

The Bee Line

NEWSLETTER OF
WESTERN CASCADE FRUIT SOCIETY
A NON-PROFIT EDUCATIONAL ORGANIZATION

FALL 1996

Apples Pears Figs Grapes Kiwis Cherries Nectarines Peaches Plums Blackberries Raspberries Strawberries Blueberries Currents Huckleberries Gooseberries Nuts

1996 FALL FRUIT SHOW

SATURDAY, OCTOBER 26

SUNDAY, OCTOBER 27

at

Edmonds Community College
200th Street SW and 68th Avenue W
Lynnwood, Washington

LOTS OF FREE PARKING

Admission: Adults \$3.00
Age 16 and under FREE

—APPLE TASTING—FRUIT IDENTIFIED—SPEAKERS—CIDER PRESS RAFFLE—
—FRUIT DISPLAYS—EXHIBITS—

SPEAKER SCHEDULE

SATURDAY

- 10:30 a.m. **EDIBLE LANDSCAPING** *Scott Connor, KOMO Radio Garden Talk Show Host*
- 1:00 p.m. **DIAGNOSIS OF FRUIT PROBLEMS** *Sharon Collman, Entomologist, former Extension Agent*
- 2:30 p.m. **GOURMET COOKING WITH FRUIT** *Francois Kissel, Maximilien-In-The-Market Chef/Owner*

SUNDAY

- 10:30 a.m. **FRUIT ESPALLIER** *Kristan Johnson, Landscape Architect*
- 1:00 p.m. **NEWEST IDEAS FOR CONTROLLING INSECTS AND DISEASES OF FRUIT** *Cisco Morris, KIRO Radio and TV, Master Gardener, Seattle University Head Gardener*
- 2:30 p.m. **STARTING A FRUIT GARDEN** *George Pinyuh, King County Extension Agent, retired*

INSTRUCTIONS FOR MYSTERY APPLE IDENTIFICATION

Our expert apple identifiers will again be at the Fall Fruit Show to identify your mystery apple. To assist the, please bring four to six specimen (if you don't have that many, bring what you have) of the fruit you want identified, with stems and free from blemishes. The fruit should be typical in color, size and shape for the tree. **DO NOT WASH OR POLISH.** Refrigerate the fruit in a plastic bag if it has to be stored for more than one week. It would be helpful if you know the answers to these questions you may be asked:

- When was the fruit picked?
- Is it from a single tree or from a row of trees?
- Is it from an old orchard or a new planting?
- When is the fruit ripe and how well does it store?
- Is the tree upright, spreading or willowy?
- Does it bear on the shoot tips?
- Is it damaged by scab or mildew?
- Is it good fresh?
- Is it good cooked?

SUBMITTING FRUIT FOR DISPLAY

The major feature of our fall fruit show is the displaying of the many varieties of fruit grown by our members. Following are instructions for submitting fruit for display:

Bring 5-7 specimen (less if that is all you have) of the best looking ones of each fruit variety you wish to display (even if you have only one, bring it-it may be the only one of its kind there!)

For each sample prepare a 3" x 5" card listing the variety name and any other information you wish to share: harvest date, for instance, or any other pertinent information

Prepare a larger sign 8½" x 11" (or so) with your name and the geographical growing area

Plates, which hold three to five specimen, will be provided. If you have fruit to spare, it would be nice to have some for the tasting table.

Orel says if you have only a few samples of fruit to bring them. all displays are welcome.

COFFEE, TEA, MUFFINS, AVAILABLE AT SNACK BAR

DIRECTIONS TO EDMONDS COMMUNITY COLLEGE

Southbound on I-5:

Take exit 181 (196th St SW). go west (right) on 196th to 68th Ave W, then south (left) on 68th Ave W to 200th. Right into College campus

Northbound on I-5:

Take exit 179 (220th SW) Go west-cross over freeway- to Hwy 99. Go north (right) to 200th St SW, turn left continue west onto campus.

FOLLOW WCFS FALL FRUIT SHOW SIGNS

**YOU ARE NEEDED AT THE FALL FRUIT SHOW
ALL VOLUNTEERS HAVE FREE ADMISSION**

Can you help at the Fall Fruit Show? You can make a difference--and have fun! You have several options to choose:
Friday set up and/or Sunday take down: contact Orel Vallen 772-2119
Tasting table: contact Bill Davis 771-8978
Education Table: contact Dick Tilbury 723-9009
Membership Table: contact Evelyn Troughton 282-6191
Selling Raffle Tickets: contact Marlene Falkenbury 522-2273
Selling Door Tickets: contact Evelyn Troughton 282-6191

Evelyn needs special help on Saturday afternoon--There is an opera performance that night so she has to be at the boutique by 1:00 p.m. Could someone oversee the check in table and membership table?

The success of this event is directly related to the volunteers who make it run smoothly.

FROM THE BOARD ROOM

Your WCFS Board met August 3 from 1:00 to 3:00 p.m. at the University Branch Library. Members present were President Joe Zeppa, Treasurer Evelyn Troughton, Board members Orel Vallen and Bill Davis; Chapter presidents Ron Schaevitz, Piper Orchard; Marlene Falkenbury, Seattle Tree Fruit Society; George Boggess, Peninsula Fruit Club; and Larry Mowrer for South Puget Sound Chapter. Excused: Secretary, Chuck Holland and T. K. Panni.

Ron Schaevitz served as secretary pro tem.

The treasurer reported a bank balance of \$12,656.46 as of July 31, 1996. An increase of \$2,483.19 for the same period in 1995.

The board voted to contribute \$2000.00, in addition to the \$343.00 in individual donations received, to research at Mount Vernon, and \$750.00 to Oregon State University research.

Larry Mowrer presented a plan for making name tags for the membership at a very reasonable cost. He brought a sample of the name tags that could be made. He was authorized to look into the cost of a machine that would make a larger name tag. Larry volunteered to make the name tags for any Chapter that wished to order some.

Plans for the Fall Fruit Show were discussed and details finalized.

A FALL TOUR TO EASTERN WASHINGTON

As reported by Marilyn Tilbury

The BCFTA (BC Fruit Testers Association) held their annual Fall tour in the Wenatchee area September 6-8. (ED's Note: Bob Norton had called me to invite WCFS members. I called the Tilbury's and asked them to contact those they thought might be interested or able to go.) Chris Wehrfritz and Dr. Bob Norton planned a most interesting weekend. First, Dr. Gene Fairchild gave us an overview of research under way at the WSU Tree Fruit & Extension Center (TFRFC). We got to see Dr. Barritt's 1987 rootstock plot in which various rootstock/scion combinations (and some scion rooted trees) were compared.

The family owned Van Well Nursery is celebrating its 50th year. We toured their East Wenatchee site with Pete Van Well, a son of the founder. They produce well over a million trees annually. Sixty five percent are apples and most are grown on M7a and M26 rootstock. Their leading varieties are Red Delicious, Red Fuji, Royal Gala, Ginger Gold and Cameo. But Pete stated that his favorite apples for eating are Jonagold, RubINETTE, and Golden Delicious when at its prime. He likes Liberty the best of the scab resistant varieties. Their trees are dug in early November, held in cold storage and shipped from February thru May.

It was fun to visit Jack Feil's roadside fruit stand and orchard north of Wenatchee. He is of pioneer stock and his orchard by the Columbia River has standard trees of old time varieties including the original Buckeye apple, now called Delicious. Jack told us that the Esopus Spitzenberg is responsible for Wenatchee being called the "apple capital of the world," after it was taken to the New York world's fair and placed on exhibit. His orchard even includes an old Norwegian fjord boat which was powered by an OX5 aircraft engine, and old vehicles--a museum.

Tom Auvil, nephew of legendary Grady Auvil, showed us the Trout fruit packing plant. Tom said they recently merged with Blue Chelan to match the growing consolidation in the retail grocery business. They export 50% of their fruit, 80% of that to the Pacific Rim. Because of the cool, late spring, fruit size is small this year.

Tom took us to the Franzen orchard outside Chelan. It is irrigated and they said they get 7" of rain in a wet year. But they are higher than the Wenatchee Valley and get better quality fruit due to cooler nights. Their Galas were the nicest looking we had ever seen and the Jonagolds looked great too, but Tom vowed to get them out of Jonagolds--they turn brown if there is a warm spell just before harvest. The Franzens had no use for Mark rootstock.

Tom explained that Chelan growers are working with 40 acre orchards on average! Their fixed costs run \$3,000/acre. Thinning and picking costs are the variables. So 500 trees/acre will never pay off the establishment cost. A single row planting of 1200 trees/acre trellised to a 6' top wire on M9 is good. It's cheaper than tatura and double rows are too shaded. Tom feels that all spur-type fruit is lower quality; nonspur Red Delicious has higher sugar and higher volatiles.

Speaking of Red Delicious quality, Bob Norton and Steve Drake of USDA Wenatchee are studying whether the old Hawkeye and Starking Delicious taste better than the new strains. There will be taste tests and chemical analyses of various strains, harvested at different maturities. The Van Well 50th year catalog pictures 10 strains on the front cover; Pete Van Well feels the Oregon Spur II is the best flavored of the modern strains. Stay tuned.

Last we visited the "best roadside fruit stand in the state" according to Bob. Rudy Prey holds forth just east of Leavenworth by the huge American flag. He came from Germany with a background in both hort and manufacturing in 1978 because he wanted to be his own boss. One year the warehouse had no more cold storage room so he sold his Bartletts by the road. The rest is history. Rudy has 145 acres (130 in red pears) and has around 20 varieties of apples and pears on display in refrigerated tables from before Mothers Day til past October 20, available 8 a.m. to 8 p.m. Rudy says this is the best place in the world to grow pears--they are more flavorful because of the cool nights.

Our thanks to Bob and Carol Norton for their gracious hospitality and to Bob and Chris (current BCFTA vice president) for an excellent fall tour. For more information about BCFTA, write to P.O. Box 48123, 3575 Douglas St, Victoria, B.C. V8Z 7H5. Dues are C\$15.00 annually. (By the way, the BC folks were touting a new apple, Ambrosia--do any WCFS folks know about it?)

FROM THE EDITOR This issue contains all the articles sent to me (and others I have researched) regarding codling moth and apple maggot the past couple of years. I couldn't decide which to use so here they are! Interestingly enough, all of them contain some of the same information, and each of them have something different. I realize this information is too late for this year, but you will have the winter to look it over, think about it and decide how you are going to defend your apples next spring. I hope you don't decide to uproot all your apple trees!

A lot of the information is directed to commercial growers, but we as home orchardists can adapt any thing that is useful to the commercial grower to our use, or at least get an inkling of the problems out there and be glad that they aren't ours. Or are they? Any time I use an article that seems to be commercial, it is for that reason, and we do have some commercial growers in our membership. Let me hear from you if you think I go too far. And thanks to those of you who request information. Sometimes it takes awhile to gather it, so I hope that it gets to you before you give up hope!

