MINNESOTA Science
Agricultural Experiment Station
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Research Works to Contain an Adaptable Enemy

We are outnumbered. Insect pests of every kind afflict humans, animals, and crops. Some are more than a mere nuisance, creating large economic losses for agriculture.

Chemicals frequently have been used as the first line of attack in this battle: about one billion pounds of pesticides are used annually in the United States. The use of pesticides often shows gratifyingly good initial results. But chemical pesticides can be expensive and inefficient, and if used in excess can pollute the environment.

Station entomologist David Andow explains: "We know that less than 0.01 percent of insecticides actually hits the target. The rest of it goes out in the environment."

In a 1980 study, Andow and his colleagues estimated that indirect costs of pesticide use in the United States include $12 million in livestock losses; $135 million in honey bee poisonings and reduced pollination; $70 million in losses of crops and trees; and $11 million in fish and wildlife losses.

And that's just part of the problem. As chemical use increases, insect pests get better at developing resistance. So, the more we use, the less they work.

Insects have shown an impressive ability to develop resistance to pesticides. One example, the case of the Colorado potato beetle (see story inside.)

By applying the chemical you are selecting the ones that are resistant, and they can reproduce," says Bh. Subramanyam, a researcher looking at resistance to chemicals used on stored grain pests. That growing resistance gets expensive.

"Insecticide resistance is costing the U.S. at least $133 million a year," says Andow. "And that includes increased insecticide use to control the target pest, having to use more expensive insecticides, and the need to control more secondary pests."

And the problem of pesticide resistance is growing. "The number of species known to be resistant to one or more chemicals has been growing exponentially," says experiment station entomologist Roger Moon. "The response to pesticide resistance is too often to increase the dosage. But there are many reasons for using pesticides as little as possible. One is the environmental issue. Another is the use of pesticides can often create other pest problems, by knocking out beneficial insects. And farmers are sometimes pouring their money down the drain when there are cheaper ways to go about it."

See stories on page 3 for more on how experiment station researchers are working to control insects while managing pesticide resistance.

Of Beetles and Brocade

Insights on saving things from two very different—yet remarkably similar—scientific collections.

If you ever spent a childhood summer vacation chloroforming butterflies and sticking them onto pins, or keeping track of your travels by matchbook covers saved in a box, or waiting for your penny collection to get really old so you could cash it in for a small fortune, you know about collecting from the angle of just plain having fun. But in the world of science, collecting is much more than child's play. Researchers in a broad range of fields rely on accumulations of specimens in their individual areas to provide historical records, concrete examples to supplement textbook learning for students, and raw material for research. Here, we take a closer look at how two such collections enrich our understanding and appreciation of the world around us.

Collection Preserves Diversity

For those who like bugs, the University of Minnesota Insect Collection (UMIC) is the place to be. In the rows upon rows of metal cabinets that hold the collection, there are more mosquitoes than on a Boundary Waters portage in June, more ants than at a church picnic. Or, if your tastes run exotic, the folks in charge would be happy to pull out an eight-inch long beetle that bears

"It's essentially a library. . .each species is like a book."

Holzenthal. "This decline in biodiversity is a crisis that demands immediate, massive efforts to collect, study, and catalog as rapidly as possible the plants and animals found in these habitats."

The task of curating a collection of this size and nature is not an easy one. Each of the 30,000 or so specimens added to the collection annually must be processed, mounted, identified as to family, labeled, and catalogued. With the help of a computerized inventory management system, Clausen also handles the collection's liberal loan program. Scientists from many countries frequently borrow specimens or groups of insects from the collection for research, keeping him busy pulling and replacing specimens. But the job has its rewards, too.

Collecting in Style

Bugs, on the other hand, are about the last thing Marilyn DeLong wants to see in her line of work. As curator of the University of Minnesota Goldstein Gallery's costume collection, DeLong is responsible for organizing and maintaining clothing items that provide an insightful cross section of trends spanning more than two centuries.

The largest portion of the gallery's three parts (the other two are textiles and related arts), the costume collection contains some 5,000 items of apparel dating from as early as 1760. Although adult women's dress comprises 65 percent of the collection, it is also home to such diverse items as a state militia uniform, baptismal gowns, and lingerie. By including clothing from a spectrum of eras and occasions, the collection's staff have sought to broadly represent the history and tastes of Minnesotans.

