about the differences, they explained their practices and offered a taste test, explaining that the more complex taste of their organic cider was caused by the wide variety and high quality of the apples they used.

•Elizabeth Ryan markets fruit, including 10,000 bushels of apples, and fruit products such as sauce and preserves at the Greenmarket in New York City, and to a few stores and restaurants willing to pay their retail price. They go to Greenmarket twice a week, beginning in March, and sending two trucks and eight workers during the fall harvest season. A cider operation and commercial kitchen on the farm produce apple and pear sauces and preserves, in order to use seconds, but Elizabeth emphasizes that despite a good market with good prices for processed products, fruit sold fresh and top grade nets the most and is their top priority. Greenmarket allows only organic growers who are certified, and does not permit growers to describe themselves as ecological or low spray.

The 1993 meeting included discussion of the market for organic and low spray fruit. Growers such as Chris Edmonds, who recently put in 3 acres of Liberties and intends to use a low spray program, trapping out apple maggot fly, is worried about whether he'll find a market for low spray fruit. Some people thought that the market is still adjusting after a spike of interest following the alar scare, and caution that fear is the worst possible reason for a customer to choose low spray or organic fruit. Others think that the demand hasn't decreased, but that there's greatly increased competition from other places. Michael Phillips suggested that an emphasis on the local economy, and the importance of supporting local businesses and agriculture, can build customers without relying on a fear motive.

Research Needs

The following are among the areas needing further research identified by farmers at the meetings.

•Use of hydrogen peroxide and baking soda for disease control
•Use of mating disruption pheromone on small acreage
•Environmental effects of sulfur-based scab programs as currently used by growers
•Use of compost in orchards and its effect on leaf litter density and potential scab ascospore dose
•Use of water sprays to release scab spores on dry days
•Non-chemical controls of plum curculio, including study of natural enemies and possible monitoring and trapping methods

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IPM Practitioner, BioIntegral Resource Center (BIRC), P.O. Box 7414, Berkeley, CA 94707.

Fruit Varieties Journal, American Pomological Society, 102 Tyson Building, University Park, Pennsylvania 16802. The January 1994 issue includes papers presented at the Disease Resistant Cultivars Workshop held in 1993.

Fruit Notes, Department of Plant and Soil Sciences, 205 Bowditch Hall, University of Massachusetts, Amherst, MA 01003.

The Annual March Message, Karen Hauschild, Western Massachusetts Regional Agriculture Center, 212 Stockbridge Hall, University of Massachusetts, Amherst, MA 01003, $10.

HortIdeas, 460 Black Lick Road, Gravel Swith, Kentucky 40328, $15 per year.

Northeast Sustainable Agriculture Research and Education (SARE) Apple Production Newsletter, Daniel R. Cooley, ed., Dept. of Plant Pathology, University of Massachusetts, Amherst, MA 01003, no charge

Pomona, quarterly journal of the North American Fruit Explorers, RR 1, Chapin, IL 62628, $8 per year.

Apple Fact Sheets

New York Fact Sheets
Tree Fruit fact sheets have good color photographs. Topics available include pear psylla, codling moth, plum curculio, green fruitworm, obliquebanded leafroller, apple maggot fly, spotted tentiform leafminer, European red mite, predatory mites, rosy apple aphid, San Jose scale, white apple leafhopper, fire blight, cedar apple rust. Resource Center-GP, 7 Business and Technology Park, Cornell University, Ithaca, NY 14850, $1 each.

Pest Management Fact Sheets
Fact sheets on San Jose scale, aphids, tarnished plant bug, codling moth, redbanded leafroller, apple maggot fly, plum curculio, European red mite, tentiform leafminer, scab, and fireblight are available at no charge from Cooperative Extension Service, University of New Hampshire, Durham, NH 03824.

Suppliers

This is far from a complete list of suppliers, but includes those that were mentioned during the meetings. For a longer list, please see the "Management Guide for Low-Input Sustainable Agriculture," above.

Consep Membranes
213 Southwest Columbia
P.O. Box 6059
Bend, Oregon 97708
(503) 388-3688

Integrated Fertility Management
333 Ohme Gardens Road
Wenatchee, WA 98801
(800) 332-3179
(509) 662-3179
organic orchard consulting

Necessary Trading Co.
Newcastle, VA 24127
(703) 864-5103
Necessary has a tree fruit information booklet which includes an organic spray schedule and some of the New York fact sheets.