Thanks to all of you for sending articles in: Ken Grant, Seattle Tree Fruit Society; Chuck Parkman, North Olympic Chapter; Dick Tilbury, Seattle Tree Fruit Society;

I read in the March 15, 1996 issue of Good Fruit Grower that funding from the U.S. Department of Agriculture for the Codling Moth Area Management Program (CAMP) was increased for the program's second year. The program, which involves five sites in Washington, Oregon and California received \$1.2 million in funding, up from \$850,000 in 1995. The funds were used for personnel, equipment, and research projects at the sites, and also to subsidize the cost of the pheromone for participating growers.

Dr Larry Gut, entomologist with Washington State University in Wenatchee, who is involved in the largest of the five projects at Chelan said the area wide program has become the USDA's major showpiece, and the increased funding reflects the success of the first year of what is hoped will be a five-year program.

The program involves 380 acres of orchard at Oroville, Washington, near the Canadian border; 1100 acres of apples at Chelan; 500 acres of apples and pears at Parker Heights, near Yakima; 300 acres of pears at Medford, Oregon; and 760 acres of pears at Randall Island, California.

Some important information came out of the first year, even though a hailstorm destroyed the crop at the Chelan site, Dr. Gut said. In some areas, growers were surprised by the number of leafrollers that appeared in the orchards when mating disruption was used in place of broad-spectrum pesticides. And, some growers had been expecting better results from the high-load lures used for monitoring codling moth in orchards where mating disruption is used. "I don't think they were satisfied with their ability to know whether they were getting good control," he said.

The leaf roller and trap issues are being given major emphasis this season, he said.

And the following information was gleaned from several articles in the April 15, 1996 issue of Good Fruit Grower which had a special focus on biological control. It would seem that the critters are developing a resistance to chemical controls.

The study of insect pheromones for mating disruption of key orchard pests has been going on for almost 100 years. Scientists had determined that insects used pheromones for communication by the turn of the century, but the first insect pheromone was not identified until 1960. Dr. Les McDonough, a research chemist with the USDA in Yakima until his retirement in January, said it took 30 years and 5 million insects before the first insect pheromone - the silkworm - was successfully identified. The silkworm was not an economic pest, it was there!

The average female codling moth has about three nanograms of pheromone, about one millionth of the amount used in lures, and scientists did not realize at first how little was present in an insect. It then took another 30 years before the pheromone dispensers became available commercially. McDonough said that one of the reasons it took so long was that previous research on the controlled release of materials had been in the area of pharmaceuticals. For example, researchers had studied the release of medications through polymer capsules into the body, and the assumption was that the same factors would control the release of pheromones into the air. This proved not to be the case, because medications move into fluids in the body, not air.

Pheromone lures, which were developed to help growers track pest population changes and determine the need for insecticides, have been in use since the mid-1970s.

Since the early 1990s, when pheromone dispensers were first introduced, manufacturers have modified and improved their products. Modifications over the years were to improve the stability of the codlemone pheromone, which degrades quickly when exposed to oxygen and ultraviolet light. It transforms into isomers of the pheromone, which may act as a repellent rather than an attractant, to the codling moth.

Early recommendations were to hang them on the shady side of the tree, now they are hung in the sun. Another change was an increase in the amount of pheromone in the dispenser. And this year the dispenser was redesigned with a spongy material on the inside which gives a wicking effect so the dispenser does not dry out, which stops the release of the pheromone.

Manufacturers are still working on improvements. Dr. Harry Shorey, a researcher with the University of California at Riverside, is experimenting with larger, canister-type dispensers with time-release mechanisms so that pheromone can be released only at certain times of day when it is needed. Codling moths tend to fly for a couple of hours before and after dusk.

In the March 15, 1996 issue of Good Fruit Grower there is an article that announces that "Guthion's days are numbered as key tool". Guthion has been an insecticide growers have relied on for 35 years and now there are signs that the codling moth is developing a resistance to it. High levels of resistance have been found in some California orchards, however the resistance level in Washington is still low enough that the product provides control.

It still works, it just doesn't work as well, according to Dr. John Dunley. "Guthion still works in most cases, but we have to consider how long Guthion is going to work," he said when he spoke at the Lake Chelan Horticultural Day and the North Central Washington Pear Day. He also said that mating disruption is probably the best long-term solution to controlling codling moth. He stressed that using mating disruption is not the same as growing fruit organically, and said growers should not be afraid to use chemicals along with mating disruption, if necessary. Dunley acknowledged that mating disruption can be more expensive, is more information intense, and is harder to use, but he encouraged growers to think about the future.

So, as Miss Manners would say, "Gentle Readers" read on -- if you stay with it, you will triumph. There are yet more articles I found on mating disruption, but they all say pretty much the same thing. I didn't know whether to intersperse them with other articles or put them together. Decided to clump them so you could more easily skip whatever part you wanted!!

KEEPING THE FAITH

By Kevin Thompson - California Farmer April 1996

In nature, codling moth granulosis virus (CMGV) is a potent enemy of codling moth (CM), one of the main threats to apple, pear and walnut growers. But man's attempts to harness the virus as a weapon against CM in this part of the world have met with only limited success. Two companies have produced commercial versions of CMGV, but later dropped their efforts.

More recently, a group known as the Association for Sensible Pest Control (ASPC) has sold an experimental formulation based on CMGV, which was used by some growers in Washington state in the wake of the Alar debacle. Growers, however, have quit using the virus in that state, and turned their resources to mating disruption technology, a more proven control.

Fruit and nut growers are looking for alternative CM controls, of course, because of CM resistance to Guthion, a widely used and highly effective chemical control. In California, a coalition of researchers and growers, known as the Randall Island Project, has for several years been researching ways to keep Guthion viable by utilizing alternatives.

But CMGV isn't one of them,

ASPC says it should be. The group, which has been a supply/marketing cooperative, but which recently registered as a "C" corporation, hopes to have a fully registered CMGV product available to California growers this season. ASPC was formed in the late 1980s following a meeting between Dr. Louis Falcon, a now-retired UC-Berkeley researcher who was producing the virus in his laboratory, and a group of about 20 growers. That group has shrunk to about 12 people, who are now shareholders of the fledgling company, including Dr. Falcon and Howard Kaplan, a farm broker and management consultant, and president of Farmvest, Inc., of Clayton. Kaplan serves as the operating officer of ASPC.

In California, interest from CMGV has come from organic growers, but Kaplan says the product has plenty of potential for conventional agriculture. "I think it would be wise for commercial growers to pursue this path, even though [CMGV] is not quite as cheap as Guthion."

CMGV works by attacking CM larvae's cells, converting the host's DNA to viral DNA, according to Dr. Falcon. After virus formulation has been sprayed onto trees, larvae ingest CMGV "capsules," where the outer covering of the capsule dissolves, exposing the viral particle. After attaching itself to the gut wall, enzymatic action fires the virus's DNA into the cells lining the wall, where it attacks the nuclei, converting them to viral DNA. The converted cells attack other cells, including blood and fat cells., Dr. Falcon explains, until virtually all the insect's cells are overcome. Within a few hours of ingestion, the larvae becomes ill, interrupting the feeding process. The entire process takes about 36 hours to complete, by which time the larvae's body is essentially liquefied.

Although the virus is extremely virulent, it is also highly selective, making it a "soft" material.

In Dr. Falcon's lab, which was shut down after his retirement and that of his assistant, Arthur Berlowitz in 1995, CMGV has been produced with the *in vivo* process, in which moths are reared to become little CMGV factories. The laboratory at UC Berkeley was the first to establish and maintain a sustained *in vivo* CMGV production culture. In this process, the larvae are reared until fully grown, then infected with the virus. After three days of viral incubation, when "total conversion is achieved," Dr. Falcon says, the larvae are collected, placed in a container and liquefied and centrifuged to filter out larger particles. After this viral mash is tested for virulence, it is ready to be formulated.

Dr. Falcon says this process increases the amount of virus by about five logs—a logarithmic increase of five. "If you can imagine a figure of seven zeroes," Dr. Falcon explains to a mathematically challenged editor, "you'll increase it to a figure of 12 zeroes. That little larvae is a factory."

"Many growers think it's hard to kill codling moth in the field," comments Kaplan. "Let me tell you, it's harder to keep it alive when you want to."

Between 1989 and 1990, after the Alar scare in Washington state, ASPC sold almost 4200,000 worth of CMGV to growers in the Northwest, under an experimental use permit (EUP) from the federal Environmental Protection Agency. (California does not permit commercial sales of a product under an EUP.) "Washington state was the biggest user by far," Kaplan notes, "with many growers embracing organic production and in transition to organic certification." However many growers who were interested in converting to organic production abandoned that pursuit. "They didn't realize the premium for organic produce wouldn't always be there," he contends, "many got beat up and got out. We lost a lot of growers."

But the vagaries of organic production and marketing aren't the only reason Northwestern growers stopped using CMGV. Kaplan readily admits that the virus has suffered some in-field failures, but he attributes that to high expectations and inexperience with the product. The Washington state growers "were in transition, didn't have beneficials, and it just overwhelmed the virus," he says. The virus, like mating disruption, requires relatively low populations of CM to be effective.

Part of the problem is that the larvae has to ingest the virus for it to work. "The kill rate for larvae that do ingest it is basically 100 percent though," he notes. In addition, since it takes about three days for the virus to consume a larvae, growers will see a "sting" or burrowing into the fruit. Kaplan says that fact has discouraged growers who have used the virus, but that's only part of the story. "There will be a sting, but you will see the insect stopped without going all the way," he explains. Not only that, but dead larvae don't produce offspring, so pest pressure will decrease in succeeding generation.

Larry Gut, systems entomologist with the Tree Fruit Research and Extension Center at Washington State University, in Wenatchee, calls the use and disuse of CMGV "a complicated issue." "In our original work with the virus, the first-year data looked terrible." Gut believes that keeping the virus viable and other quality control issues may be controlling factors. He says his work with organic growers in Washington showed that the virus was effective for three to four days, then dropped off. "Growers need about 10 days," he says.

"I tried [California-produced virus] here under some good codling moth pressure and did not get the kind of results I was looking for," according to Gut. "I didn't pursue it from that point on." However, he notes that CMGV being used in Europe and in New Zealand are showing good control. The New Zealand virus is based on a Swiss formulation.

"I strongly think it's the formulation," Gut maintains, "Otherwise, the European data doesn't make sense."

Dr. Helmut Riell, an entomologist at Oregon State University, has worked with a version of the virus produced in France, with which he was impressed. "There certainly was some efficacy," he comments. The French CMGV was applied at 10-day intervals. "When we looked at the damage, there were quite a few stings and some entries. But larval mortality was quite high. When you only look at evidence of stings and entries, it doesn't look that good, but when you look at larval mortality, it looks quite good."