"If we only collected wedding gowns, we wouldn't have much of a commentary on everyday life," explains former gallery director Joanne Eicher. "They're really very important sociopolitical documents about Minnesotans. These items which we classify, store, and retrieve are really just the parallel of bugs in an insect collection. For us, looking at items of apparel tells us many things about the history of people and of technology. So it's very important that we preserve these for the future."

The collection, according to DeLong, has three purposes: teaching, research, and public service. Researchers studying apparel and design use items to evaluate trends as well as similarities and differences in garments of various origins. Through the collection, students have a hands-on opportunity to observe textbook principles, a ready-made source of features that make it unique, says DeLong. It focuses primarily on items worn by Minnesotans, and has placed particular emphasis on documentation of items as part of the acquisition process. It is associated with a gallery and is housed in a special climate-controlled area.

Begun in 1957 by Helen Ludwig ("I think what she did was she found things that were exquisite examples of what she was teaching in her classes and then just started collecting things," DeLong speculates), the collection has expanded substantially over the years, mostly through donations. An organization called Friends of the Goldstein Gallery is especially helpful in augmenting the collection. Members of the group have done everything from rummaging through estate sales in search of "wish list" items, to convincing designer Bill Blass to donate a contemporary gown.

Marilyn DeLong, costume curator, examines clothing and accessories in the climate-controlled storage of the Golstein Gallery.

Goals for the collection, DeLong

an uncanny resemblance to a rhinoceros. With more than 2.6 million specimens, the collection most likely includes an insect to please just about anyone.

One of the top ten university-based insect collections in North America, UMIC was started in 1897 by state entomologist Otto Lugger with insects from Lake Superior's North Shore. Since then, specimens from some 37,000 species from all over the world have been added, including rare or endangered species and irreplaceable one-of-a-kind specimens. The overall value of the collection has not been calculated, but according to curator Phil Clausen, some individual bugs are worth thousands of dollars.

"It's essentially a library of the world's insect fauna," says Ralph Holzenthal, assistant professor of entomology and director of the Agricultural Experiment Station project that funds UMIC. "Specimens are catalogued much like a library is catalogued. Each species is like a book—it contains information."

Like a library, the collection serves a variety of purposes. As a permanent physical record of insects, it's an invaluable tool for research in systematics and related sciences, providing the groundwork for applications in pollution control, resource use, agriculture, and public health. Students from grade school through grad school use it to observe and analyze first-hand the incredible diversity of insects. The collection also serves as a useful identification resource for university scientists, extension agents, state agency staff, environmental groups, and others. But of perhaps the greatest global consequence, UMIC helps preserve specimens that, through habitat destruction (particularly in the tropics) and subsequent extermination, might otherwise be lost to science for all time.

"Species are being destroyed before they are even known by scientists," says

Ralph Holzenthal, front, and Phil Clausen display a few of the specimens from some 37,000 species in the insect collection.

"If there's a best thing about curating a collection, it's being able to see the abundance and diversity of things," Clausen says. "I do enjoy seeing different sizes, different colors. Even though I don't find myself in awe of it all the time, I do like to see it and get it all in order."

—Mary Hoff

inspiration for further design innovations, and an opportunity to gain experience in gallery operation and collection maintenance. The collection also is available to the public through gallery displays and occasional loans to enhance broader appreciation of the diversity and complexity of apparel and design.

This costume collection has several

says, include computerizing the inventory and continuing to add to the collection based on set criteria. "We're evaluating what we have and trying to move from a point of just taking what people offer us," she says. "When we can develop criteria, then collecting becomes an easier job."

—Mary Hoff

The BWCA Is a Beautiful Setting for Research

Just a mention of the words "Boundary Waters Canoe Area" can bring out deep feelings in most Minnesotans. The BWCA has provided a wilderness experience for countless visitors, as well as providing jobs, history, beauty, and controversy. With over one million acres, it is by far the largest wilderness area in the eastern two-thirds of the country. It is within this vast area that long-term ecological studies are carried out by College of Forestry researchers Clifford and Isabel Ahlgren.