North Country Organics
Depot Street
Bradford, VT 05033

Orchard Bees
1111 Cindy St.
Auburn, IN 46706
(219) 925-5076
information on improving habitat for wild bees

Pest Management Supply Co.
PO Box 938
Amherst, MA 01004
(413) 256-0886
(800) 272-7672

Peaceful Valley Farm Supply
11173 Peaceful Valley Road
Nevada City, CA 95959
(916) 265-FARM

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Additional copies of the proceedings are available from the NOFA chapters listed below at $3.95 each plus shipping and in-state sales tax. Please specify which crop proceedings you are ordering (apple, sweet corn, greenhouse bedding plants, livestock or strawberries). You may also join one of NOFA's seven state chapters by including the appropriate dues listed below for your state.

NOFA/Connecticut: Box 386, Northford, CT 06472
Proceedings: $3.95 each plus 6% tax (24¢) plus $1.75 shipping for a total of **$5.94**.
Dues: Individual or household: $25, Institution: $50, Supporting: $100, Low income: $15

NOFA/Massachusetts: 411 Sheldon Road, Barre, MA 01005, (508) 355-2853
Proceedings: $3.95 each plus 5% tax (20¢) plus $1.50 shipping for a total of **$5.65**.
Dues: Individual: $25, Family: $35, Low income: $15, Supporting: $100

NOFA-New Hampshire: Jan C. LaPlante, c/o Green Pastures Estate, 38 Ladds Lane, Epping, NH 03042
Proceedings: $3.95 each plus $1.30 shipping for a total of **$5.25**.
Dues: Individual: $25, Family: $35, Student/Senior: $18, Supporting: $100

NOFA-New Jersey: 31 Titus Mill Road, Pennington, NJ 08534, (609) 737-6848
Proceedings: $3.95 each plus 6% tax (24¢) plus $2.50 shipping for a total of **$6.69**.
Dues: Individual: $25, family/organizational: $35, Supporting: $50, Sponsor: $100

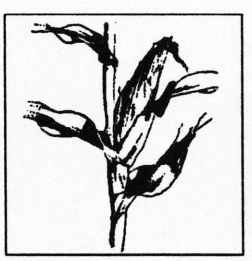
NOFA-New York: P O Box 21, South Butler, NY 13154, (315) 365-2299
Proceedings: $3.95 each plus $1.50 shipping for a total of **$5.45**.
Dues: Student and Senior (over 65): $15, Student and Senior Family (2 adults): $20, Individual: $25, Farm Listing: $30, 2 adult family: $30 (each additional adult, $5), Business: $35, Patron: $100, Corporate Sponsor: $500, Lifetime: $1000

NOFA/Rhode Island: c/o Casey Farm, 2325 Boston Neck Rd., Saunderstown, RI 02874
Proceedings: $3.95 each plus 7% tax (28¢) plus $1.75 shipping for a total of **$5.98**.
Dues: Individual: $20, Family: $25, Supporting: $50, Lifetime: $250

NOFA-Vermont: PO Box 697, Richmond, VT 05477
Proceedings: $3.95 each plus 5% tax (20¢) plus $1.21 shipping for a total of **$5.36**.
Dues: Individual or Family: $20, Supporting: $35, Sponsoring: $75

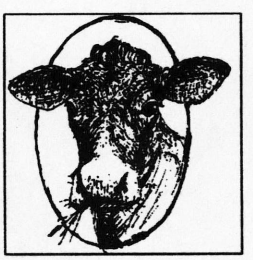
Some participants in the grower groups came from Maine, where the Maine Organic Farmers and Gardeners Association (MOFGA) performs work similar to NOFA's. MOFGA's address is Box 2176, 283 Water Street, Augusta, ME 04330, (207) 622-3118.

Apples

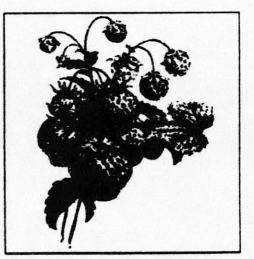


Sweet Corn

Greenhouse



Livestock



Strawberries