Kaplan points out, however, that European success with the virus is also due to climate—there are only one or two generations of CM there. "There's far more damage when you do nothing in California," he says. With CM, 5 percent economic damage can be a problem for some growers.

Kaplan contends that virus formulation must be used correctly to be effective. Growers attempting to control CM with the virus alone need to apply it in the field from 2% to 98% hatch, he explains. "It needs to be applied weekly — that's 12 to 15 sprays during the season, to cover three full generations of codling moth. Some of those sprays can be tank-mixed with other materials."

The virus is extremely sensitive to ultraviolet (UV) light, so formulations must include an inhibitor. The ASPC mix included water, sugar and NuFilm 17 or NuFilm P, a UV inhibitor and sticker-spreader.

When used in combination with a mating disruption program, "if you've got low populations, you might be able to get by applying virus from 25% to 75% hatch—just two applications per generation," Kaplan says. "If it starts getting away from you, put out a couple of more virus sprays. If that's working, it's insurance to control blow-ins"—moths that originate outside the mating disruption area.

He also notes that coverage is critical—small droplets must be applied. Dr. Falcon echoes that sentiment. "The ingestion rate is a function of the amount of virus that's in the field, which is a function of the sprayer," he says. Sprayers that do the best job have an external air shear, which produces droplets in the range of 40 to 60 microns, according to Dr. Falcon. At Washington State, according to Gut, all of the virus test were applied with hand guns, "and I got good coverage," he says.

Kaplan also notes that growers who use the virus should test their trees several times a year for coverage, using water sensitive paper.

If the weather is especially hot, the spray interval should be shortened to five days. "Growers are reluctant to do that because it costs a lot," Kaplan notes, "but you can get a lot of damage in just those two extra days." ASPC's CMGV product costs \$20 per acre treatment. The company recently lowered the price from \$25.

If the weather is especially hot, the spray interval should be shortened to five days. "Growers are reluctant to do that because it costs a lot," Kaplan notes, "but you can get a lot of damage in just those two extra days." ASPC's CMGV product costs \$20 per acre treatment. The company recently lowered the price from \$25.

The pH of the water should be between 6.5 and 7.5, "especially if mixed with other materials," he says. Other best-management practices for CMGV include spraying during relatively stable conditions—no more than 10 miles per hour (MPH), and the sprayer should move through the field at no more than 1.5 MPH of wind. "It's all the good habits that get lost in the heat of battle," Kaplan comments.

Tim Bates, an organic apple grower in Mendocino County, is sold on the virus's potential. Bates, who became a shareholder in ASPC when it converted to a corporation, has been using the virus since about the mid-1980's, and uses it in combination with mating disruption. "I'm glad it's there," he says. "Mating disruption can be hit and miss." Bates adds that CMGV proves valuable later in the growing season, when CM pressure can build again.

In the Anderson Valley, where Bates' operation, The Apple Farm, is located, the climate is excellent for both apples and codling moth. "We have a minimum of three generations per year. It's a long, hard battle here." Bates experiences about 8% damage from CM, which he calls "livable." He would like to get that tally down to about 5%, which he figures he can do by buffering the water in his mix to lower the pH to recommended levels. "I've ignored buffering my water, but I'm definitely going to try that," he notes. Bates is also a big proponent of using NuFilm 17. "It really spreads the virus," he explains. Bates says he's seen "no hard evidence" that the virus tapers off in its effectiveness just three days after application. "We've tried all sorts of combinations and they've all worked well. The formulation has to be worked on, no doubt about that."

Since Dr. Falcon's UC-Berkeley lab closed last year, ASPC has been using up its inventory of CMGV. However, the firm is in the final stages of getting regulatory approval to import virus from a Swiss firm, Andermatt Biocontrol. The plan for the 1996 season, assuming all goes well, is to import raw virus and produce ASPC's registered formulation, "we'd have to get our EPA registration modified, and we weren't sure we could have accomplished that in time," he says.

However, Kaplan expects the Swiss version of CMGV to be approved for use in 1997, "and we may have some better formulation by then that we'll be testing." the virus was fully registered by U.S. EPA in August 1995. Cal/EPA, which has granted a conditional use permit in May 1994, canceled that permit, as is the procedure when full U.S. EPA registration is granted. "I believe they try and force you into completing the California registration," says Kaplan, who adds that Cal/EPA has been "extremely cooperative" with ASPC. Once the agency has reviewed the company's efficacy data, full California registration should be granted—perhaps by the middle of this month.

CMGV's progress to commercial use in the United States has been in fits and starts. Two firms, Sandoz, Inc. and Microgenesys, Inc., have experimented with the virus, but subsequently dropped their programs in favor of more promising products. Sandoz dropped its CMGV work "because they didn't see a future in it—and so far they've been right," Kaplan jokes. He adds that at present, a company (which he declines to name) is experimenting with a microencapsulation formulation for CMGV. ASPC may at some point become involved with that firm, Kaplan says.

Dr. Falcon thinks the virus's specificity hurts its commercial appeal, because it doesn't have a broad range of uses. And, he says, "One of the major problems is that you cannot patent this product. The pharmaceutical companies live off the royalties that their patents produce." He points out that CMGV could be patented if a new strain is produced through genetic engineering. "The virus lends itself to this," he adds. In addition, formulations can also be patented.

Dr. Falcon also notes that ASPC has spent much of its energy and resources in getting the virus registered. Now, he contends, it's time to improve the product itself. "We need to get this thing out there, even in small quantities, where it will be improved by use. We've done the minimum of testing out in the field. I'm hoping it will be improved, with better formulations. Sunlight is its worst enemy. We've gotten it registered and it's available to the grower community. Maybe now some larger companies will get involved."

"It would be nice to have more soft material to protect our borders and supplement pheromones," says Washington State researcher Gut. "Right now there aren't many good soft supplemental materials."

Dr. Falcon compares the potential of CMGV to *Bacillus thuringiensis* (Bt), which was registered as a pesticide in 1960 by a former colleague of Dr. Falcon. "For 25 years, nobody used it—it was just an unusual product on the shelf. It took 25 years for it to get visibility."

ASPC continues to investigate new formulations to improve the performance of the virus. "As volume builds, there may be opportunities to reduce the cost of codling moth control with CMGV," Kaplan says.

GOD DIDN'T MAKE THESE LITTLE GREEN APPLES
From New Scientist September 1995

Apple trees with a few extra genes are ready for planting out in a Derbyshire orchard. David James and his colleagues at Horticulture Research International's research station in East Malling, Kent, have equipped these apples with extra genes designed to fend off fungi and moth larvae.

One of the genes makes a protein from cowpeas that is toxic to larvae of **codling moth**. The other is meant to combat apple scab, the most damaging fungal disease of apples. The main aim of the two-year experiment, however, is to see whether the added genes function as well outdoors as they have in glasshouses. "We want to make sure the genes are still switched on in the cold," says Jill Chartier-Hollis of the University of Derby, who is handling the trial with her colleague, Paul Lynch.

Lynch and Chartier-Hollis hope that the Department of the Environment will allow them to plant 40 or so trees of the noncommercial variety Greensleeves in the grounds of Derbyshire College of Agriculture and Horticulture near Ilkeston this autumn. The experiment is part of a pan-European project to develop genetically engineered apple trees, funded through the Framework Programme.

CLOSING IN ON CODLING MOTH
Pheromone research aims to cut the cost of controlling the pest in half
By Renee Stern-The Grower October 1995

Researchers studying pheromone mating disruption from California to Washington hop their work will cut costs to growers 50 percent and lead to wider acceptance.

Five USDA-funded projects cover a mix of fruit, climates, orchard sizes and pheromone experience,, said Alan Knight, a research entomologist at the Agriculture Research Lab, Yakima, Washington. Knight leads a 400-acre project along the Canadian border in Oroville, Washington.

Using pheromones to control codling moth by preventing future generations now costs about \$100 an acre. Knight said he thinks improved techniques gleaned from the research could bring the cost to \$50 an acre.

Guthion, the pesticide used for 35 years against codling moth, carries its own costs that make alternatives such as mating disruption increasingly attractive. Extended waits after spraying to avoid injury to orchard workers add more management difficulties, particularly for larger orchards, Knight said. Even more troubling is growing resistance to Guthion in the pests that it's meant to combat. California growers are seeing up to 2% of their crop damaged by codling moth, no matter how much pesticide they use, while Yakima Valley orchards resort to four or five applications a year, when the average used to be three, he said. A California research project incorporates gathering data on reversing Guthion resistance.

Although IPM wouldn't eliminate Guthion completely, the goal, Knight said, is an 85% reduction in its use through developing softer programs that rely on man-made inputs.

Pheromone use has increased 20 to 30% in recent years as growers, particularly those running larger operations, "recognize a need to change practices," he said. Researchers and growers working on their own are experimenting with different techniques, such as applying an initial cover of Guthion and then relying on pheromones for the rest of the season, Knight said. Less disruptive chemicals and techniques such as chemical growth regulators for insects also are on the horizon, he said.

Greater pheromone use and a growing number of companies offering the products will help bring the price down. Registered compounds are ISOMATE C+, CHECKMATE-M and NoMate. A fourth, CIDeTRAK, should receive registration next year.

Although pheromones cost more than Guthion in initial outlay, the use balances against spraying the pesticide three times, Knight said. Extensive orchard monitoring, through traps and inspections, is the biggest expense of pheromones. And mating disruption leaves orchards vulnerable to pest migrations from outside the control area.

Because the projects involve large stretches of orchards under different owners, researchers can investigate whether broader use of these controls eliminates "edge effect," Knight said. That means that as the pheromones are spread out to the edges, diffusion decreases their effectiveness.

EXPANDING OPTIONS FOR CODLING MOTH CONTROL

California apple growers who want to reduce or eliminate synthetic chemical insecticides from their orchards still need ways to combat infestations of codling moth (*Cydia Pomonella*). If left unchecked, an orchard's codling moth population may build to the point that the moth larvae—which burrow into apples to feed and develop—damage or destroy much of the crop. The challenge of controlling this pest without conventional insecticides has been a major barrier for growers who want to make the transition to organic production.

Since 1989, researchers from the Center for Agroecology and Sustainable Food Systems (the Center) have developed *mating disruption* techniques for the Monterey Bay region's apple growers. In this "birth control" system, a synthetic copy of codling moth pheromone—the scent released by females to attract male moths—is released into orchards in quantities large enough to camouflage the females' own scent and prevent males from locating females.