From May to October for almost forty years the Ahlgrens have been stationed at the Quetico-Superior Wilderness Research Center. The center's original site was on Basswood Lake, in the heart of the BWCA. Isabel Ahlgren recalls the rigors of reaching the center in those early years: "I remember portaging in all our kids' stuff each year. . . playpen, high chair and clothes, plus all of the equipment for our work."

The center, now located near Ely, has been operating since 1948 when the feeling towards the wilderness was "leave it alone and it will take care of itself," Cliff Ahlgren recalls. Over the years it has been privately funded by the Wilderness Research Foundation and Frank B. Hubachek, Sr., with additional support from the Agricultural Experiment Station and other agencies.

Director of the center from its beginning, Cliff Ahlgren has used the wilderness area as a unique laboratory. "The BWCA is a maverick among wilderness areas in the United States in size, location, land form, accessibility, ecology, and human attitudes towards it," he says. "We have explored the forests of the BWCA to see how individual species adapt to a changing environment."

Cliff and Isabel Ahlgren have cooperated with scientists from many states and Canada and been involved with studies in forestry, plant and animal ecology, botany, ornithology, and wilderness recreation.

In a major study, they recorded change on 2,000 plots they established throughout the Superior National Forest in Minnesota and Quetico Provincial Park across the Canadian border. Their observations provide a record of change taking place in the wilderness. Some of the shifts were natural, others the result of human intervention over the past century. Their popular book *Lob Trees in the Wilderness* documents how early inhabitants, logging, and recreation have impacted the wilderness.

BWCA *continued on p. 4*

An Adaptable Enemy

Keeping Ahead of Pesticide Resistance

Livestock producers have to deal with insect problems differently than do crop producers.

"A lot of cattlemen, for example, rarely see their cattle all summer long. They work them in the fall, keep the animals close to the farmstead during the winter, and then they turn them out in the spring to graze. They don't have as many options for pest management as a crop producer," says station entomologist Roger Moon, who researches livestock pest control options.

Insect pests can be more than a cause of discomfort to an animal. They can cause disease and economic loss. "We can predict that face flies, for example, will cause more damage than it currently costs to control them," Moon says. We find that calves are heavier from cows without the flies. What happens is, the mother is bothered by the flies, and she burns up some of her energy fighting them off, and as a result her unborn calf suffers too."

Moon is studying the effectiveness of insecticide ear tags to control horn flies on cattle. These ear tags came out in 1981 and have since been used widely and successfully by cattle producers, Moon says. "With ear tags, cattlemen could turn the cattle out to pasture and they would come back three to four months later still fly-free. They cost $2 to get probably $8 to $10 back per animal, so they were a wise investment."

Horn flies are one livestock pest for which an effective control was recently developed. Already there is evidence of pesticide resistance.

year it was detected in Iowa, South Dakota, and North Dakota, but not in Minnesota so far," Moon says. "We were a couple years behind in adopting the use of the tags.

"I think this growing resistance has something to do with the efficacy of the method. It's a bit of a Catch 22. If we have a method that is convenient, portable and widely used, the pest will ultimately develop resistance. So we've got to find a delicate balance between sufficient control to justify the cost, but sloppy enough control so that we are not selecting for resistance very rapidly."

There are ways of dealing with the pesticide resistance problem that have not been tested in the field, Moon says. [illegible] theoretical solution is to use insecticides in combination.

But Moon's long-range goal is to deal with the pesticide resistance problem from another angle—by introducing beneficial insects that would prey on the flies. "A lot of the predators and parasites of insects are host specific, or at least habitat specific. They are adapted to a very narrow species of pest. The flies and the cattle probably co-evolved, and our theory is that beneficial insects have also co-evolved," he says.

Since the grazing animals that evolved into today's cattle came from Central Asia, that would be the best place to look for these beneficial insects.

An Adaptable Enemy

An Old Enemy Returns

The case of the Colorado potato beetle is a case of déjà vu. It was gone, but now it's back again.