Studies by Center entomologist Sean Swezey and his colleagues have shown that mating disruption works best in relatively dense planting of semi-dwarf trees, where the pheromone scent concentrates in the tree canopy.¹ In some of the Santa Cruz County orchards that Swezey has monitored for the past five years, pheromones controlled codling moth damage as well as or better than conventional programs.²

Despite these success stories, Swezey acknowledges that the method isn't foolproof. "It's really unlike synthetically based cover sprays in that there are many environmental features that influence its effectiveness," says Swezey. These features include the orchard's topography, surrounding crops, and the variety of apple being grown—for instance, some late-ripening varieties are more vulnerable to a late generation of moths. Orchards with taller canopies, or "gappy" orchards where moths may find each other in open spaces, are less suited to pheromone treatments. Because the scent tends to settle in low areas and can be dispersed by the wind, the technique may not work as effectively in orchards located in hilly or windy terrain.

In situations where mating disruption looks like a promising option, growers must be willing to carefully monitor the moths' breeding cycles in order to properly time pheromone applications. "It's a monitoring-intensive approach to codling moth control," says Swezey. "You must have the basic monitoring information at your disposal." According to Swezey, pheromones should be put out at least one week before the predicted date of adult emergence in each codling moth generation. Growers should use pheromone lure traps and the degree-day model to help predict when the adults will emerge.

NEMATODES DESTROY MOTH LARVAE Because mating disruption alone may not be sufficient to keep moth damage low in some situations, Swezey and coworker Matt Grieshop have been studying the effectiveness of nematode sprays as a supplemental control. Some species of nematodes (tiny, soil-dwelling worms) are parasitic natural enemies of the codling moth. Juvenile nematodes enter the moth larva or pupa, then release bacteria which kill the host. The nematodes mature and reproduce inside the dead host, and the young nematodes feed on the corpse. Once their food supply is exhausted, the juvenile nematodes re-enter the environment to seek new prey.

One advantage of using nematodes rather than conventional insecticides is that they don't affect the beneficial beetles, spiders, wasps, and other non-arthropod organisms living in the soil environment and tree canopy that growers want to encourage. They're safe for the humans who do the spraying or work around the trees, and if consumers feel squeamish about the idea of tiny worms near their apples, they can be assured that nematodes don't survive the dry conditions in the tree canopy.

Grieshop is refining the timing and application methods for using nematodes to control codling moth populations. Working at the UCSC Farm's organic apple orchard, he's spraying millions of *Steinernema carpocapsae* (a commercially available nematode species) on the soil at the base of the trees and on the trunks where codling moth larvae may hide. "Fortunately, you don't need any special equipment to use the nematodes—they can be applied in water with conventional spray gear," says Grieshop. Sprays coincide with orchard irrigation, since the nematodes can only move around and seek prey in moist conditions.

STUDIES SHOW PROMISING RESULTS In a study conducted from the fall of 1993 through the summer of 1994, Grieshop tested the effect of the nematode sprays on pupating larvae. Grieshop first banded apple tree trunks with cardboard to attract the newly hatched codling moths—the larvae crawl beneath the bands to pupate, and researchers can collect and analyze the treated larvae and pupae. "Banding the trees and monitoring the bands is critical," says Swezey. "You don't just apply the nematodes at any time; you need to wait until the seasonal intervals when late-stage larvae or pupae show up in the bands," he says. According to Grieshop, growers can use the degree-day model to predict when to apply nematodes.

In Grieshop's initial study, nematodes were mixed with water and applied to tree trunks using a 30 gallon spray tank with a hand sprayer. He also banded control trees and sprayed them with water as a check for the nematode treatment. Results from two separate trial dates showed that nematodes were extremely effective in killing the larvae; average percent mortality of larvae treated with nematodes was 69.2% for the two trials, versus 3.5% mortality for the control treatments (Table 1). These results were consistent with those from earlier studies conducted by entomologist Lyn Garling, who found similarly high rates of larvae and pupae mortality following treatments of overwintering larvae with nematode sprays. Garling's studies were also conducted at the UCSC orchard.

This summer Grieshop expanded the study to examine how nematodes affect codling moth larvae that burrow in the soil. He sprayed nematodes on the soil at the base of the trees, and a week later collected the larvae that had been placed in the soil for the study. Again, the nematodes killed nearly all the treated larvae and pupae (Table 2). Grieshop also found that a surprisingly high number of larvae from the untreated control sites were also infested with nematodes, which may have persisted in the soil from earlier studies and moved into the unsprayed rows.

Based on Grieshop's findings, Swezey feels that nematodes can play a role in an overall codling moth control effort. "We see nematode treatments as an alternative in commercial settings where you can apply them in concert with irrigation," he says. "This would be a supplemental program to assist a mating disruption program. For now the nematode has been useful in troublesome small areas where you want to get local suppression."

Asked about the cost of using nematodes, Swezey noted that some nematode formulations are very reasonably priced and have a six month shelf life, but contain a small amount of material that is not on the list approved by the California Certified Organic Farmers (CCOF), the state's largest organic certification group. The formulations approved by CCOF are about ten times more expensive than the non-approved formulations and cannot be stored, since the nematodes are shipped live—this makes timing the application more complicated.

If the cost of the nematodes can be brought down, or if CCOF approves the cheaper formulations, Grieshop and Swezey feel that nematodes could be a cost-effective means of controlling codling moth infestations. "We applied a lot of nematodes for this study, but I think you could still get good control with lower application rates, which would help cut costs. Also, if the nematodes persist in the soil, they'd provide some ongoing control, especially if the applications are timed to allow establishment and augmentation of the nematode population. That's something we want to look at in our next tests," says Grieshop.

BENEFICIAL WASPS AN OPTION Another potential member of the codling moth "biocontrol team" is a tiny wasp of the *Trichogrammatid* family that lays its own eggs inside those of the codling moth. The developing trichogrammatids destroy their host's eggs, and once they hatch and mature the next generation of wasps continues the cycle.

Swezey and research assistant Cathy Carlson hope to supplement pheromone mating disruption efforts in Santa Cruz County orchards by using a locally adapted *Trichogrammatid*. UCSC Environmental Studies student Erika Mouw discovered the parent line of these wasps two years ago in a local organic apple orchard. Taxonomist John Pinto at UC Riverside's Department of Entomology has identified one population as *Trichogramma* (nr.) *platneri*.

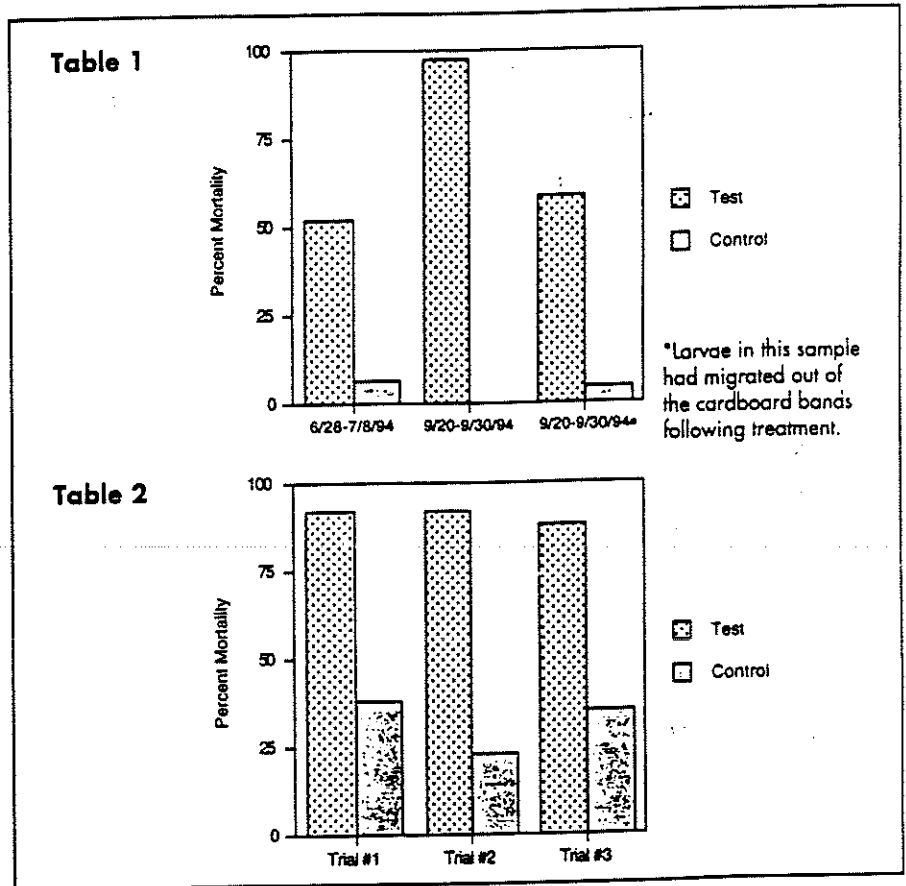


Table 1 shows percent mortality of pupae and larvae from treated and untreated cardboard bands. Table 2 shows percent mortality of treated and untreated pupae and larvae in the soil at the base of trees.

The Organic Farming Research Foundation recently awarded Swezey and Carlson a grant to breed the *T. nr. platneri* strain at the Center's insectary and test its effectiveness in local orchards. If the wasp shows promise as an aid in controlling codling moth, Swezey hopes to eventually make it available at cost to local growers.

References: ¹Swezey, Sean L. et al., 1994 Granny Smith conversions to organic show early success. *California Agriculture* 48:6, pp. 36-44
²Cascorbi, Alice. 1995 Codling moth study identifies new challenges *The Cultivar* 13:1, pp. 5-7.

The above article by Martha Brown, Senior Editor, appeared in *The Cultivar* Vol. 13, No. 2 Summer 1995

WSU-TFREC BULLETIN NOW AVAILABLE ON CODLING MOTH MATING DISRUPTION

A bulletin on how to implement mating disruption for codling moth in Washington State apple and pear orchards is the first of an Information Series compiled by researchers at Washington State University's Tree Fruit Research and Extension Center in Wenatchee.

Dr. Jay Brunner, who wrote the bulletin with colleague Dr. Larry Gut, said it should answer the many questions people have when they are using mating disruption for the first time. "It's impossible for us to talk to everyone, so what we have done is try to gather our best collective wisdom and put it in one spot.

Brunner said mating disruption is a new approach to pest control in that it is highly selective, targeting only one pest. "We're suggesting monitoring methods and protocols that are different from ones we have used in the past.

"You have to choose a product, apply it correctly, understand how it's going to work, and maybe how different physical factors may affect its performance, and then how to evaluate if it's working or not."

The bulletin explains codling moth mating behavior and the concept of mating disruption. It covers the influence of physical factors in the orchard, how the dispensers should be applied, and the amount of pheromone needed.

Protocols are suggested for monitoring codling moth in orchards where mating disruption is used, which is more difficult than where conventional controls are used.

Often, mating disruption alone will not provide acceptable control in orchards with moderate or high pest pressure, and supplemental controls may be needed to reduce populations at first. The researchers have developed action thresholds, based on trap catch, to help orchardists determine when controls may be needed.

The bulletin (WSU-TFREC #1) is available for \$5.00, plus \$2.00 shipping, through WSU-TFREC, Wenatchee; area WSU Cooperative Extension offices; and Good Fruit Grower. Mail orders may be placed with VISA, MasterCard or American Express toll free at 1-800-487-9946 (Good Fruit Grower).

IPM AND CODLING MOTH CONTROL

As you have read, the Agricultural Research Tree Fruit Research Laboratory at Yakima, in coordination with Washington State and Oregon State universities and the University of California at Berkeley, has implemented an area-wide integrated pest management project aimed at the codling moth. The focus of this project is to incorporate IPM technologies that have been used only on a limited basis.

What is IPM? Integrated pest management involves many aspects of growing crops, including choosing effective pesticides. In a practical sense, IPM is a complex mixture of practices and technologies, specific to a given crop, to control pests. IPM is an evolutionary process that continues to advance the way growers manage pests to the benefit of society's environmental and economic well-being.

There are several things IPM is not: it is not new, not implemented overnight, not organic farming, and not a formula to eliminate or reduce pesticide use.

IPM also is not a rigid program of management techniques: it is a balance of all suitable techniques, providing the grower with options to manage pests within a given crop production system.

APPLE MAGGOT IN WESTERN WASHINGTON

By Dick Tilbury

Until recently Western Washington was free of two fruit pests endemic to the eastern U.S., namely apple maggot and plum curculio. To my knowledge we are still thankfully free of plum curculio; however the presence of apple maggot flies (*Rhagoletis pomonella*) in the Northwest was first confirmed in the Portland, OR area in 1979 and soon after in Southwest Washington.

In July 1984 the Washington State Department of Agriculture initiated a quarantine on movement of home grown fruit. The quarantine covered all of Western Washington except the three northern counties of Snohomish, Skagit and Whatcom. The quarantine hopefully slowed the rate of infestation but the little beasts are inexorably moving north up the I-5 corridor toward British Columbia, and in 1995 Snohomish County also came under quarantine. (Please note there is no apple maggot problem in the commercial apple growing areas east of the Cascade mountains.)

We are situated on a city lot in Seattle and have a scattering of fruit trees (apple, pear, plum, peach, fig.) We had no evidence of apple maggot until 1994. At that time Orel Vallen, a fellow member of Western Cascade Fruit Society, took it upon himself to determine the degree of infestation in the greater Seattle area. He fabricated yellow sticky traps and hung them in apple trees of those willing to participate.

The traps were 9" x 5½" x ½" wood panels, well coated with white primer followed by a coat of Zynolyte brand lemon yellow fluorescent paint. Each panel was slipped into a clear plastic envelope. A mixture of brush-on Tangle Trap and ammonium acetate was spread on the outside of the plastic. This attractant was mixed at the rate of 60 grams ammonium acetate crystals to one quart (2 pounds) Tangle Trap (roughly one-half gram ammonium acetate per trap coating.)

The traps were hung in the outer third of the fruiting canopy, anchored to prevent swinging in the wind and foliage was removed near the trap. Traps were monitored and new envelopes with fresh coating were installed every two weeks. The monitoring program confirmed apple maggots with particularly heavy captures to the southwest of Seattle. Our three panels trapped a total of 7 apple maggot flies in 1994.

At this point I wish to digress to emphasize one of the many benefits of being a NAFEX member. At the 1994 NAFEX annual meeting at the University of Massachusetts Dr. Ronald Prokopy, professor of Entomology, talked on apple IPM. Here we were obtaining all this information based on his years of apple maggot research at the same time the first apple maggots were moving into our area. We have since subscribed to Karen Houschild's tree fruit newsletter published by UMASS cooperative extension so we can keep track of Dr. Prokopy's research. Karen recently sent us a copy of a 1984 report by Dr. Prokopy in which he concluded that red spheres coated with Tangle Trap and hung in the fruiting canopy, one per every 100 apples, could offer less than 1% apple maggot injury in a home orchard.

In 1995 we again deployed three yellow panel traps plus one dark red ball, all coated with the above sticky attractant. From June 9 through September 5 we trapped 95 apple maggot flies on the three yellow panels and 94 on the one red ball. We also picked up and destroyed fallen fruit daily and saw maggot damage in about 6 Summerreds.

This shows how fast pest populations can build up and why apple maggot control will be mandatory in our area from now on. Now if I could just get codling moth control without resorting to a pesticide spray program, but that's another story.

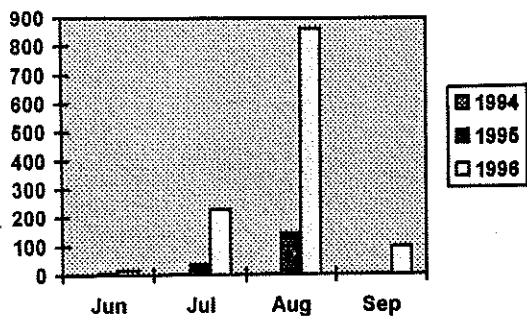
Editor's Note: Dick Tilbury is a member of the Seattle Tree Fruit Society chapter of WCFS. He has served on the Board of WCFS in many capacities. This article was written for publication in the NAFEX newsletter "Pomona", summer 1996 issue.

Dick's 1996 statistics: Three baited yellow sticky panels and 3 Gempler's sticky red balls were deployed in pairs on May 15. The red ball and yellow panel were hung about 20" apart and a Gempler vial of apple maggot lure was hung between them. A single Ladd trap was hung on August 8 in a prime position. Flies were collected and sex determined daily. Data are through September 19.

There was a marked difference in fruit damage between 1995 and 1996—damage in 1995 was minimal and confined to one early variety, Summerred. This year damage was much more extensive but the early apples like Gravenstein, Jonamac and Summerred were unscathed! Mid and late season apples such as Holstein, Jonagold and Melrose have seen at least 10% damage.

The yellow panels trapped 374 AMF, one third of the total, BUT 77% of these were (presumably immature) females. The red balls trapped 704 AMF and 66% were (presumably immature) females. The Ladd trap caught 126 flies and only 44%

were female. Our strategy for 1997 will be to hang more yellow panels and red balls, positioning some of them toward the borders.



The graph at the left represents the apple maggot flies trapped in 1994, 1995 and 1996. No attempt was made to determine if some of the flies caught were snowberry maggot, an innocent lookalike. A dissecting scope and skill are needed for this. No pesticide was applied.

| Year | Total AMF |
|------|-----------|
| 1994 | 7 |
| 1995 | 189 |
| 1996 | 1204 |

Editor's note: The Ladd trap (available through Ladd Research Industries, Inc, in Vermont) Dick mentions is a commercially produced yellow plastic panel with half a red ball on each side. Dick says it is as effective as using the yellow panel and the red ball, but it is not as easy to maintain. The wooden panels Orel Vallen makes are sturdier, the plastic panels are not easy to scrape and recoat as they bend.

Dick also sent along the following article, simply titled "Apple Maggot", with this note: "This is an article we got from Ed Lewis. Somebody else gave it to Ed. They must have picked it up from the INTERNET. Great information, primarily for the commercial grower, but still very useful for the home orchardist. Good supplement to my article." The comments [in brackets] are his as is the underlinement of some text.

APPLE MAGGOT

Detection and containment of the apple maggot within its present geographical limits in Washington is a high priority of the WSDA. Surveys and surveillance for this pest will continue in Washington. There has been no major expansion of the known apple maggot distribution in eastern Washington since 1987.

MANAGEMENT RECOMMENDATIONS The following recommendations are to ensure that this insect does not successfully infest commercial fruit. These recommendations are considered minimum precautionary steps a commercial orchardist should follow to protect fruit from attack by the apple maggot. The recommendations are divided into a monitoring section and control section. Appropriate action depends upon the proximity of a commercial apple orchard to an apple maggot detection.

MONITORING Counties not known to be infested by apple maggot need not conduct any special monitoring programs in commercial orchards. The WSDA is conducting a monitoring program for apple maggot throughout the state in counties where apples are grown commercially. This program concentrates on monitoring of apple maggot hosts in high risk areas, including urban centers, parks and rest areas, along major roads, and in commercial orchards bordering these areas. If apple maggot is detected in new areas of the state, immediate notice will be given to WSU Cooperative Extension and fruit industry representatives.

In counties where the apple maggot is known to occur, monitoring and control actions will depend on how close an apple maggot detection is to the orchard. Traps recommended for monitoring the apple maggot are only effective in detecting apple maggot within the tree in which they are placed (that is, they do not attract apple maggot to the trap from more than a few meters). Therefore, monitoring early maturing apple varieties in July and August, then shifting monitoring activities to later maturing apple varieties and hawthorns in late August or September, is a good method to spread monitoring resources between hosts when apple maggot activity on them is most likely to be at its peak.

If the apple maggot is detected within 2 miles of an orchard, then monitor apple maggot hosts up to 1/4 mile from the orchard border. If an apple maggot is detected within 1/4 mile of an orchard, the orchard is considered to be in a "threatened status," and control sprays or monitoring of the borders adjacent to native habitat areas should begin immediately. It is not necessary to monitor orchard borders that are next to other commercial orchards. If apple maggot was detected adjacent to or within the orchard the previous year, then begin monitoring orchard borders when the

trapping period starts. In this latter case, monitoring apple maggot hosts within 1/4 mile of the orchard is also strongly suggested.

TRAPS The apple maggot fly is attracted to specific colors, shapes and odors. There are two trap types that use the attractive cues listed above as the basis of their effectiveness. A yellow panel trap is attractive because of its color. This trap is usually associated with a lure (ammonium acetate, ammonium carbonate or protein hydrolysate or combinations of these) that enhances its ability to attract apple maggot flies. [Dr. Prokopy, UMASS, stated that ammonium carbonate lasts much longer than ammonium acetate.] A red sphere trap (7-8 cm in diameter) is also effective. Attraction is based on the color and shape; lures do not enhance capture. Both of these trap types are coated with a sticky trapping adhesive in which the apple maggot fly becomes stuck. None of the traps available for apple maggot monitoring will attract flies from a distance of more than a few meters (they are essentially only effective within the canopy of the tree in which the trap is placed). The most efficient trapping of apple maggot flies is achieved when yellow panel traps with an ammonium carbonate lure and red sphere traps are alternated within an area. [Excellent recommendation.] Traps can be purchased from vendors specializing in the sale of insect monitoring systems. [Gempler's P.O. Box 270 211 Blue Mounds Rd Mt Horeb, WI 53572 1 800 382-8473]

TRAP PLACEMENT AND MAINTENANCE Place traps in trees at intervals of every 100-150 feet along the orchard border. Where dusty roads occur along orchard borders, place traps in one or two rows. Check traps weekly and collect flies as described below. Place the trap within the fruiting canopy of the tree. Attach the yellow panel trap securely to a limb so it will not move in a light wind. Remove all fruit and foliage within 12-18 inches around the trap so that it remains in an open area but within the tree's fruiting canopy. Align the yellow panel trap with its broad surfaces facing the foliage within the canopy and not oriented toward the outside of the tree.

Traps should be in place by the first of July. [First of June for western Washington.] Examine traps every week and remove suspect flies. Place the flies in a vial containing the solvent 1,1,1 trichloroethane which can be obtained at hardware stores. Include in the vial a label written in pencil, indicating the location and date the flies were trapped. Correct identification of the apple maggot requires examination of the flies under magnification by trained personnel. [Apple maggot fly and snowberry maggot fly look alike. Need microscope to tell them apart.] Send properly preserved flies to an appropriate location for identification. Recent research has indicated that the pre-baited Pherocon AM trap is most effective for about 7 days. Change this trap every week to ensure maximum performance. There are other apple maggot traps that retain their attractancy for longer periods of time (e.g., red sphere traps or yellow panel traps with an ammonium carbonate lure).

CONTROL RECOMMENDATIONS Counties where the apple maggot has not been detected need not apply additional protective sprays specifically for the apple maggot. In counties where the apple maggot has been detected, control recommendations depend upon how close an orchard is to an apple maggot detection. If the apple maggot is detected at a distance greater than 1/4 mile from an orchard, no protective sprays specifically for the apple maggot are required. If an apple maggot is detected within 1/4 mile of an orchard, the orchard is considered to be in a "threatened status."

Two options, no trapping or trapping, are offered to growers when orchards are in a "threatened status." These options are specifically outlined below.

No trapping option. No orchard monitoring is conducted so it must be assumed that the apple maggot is in the orchard and direct controls must be implemented as follows.

1. Initiate apple maggot control treatments (see materials and rates recommended) immediately when the orchard reaches the threatened status.
2. Apply control treatments every 14-21 days until harvest.
3. Have fruit inspected by the WSDA, certifying that it is free from apple maggot infestation, or place the fruit in standard cold storage for a minimum of 40 days before shipment out of the quarantine area.

Trapping option. The need to apply control treatments for apple maggot can be based on results from orchard monitoring as follows.

1. Initiate apple maggot monitoring as soon as the orchard reaches a threatened status by placing traps at an interval of one every 100-150 feet along orchard borders adjacent to native habitats;
2. Apply control treatments within 7 days of detecting an apple maggot fly on traps in the orchard;
3. If flies continue to be caught, repeat treatments in 14-21 days;
4. If no more flies are caught within 14-21 days after the first capture, then additional treatments are not necessary until another fly is detected;
5. Have fruit inspected by the WSDA, certifying that it is free from apple maggot infestation or place the fruit in standard cold storage for a minimum of 40 days before shipment out of quarantine area.

PESTICIDES RECOMMENDATIONS FOR APPLE MAGGOT

| Use of any of the listed materials | Amount per acre | Amount per 100 gallons | Days from last spray to harvest |
|--------------------------------------|-------------------|------------------------|---------------------------------|
| azinphosmethyl (Guthion 35WP) | <u>2-3 pounds</u> | 1/2-3/4 pounds | 7 |
| azinphosmethyl (Azinphos-M 50 WP) | 1 1/2-2 pounds | 3/8-1/2 pound | 7 |
| phosmet (Imidan 50 WP) | 4-6 pounds | 1-1/2 pound | 7 |

Note: Guthion and Imidan at these rates can be applied by air late in the season if ground sprayers cannot be pulled through the orchard.

OTHER MANAGEMENT RECOMMENDATIONS Removal of apple maggot hosts from an area 1/4 to 1/2 mile around the orchard will help reduce the threat of movement of the apple maggot into the orchard. Wild or unsprayed apple trees, native and imported or ornamental hawthorns and crabapple trees represent high risk apple maggot hosts, which should be removed. Second generation codling moth sprays applied in mid-July or early August will give protection against the apple maggot for 14-21 days, provided the recommended materials and rates given above are used.



TEN - COUNT 'EM - TEN BEST APPLES ARE YOU READY FOR THIS?

In 1992 Dave Battey - newsletter editor extraordinaire - sent out a plea for your ten best apples. In a folder I inherited I found some responses--seven to be exact. Well, small wonder he didn't publish the results. But I am cleaning out the folder and here they are. There were 42 apples listed: 4 votes-Chehalls, Gravenstein, Jonagold; 3 votes-Gala, Akane, Spartan; 2 votes-Melrose, Buckley Giant, Hudson's Golden Gem; 1 vote-Spitzenburg, Tydeman's Late Orange, Spigold, Burgundy, Yellow Transparent, Cox's Orange Pippin, Golden Delicious, Summerred, Wagener, Lodi, Royal Gala, Holstein, Arlet, Elstar, Red Spy, Idared, Fameuse, McIntosh, Northern Spy, Bramley, Golden Russet, Snow, Rambo, Summer Russet, Karminj de Sonnaville, Ginger Gold, Earligold, Ashmead's Kernel, Liberty, Mutsu, Thomkins King. (There is no particular order to this listing other than votes.)

Well, isn't it about time for another ten best? Has your taste changed? Have you found a better apple?

I suppose there should be some order to this, so how about harvest time, early, mid-season and late. And if you really want to get into this, two lists--one eating the other cooking.

Let me hear from you by November 15 so I have time to tabulate the results for the January newsletter. (Or you can drop your list off at the Fall Fruit Show, there will be a box to put it in, save some postage.) A postcard will do fine. If you want to tell why it is your favorite --disease resistance, storage, just plain flavor, whatever-- that would be great. Lets help support the Postal Service, overwhelm my mail carrier, every one send me your list. (Besides, I haven't been getting much mail lately since I'm not taking reservations for a fund raiser!!) My address is on page



BENEFITS OF FERTIGATION

By Geraldine Warner
Good Fruit Grower September, 1996

Dr. Guy Witney, the new Washington State Extension University Cooperative Extension agent for north central Washington has seen some pretty sophisticated high-density apple plantings since he arrived from California in April. But he's also seen some rather unsophisticated nutrition programs.

Witney, formerly an Extension citrus management specialist with the University of California, Riverside, has been surprised at the number of orchardists in Washington State who are still using dry fertilizers, rather than liquid fertilizers. "There are clearly situations where dry fertilizer is the way to go," he noted, "but I think in some of the newer high density plantings, there's technology available that would simplify orchard management if liquid fertilizer were used."

Witney said almost half of California's subtropical tree fruit industry uses liquid fertilizers because they are more economical. One of the greatest savings is in labor, as liquid fertilizers can be applied through the irrigation system, eliminating the need to walk from tree to tree applying fertilizer by hand.

It has been reported that tree fruits are not very efficient at using nitrogen. Only about 25% of the nitrogen applied is taken up by the trees. Witney believes part of the reason for that is probably that nitrogen has been applied in a concentrated, granulated form that has simply been washed through the soil.

An advantage of fertigation is the accurate placement of fertilizer. Sprinklers apply fertilizer only to the area where the tree roots are, as roots tend to follow the sprinkler pattern. This reduces the risk of nitrogen contaminating ground or surface water. Witney said this may become a significant advantage if nitrogen management becomes more regulated.

Witney said the Washington tree fruit industry's nutrition program appears to have been adapted from the practices used in the row crop industry. However, whereas soil analysis is a good basis for assessing the need for fertilizer in row crops, leaf analysis is preferable in perennial crops, such as tree fruits. Soil nutrients can be measured, too, but should not be used as a tool for making decisions about the fertilizer program.

A leaf analysis will indicate what nutrients will be required the following season. The laboratory doing the analysis can send the results directly to a fertilizer supplier. Suppliers can supply customized mixes of liquid fertilizers to suit a specific orchard's needs.

Although the trees' nutritional needs may differ according to the age or type of trees, there is no good formula to determine that, Witney said. "That's why it's important to go back each year and take the leaf analysis, and see where you are, and see where the previous season's fertilizer program has had an effect," he explained. The main objective is to keep the nitrogen, phosphorus, and potassium levels in balance, although micronutrients, such as zinc and boron, can be added too.

Witney said some growers say that applying granular fertilizer with a coffee can or similar device allows the flexibility to judge each tree's needs and adjust the rate accordingly, applying more to small trees, and less to large. "The grower can make a judgment call for every single tree, which sounds good," Witney said, adding that applying fertilizer by hand probably caused the variability in the trees in the first place. "But what tends to happen with a liquid fertilizer program—if it's done right from the onset of orchard establishment—is you tend to get very even growth. As long as you have a distribution system that's very uniform, you will end up with even tree nutrients.

A drawback to applying nutrients through the irrigation system is that most systems also irrigate the grass between the rows to some extent. Witney said this is usually not a major problem as long as the system is designed to place most of the water in the tree row and only a small amount in the alleys.

Although liquid fertilizers are more expensive, they can work out more economical in the long term, because growers should be able to use less fertilizer and save on labor costs.

Fertigation is probably not feasible for low density systems because there is more grass in the orchard and because the distribution pattern from high impact sprinklers is uneven, he said. "If you added liquid fertilizer to those systems, you would end up with very poor, nonuniform fertilizer distribution, and you would be feeding mostly grass," he said.

Witney said the computerized variable-rate applicators that are being developed would be useful for ensuring that the nutrient content of the soil is uniform before planting the orchard, but should not be necessary after that. "My experience in southern California, where they have very steep and inconsistent blocks, is that fertigation has been the key to even

tree growth because you're supplying each tree with the same amount of nutrient. You're supplying everything the tree needs. It's surprising how even you can get things to grow."

Witney said he would like over the next few years to do some applied research projects with growers who are interested in working with liquid fertilizers to see if they can demonstrate a benefit. Witney, 36, said he chose Extension work as a profession because he enjoys working with growers and seeing things changed in the orchards to benefit growers. "I enjoyed applied research—the type of field trials that can be done in a few years and get results—but I enjoy more taking those results to growers and seeing the change," he said.

One of the first projects he tackled on arriving in Washington was to compile information on what effect the winter freeze might have on trees in the coming years. "I fell into that because these winter injury questions started coming into the office, and we started getting more and more of them, and I had the time to go back and look at the history of previous freezes and freeze damage," he explained. Based on past experience, he assessed what growers could do and what they can expect in the next few years from the orchards damaged this year. He wrote two articles for the *Good Fruit Grower* about winter damage. One was published in June and the second in July.

He has also written an article urging growers to be cautious about new products that are being sold, and said growers should be wary about products that may come on the market that claim to be cures for winter damage. As more new technology becomes available, it is easier for people to slip in technology that is not tested or even verges on being fraudulent, he said. Although some products might work, growers should be wary of outrageous claims.

Witney said he feels he could be of use in working with growers to test new products in properly replicated situations, and find out which are worthwhile and which are not. He encourages growers who have doubts whether or not they should buy something to call the Cooperative Extension office. "You don't want to put down something that might be fantastic, and you have to be open minded," he said. But he urged growers to have a degree of skepticism and not just accept the sales pitch given.

In future, Witney expects to be working primarily on irrigation, nutrition, and other horticultural projects, such as varieties and rootstocks, while his colleague Tim Smith focuses mainly on pest and disease control.

Witney grew up near Durban in South Africa, where his parents and five siblings still live. His parents had a 10-acre orchard. He earned his bachelor's degree in agriculture and master's degree in horticulture at the University of Natal, and came to the United States 11 years ago to study for his doctorate at the Virginia Polytechnic Institute and State University, while teaching horticulture. For his doctorate, he worked on the preharvest factors that influence postharvest bitter pit in apples.

He found himself working with citrus and subtropical fruit crops when he was appointed as an area Extension advisor for the University of California, Riverside. He covered Riverside and San Bernardino counties, the two largest counties in the country. The major crops he worked with were grapefruit and avocado. Before moving to Washington State, he was working at UC Riverside as an Extension specialist, providing statewide support for advisors working in citrus.

Witney was the founder and editor of a quarterly newsletter on subtropical tree fruit orchard management, which started out as a publication for Riverside and San Bernardino counties and later expanded statewide. When he left, it was being distributed to 4,000 growers, and there were plans to extend its readership.

Although Witney will be making information available to Washington growers through Washington State University's Bulletin board and other electronic means, he also sees a need for traditional means of communication. "Electronic communication's fine, and there's already very good use being made of it," he said. "But I think perhaps some of the growers that need Cooperative Extension the most may not be connected electronically to Extension, and those are the ones that need to be contacted by conventional means. So, it can never replace the conventional growers' meetings and one-on-one contacts."

Witney is based at the Chelan County Cooperative Extension office in Wenatchee.

Editor's note: I had hoped to have some specific information from the Mt Vernon research station regarding their fertigation system, but to date it has not arrived. I'll include it in the next newsletter.

POMONA'S HARVEST
by H. Frederick Janson

Reviewed by Marilyn Tilbury

Who was Pomona? What exactly is pomology? When did people learn to graft fruit trees? What techniques did they use? Who started espaliers? What has been written through history about fruit trees?

Answers to the above questions and much, much more are found in a beautiful new book by Fred Janson, one of the founders of NAFEX (North American Fruit Explorers). Fred starts with Greek and Roman mythology and proceeds through the antiquarian European fruit literature. In seventeen chapters he organizes and gives context to this surviving literature.

One may read the book strictly for the knowledge of pomology that will be gained, or study the development of scientific observation, or be bemused by plagiarism in early writings (no copyrights here!), or learn the effects of war and immigration on pomology, or simply enjoy the many illustrations.

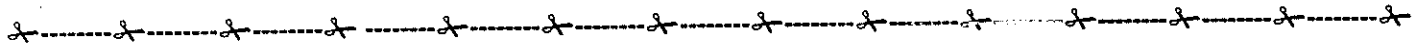
The book contains many reproductions of original title pages and engravings. A special treat is eight pages of reproductions of hand-colored plates from books published in the 1700 and 1800's.

The book is capped by a list of references and a bibliography. The bibliography is comprehensive and well-annotated, running some 100 pages. Only works covering a single species are omitted. Fred's book is a labor of love by a true scholar.

Note: In the fall of 1994 Dr. Robert Norton conducted an apple buffs tour of western Europe. Fred was one of the participants. We were busy but Fred managed to frequent used book stores and libraries all along our route. He also graciously supplied translation services for those of us who were linguistically impaired.

Timber Press offers this book for \$59.95 plus \$8.00 for shipping

Editor's note: Western Cascade Fruit Society members have been offered a special price with a minimum of 24 orders, prepaid. All copies will be individually signed by the author, and he will inscribe your name if you so wish. Our price is \$42.25 which includes shipping to one address. This book will be on display on the education table at the Fall Fruit Show, where you may place your order or you may send in the order blank below. Please add \$2.00 for shipping to you. There is one order now, so need only 23 more! THIS WOULD MAKE A GREAT GIFT.



Please send _____ copy/copies of Pomona's Harvest at \$44.25 each.

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2625 13th Ave W Unit 306
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SUCCESSFUL HARVESTING & STORAGE OF TREE FRUITS GROWN IN SMALL ORCHARDS

By Eugene Kupferman
WSU Extension Horticulturist

Prepared for the Western Cascade Fruit Society, Fall 1996

In order for fruit grown in a small orchard to be stored and consumed over several months there are a few things which must be considered. These include the type of fruit, the variety, fruit quality, maturity at harvest and the type of storage available. Half of the challenge comes in selecting and growing fruit with storage potential.

I. Choosing The Correct Fruit To Grow

Apples and pears are the tree fruits grown in the Pacific Northwest which can be stored at home. The flesh of apple and pear fruit contain starch which is converted to sugar during storage. The conversion of starch to sugar provides energy for the fruit's life processes. Peaches, cherries, nectarines and other "stone fruits" do not lend themselves to storage. Berries or grapes also do not last long. Stone fruits and berries do not store photosynthates as starch, thus they have no reserve and cannot be stored for long periods. Incidentally, it is the starch in apples which makes them taste like a potato when eaten immature.

a) Determine which apple variety to plant:

Variety selection is crucial to successful storage. Summer maturing varieties will not store as well as varieties which mature in the fall. For example, Gala, a variety which matures in late August in Eastern Washington, is currently the earliest maturing commercial variety. Unfortunately, Gala loses its flavor in only a few months in even the best commercial controlled atmosphere (CA) storage. On the other hand, Granny Smith, one of the latest maturing varieties, holds its flavor for many months even in less than optimum conditions.

There are many apple varieties which can be grown in Western Washington and Oregon. Many are described in the excellent bulletin by Robert Norton titled *Apple Cultivars for Puget Sound*. It is available from WSU Cooperative Extension offices under the catalog number EB 1436. This publication lists many cultivars and describes bloom dates, scab and mildew susceptibility and most relevant to this discussion, harvest date.

b.) Determine which pear variety to plant:

Pear varieties are also stored commercially in Washington and Oregon. The longest storage pear grown commercially is Anjou which matures in September in the Wenatchee River Valley. It is difficult to store varieties which mature before Anjou.

Some of the early maturing pears, like Bartlett, ripen if left on the tree. However, they lack the full flavor and uniform texture of fruit which has been refrigerated before being ripened. Commercially, warehouses will stimulate uniform ripening by storing fruit in the cold or use ethylene gas before shipment.

After proper storage at precise cold temperatures, winter pears must be allowed to ripen at room temperature for 4-7 days before they will achieve a buttery texture and juicy flesh. Even then, some individual pears fail to ripen for reasons we do not comprehend.

If after this warning you are still interested in growing and storing pears, the best varieties of European pears for Western Washington homeowners would be Comice, Bosc, Highland or El Dorado.

Asian pears are a new introduction into our diet. They are also called oriental pears, Chinese pears, salad pear and apple pear. Since they ripen on the tree and currently have only a short storage season, I will not discuss them here.

II. Growing Quality Fruit; Selecting Fruit for Storage

Fruit storage is somewhat like computers--"garbage in, garbage out." Only the highest quality fruit should be stored. This fruit must be strong enough to resist the ever-present fungi. This fruit must be bruise free and without cuts or punctures. Fruit must be high in calcium and have a balanced nutrient content. Growing quality fruit requires a careful blending of fertilizer, pruning and protection.

It is impossible to give a recommendation for the amount or type of fertilizer needed. However, one can gauge fertility on the basis of shoot elongation. The best fruit is grown on a tree with balanced nutrition. Fruit bearing limbs should grow no more than 18" per season. Longer growth indicates the tree is receiving too much fertilizer. In this case, nitrogen fertilizer should be cut back significantly. Growth of less than 10" indicates a need for nitrogen fertilizer. Trees

without fruit will have greater extension growth. Trees with too much nitrogen will have fruit which remains green, soft and will not store well

Calcium sprays build strong cell membranes which resist both fungal diseases and physiological disorders. Washington soils usually have sufficient calcium, and the problem is allocation of calcium within the tree. therefore, repeated sprays of calcium are important. One spray per season will not get enough calcium on the fruit--6-12 sprays are necessary.

Pruning is a fruit growing imperative. Pruning is an annual event necessary to produce quality fruit. Light is what makes the machine run! Light must penetrate the full canopy and not just the outside perimeter. The leaf to fruit ration affects fruit size and quality. More leaves grow bigger fruit and often higher quality fruit.

Pest control is another imperative since fruit with scab, codling moth or mildew will not store well. The moisture retained by the fruit in storage depends upon the continuity of the skin and the natural wax (cuticle) layer. Mildew, scab and other surface blemishes provide places for moisture to exit. Therefore, this fruit will not store without shriveling.

Fungi are the most destructive organisms which attack fruit after harvest. It is very important to protect fruit from fungal organisms. Infected fruit placed in storage will at best continue to decay and at worst will spread disease onto healthy fruit. A first step is to reduce the number of fungal spores on the fruit by creating an environment hostile to the growth and spread of the decay organism. Reducing the number of spores can be done in several ways.

1. Fruit should be sprayed with a fungicide as per your WSU County Agent's advice. This reduces the possibility of infection during the growing season and reduces the number of spores in the tree canopy. However, when too much fungicide is used, the number of spores resistant to the fungicide increases, and control is reduced. Therefore, limit sprays to recommended levels and be careful as to timing of application.
2. Do not harvest fruit which has fallen to the ground as it is likely to be infected. Fruit growing close to the ground in contact with grass or soil should be considered infected as well.
3. Bruising of fruit should be avoided at any cost. Bruised fruit does not taste or look appealing. Do not store seriously bruised fruit--it will not improve in storage, rather it will deteriorate very rapidly. bruised fruit becomes easily infected by fungi which can then go on to infect healthy fruit in storage. Commercial growers hire people at harvest to check the amount and type of bruising appearing on the fruit as its brought into the warehouse. It is sad to see the amount of cullage coming from warehouses which can be attributed to bruises.

III. Harvest Maturity

I remember my aunt and uncle had several fruit trees. They refused to let anything go to waste, so they would try to use every fruit their trees produced. Also, they were always late harvesting to get full flavor, and by the end of harvest season they were salvaging fruit which had fallen on the ground. delaying harvest and picking fruit from the ground are both natural tendencies, but these fruit are not suited for storage. As a consequence, all winter long we were treated to poor quality, overmature fruit. Had they harvested on time and been selective in fruit they placed in storage, we would have had better fruit.

Determining when to harvest apples and pears for storage is very difficult. The basic principle is to harvest fruit for longer-term commercial storage when fruit respiration is at a low ebb. This low ebb comes just before the fruit is ready to eat off the tree; before it develops full flavor. Once it is ready to eat off the tree there is very little starch reserve for storage. Fruit begins its final decline, the rate of respiration increases, and it becomes increasingly difficult to store so that it will have acceptable eating quality after storage. Fruit designated to be stored 3-4 months must be harvested well before it achieves the best edible quality on the tree, and it will develop flavor and aroma in storage, as the starch converts to sugars.

How then does one determine when to harvest? It is very difficult. Let me give you a short explanation of how the apple industry decides when to harvest. The industry has funded a laboratory to which fruit from 50-70 orchards is brought each week, starting in August. The lab analyzes the fruit for 11 different horticultural indicators including flesh color, firmness, the quantity of sugars, acids, ethylene and respiration. The lab reports are discussed by industry horticulturists at weekly meetings. The horticulturists combine the scientific information with their own experience and send out an advisory statement to the growers. This is a long way of explaining that we are dealing with a biological system influenced not only by the tree, but by weather and man. Scientists have not fully unlocked the keys to ripening.

To the backyard horticulturist, I would suggest several things you can do to determine the progress of maturity of the fruit on your tree. First, get a notebook in which you can write (and keep) notes from year to year. Start 3 weeks before you expect to harvest. You can determine the approximate harvest dates from nursery catalogs, WSU Cooperative

Extension, or Master Gardeners. You will need to sacrifice a number of fruit. Pick 2-3 fruits on the south side of each tree; pick those on the sunny upper part of the tree as they mature first. Note the skin color of each fruit. The background color changes in most varieties from green to white then to yellow as the fruit matures.

I would perform a number of tests on the fruit and mark the results in your notebook for future reference. If you have several trees and are serious about fruit growing you may wish to invest in a pressure tester (about \$150). A pressure tester is a plunger with a dial. Testing the firmness of several fruits can help determine when the fruits are maturing. Remove the skin of the fruit by making two shallow cuts on opposite sides of the fruit - preferably not on the sunny side of the fruit (as this will be softer). Usually there are two tips provided with the pressure tester. Select the apple tip (the larger one) and push the plunger into the fruit while holding the fruit against an immovable object. Insert the plunger up to the mark on the tip (about 1/4 inch). Record the reading from the dial and average all readings for that variety. This is your average firmness for that variety that week.

Then cut each fruit horizontally through the seed cavity. Look at the color of the fruit flesh. Most varieties will begin to change from green to white flesh as they mature. Once they are white fleshed they will not continue to increase in size. When the flesh turns yellow it is too late to store the fruit as there will be little starch.

Obtain a solution of iodine from a veterinarian and place it in a spray bottle. Spray the cut surface. Be careful not to get the iodine solution on your clothing as it will stain. When the iodine contacts the starch in the flesh of the fruit the flesh turns blue/black where the starch is present and remains white where it is absent. Look at the pattern. In many fruits, and depending on the desired length of storage, 25-50% of the fruit's flesh should be blue/black when the fruit is ready to be harvested for storage. This figure is broad because the fruit variety, length of storage, and type of storage will dictate the desired amount of starch. You will notice that the starch 'clears' progressively from the core area out to the skin. A very immature apple or pear has starch all the way to the core. A very edible fruit has no starch remaining and no storage potential.

Apples and pears will get easier and easier to remove from the tree. They will begin to separate with a snap rather than being removed with broken stems.

Pears are very tricky since they do not soften appreciably as they mature. The industry uses a combination of temperature records, firmness, skin finish and ease of separation to determine harvest maturity.

In summary, you can keep track of the maturation of apples and pears by using flesh color, background color of the skin, uniform seed color, starch and firmness. Now that you have accumulated the information the decision of when to harvest must be made. Consider harvesting apples when the background skin color turns white, the starch has cleared from 1/2 to 3/4 of the flesh and the firmness has not dropped. Pears should be harvested when the seeds have turned a uniform dark color, fruit finish is smooth and half the starch has cleared. Again pears will be firm at harvest and only soften after storage.

Try picking the same variety on two harvest dates a week apart and see which one comes out of storage with better edible quality. After a few seasons you'll get the hang of it.

IV. Minimizing Decay in Storage

As noted above, healthy fruit are less susceptible to decay. Bruised fruit, overmature fruit, and fruit picked from the orchard floor are all candidates for decay. Fruit which has russet, scab or insects are subject to shrivel in storage. So select your fruit with great care.

Reduce decay organisms coming in on fruit by following an appropriate fungicide program throughout the growing season. Researchers have found that a spray of fungicide two weeks prior to harvest will reduce decay. Also, the application of Nutraphos 24, a nutrient spray, has also helped reduce decay.

Following harvest some orchardists have had luck with the application of a chlorine spray onto fruit in the bin. Others use a fungicide after harvest and before storage. If the storage does not have good air circulation, it is important to have the fruit somewhat dry when entering the storage room.

V. Storage Techniques for Small Growers

The basic principle of fruit storage is to slow the respiration rate of the fruit to the bare minimum by reducing the temperature. In most cases, 32° - 34° F is ideal for apples and pears. A few apple varieties like Spartan and McIntosh

will suffer chilling damage at 32°F. The faster the 'field heat' is removed, the colder the fruit is held and the more controlled the temperature, the longer it can be stored.

Another way to reduce respiration is to lower oxygen. This is called CA--Controlled Atmosphere storage, and 50% of Washington's commercially grown fruit goes into CA storage each year. CA storage is atmosphere modification in refrigerated rooms.

Backyard gardeners may wish to purchase a used refrigerator to keep the longest storage fruit, and use a root cellar for shorter term storage. Fruit should be dry and isolated from each other by a paper wrap and enclosed in a plastic sack to prevent moisture loss. Obtain used apple boxes from grocery stores and line the box with a plastic bag. Pencil size holes should be made in the plastic bag for ventilation. Avoid having apples and pears in the same plastic bag since the apples easily give off a gaseous hormone ethylene, which will stimulate the ripening of the pears. Inspect the fruit at weekly intervals and promptly remove any which have rotted as they will give off both ethylene and fungal spores.

Do NOT store apples with potatoes or they will pick up off flavors. Don't store apples with carrots or the carrots will taste funny.

In summary, choose the correct variety, grow it well, and harvest it at the proper stage of maturity. Protect it from fungi, select only high quality fruit. Use low temperature and possibly low oxygen to preserve quality.

CONTINUING THE SAGA OF RANDY THE RACCOON VS BARBARA CHERNICK

I wrote about him last year, and he's back again; this time with some new tricks up his furry sleeves. I think he first declared war when we came between him and our garbage. He could have had it all, if he hadn't been so noisy about it in the night, and so messy. Now the cans sit up on concrete blocks, enclosed by a railing so they can't be tipped. The lids are secured with hooked rubber straps that I can just manage to undo myself on good days.

Or maybe he didn't like those fruit tree skirts I mentioned, the sheets of corrugated fibreglass tied around the trunks. They're too slippery for him to climb.

In a fit of pique he turned his attentions to our corn; he's strong enough to pull over the stalks and dexterous enough to shuck the ears. Somebody told me to leave a radio on in the corn patch at night, so I plugged it into an extension cord and covered it with a tarp. I changed the station every evening, from soft rock to hard rock to classical. He hated them all, and stayed clear.

Randy the Raccoon regrouped and called in reinforcements. In the form of a deer, who tripped over the cord on his way to an engagement with our rose net. This unplugged the radio, and Randy realized he'd been tricked and lost no time in making a complete pig of himself.

For awhile he didn't get at the grapes, because we stapled together little screen jackets for each bunch. But he managed to suck the juice out through them, or undo them and now I'm planning to rent him out as a staple remover. In the meantime we're putting in slippery 8' pipes as supports for the vine.

So he went back this year to the corn patch. Early, this time, before the ears had even showed up. He pulled over the stalks to see how they were coming and because they weren't he began to chew on the stalks instead. I don't know why he didn't try them when they first emerged, because anyone who has ever thinned seedlings knows they're much sweeter at that stage.

So we put up a net. This time just a 3-4 footer, made of that stretchy fish net that insists on grabbing your shirt buttons. This won't bother Randy because he hasn't any, but writer Helen Chesnut wrote some years ago that 'coons distrust "trembly footing". She's right, because our corn patch is now intact. But I'm not counting my cobs till they're in the freezer. I feel I should really take some to Helen.

I like to think we've triumphed, in a small way. But Randy's out there thinking; I can hear the wheels turning. He's probably checking out the renting of parachutes or those cherry pickers used by the hydro. The next move is up to him. To be on the safe side I've hidden the freezer key, screwed those jar lids down tight and ordered a deadbolt for the back porch. For Randy the bandit is smart - as well as greedy.

Barbara Chernick is editor of *Fresh From the Cider Press*-Newsletter of British Columbia Fruit Testers Association.

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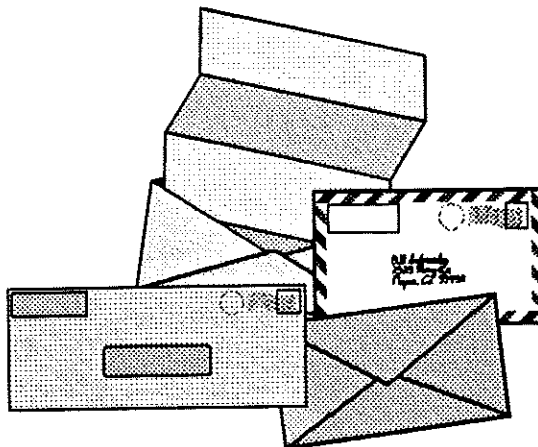
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If the DUE DATE on your mailing label is highlighted in **green**, your dues are payable before the next newsletter.
If it is highlighted in **yellow**, your membership dues are delinquent.
If it is highlighted in **RED**, this is your last newsletter. **DON'T LET IT HAPPEN TO YOU, WE'LL MISS YOU.**

INCREASED POSTAL RATES HAVE EFFECTED BULK MAILING ALSO. (WE HAVE ANOTHER INCREASE THIS MONTH.) IT IS VERY IMPORTANT THAT YOU LET US KNOW OF YOUR CHANGE OF ADDRESS AS THE POST OFFICE CHARGES 50 cents FOR EACH ADDRESS CORRECTION AND TRASHES THE NEWSLETTER. IT IS 78 cents TO SEND ANOTHER ONE TO YOUR NEW ADDRESS AND WE DON'T ALWAYS HAVE EXTRA COPIES. **SNOWBIRDS YOUR NEWSLETTER IS TRASHED ALSO.** LET US KNOW IF YOU ARE GOING TO BE AWAY "TEMPORARILY" SO WE CAN HOLD IT , OR GIVE US YOUR TEMPORARY ADDRESS AND WE'LL SEND IT THERE, IF YOU WISH.



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FALL 1996
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