The Colorado potato beetle, a native insect which shifted its allegiance from wild plants to the cultivated potato back in the 1850s, was the scourge of the potato fields by the 1860s. It quickly spread all across the country, and now has found its way across Europe and into Asia, says Ted Radcliffe, experiment station entomologist who researches methods to contain potato pests.

"By the 1860s growers had started using insecticides against the beetle, and as far as we know, these were the first attempts to use insecticides against a field crop pest," he says. "The beetle eats a lot and has a high reproductive potential, so was a major pest for 60 to 70 years."

But the introduction of modern insecticides stopped the Colorado potato beetle cold. "From the early '50s until 1980 or so, the beetle virtually disappeared in Minnesota," Radcliffe says. "So what was always said of this insect was that here was an example of a pest that couldn't cope with insecticides."

But the resiliency of the pest was underestimated. By the early 1980s it had started to reappear in Minnesota potato fields. The interesting thing, Radcliffe discovered, was that when the beetle first reappeared, it did not show much pesticide resistance: "We were testing these darn beetles and we could kill them just by looking at them. But lately when we've been testing them, their resistance has increased perhaps [illegible]

However, although the ear tags are a relatively new invention, there are already some signs of growing resistance to the insecticide. "Resistance started appearing in Florida and Texas and each year it has moved further north. Last

One way is to rotate insecticides. That strategy will work if the pest does not already have any resistance to any chemical in the mix. Once resistance has started developing, this strategy won't retard it very much. The other

"We brought in the pests, but we didn't bring in the beneficial insects," Moon says. "We need to go back and reunite old enemies."

—Jennifer Obst

200-fold. We've been putting insecticide right on the back of the beetles and they are resistant to it."

They are still being killed in the field, because the larvae are less resistant, although Radcliffe sees potential for trouble this year. "It was kind of naive of us to ever say that the Colorado potato beetle couldn't cope with pesticides. It eats potato foliage, after all, that's loaded with glycoalkaloids. It's coped with toxins all its life," he says.

What can be done once a pest has developed resistance? Not much, Radcliffe says: "It's difficult to manage resistance once you've got it."

"There are strategies that we can suggest to reduce the further selection.

Potato Beetle *continued on back page*

An Adaptable Enemy

Stored Grain Offers Insects a Feast

If there is one place where insects are likely to congregate, it is where there is an ample supply of free food. And with Minnesota's grain storage bins full to overflowing, the insects are having a field day.

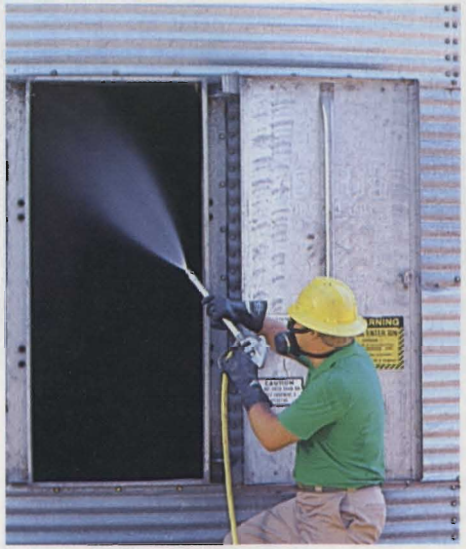
The farmers are the losers, though they don't seem to realize the real costs to them, according to Phil Harein, experiment station entomologist. "The losses in Minnesota stored grain due to insects in 1986 was estimated at $82 million. These losses will be higher in '87, no doubt about it," he says.

Harein is leader of the Minnesota Pesticide Impact Assessment Program, which compiles and maintains a data base of information about the legal pesticides in the state and their best use. A research aim of this program is to fill information gaps about the usefulness or limitations of a pesticide.

Part of that project was a two-year study of resistance to malathion, a common insecticide used on stored grain. The study showed that Indianmeal moth larvae were, on the average, 350-fold resistant to malathion. That is, comparing insects collected in the field to susceptible insects, the ones in the field were 350 times harder to kill with malathion. "That means these insects can take a bath in this stuff without harm," Harein says.

Last year two new chemicals—Reldan and Actellic—came on the market as alternatives to malathion for use on stored grain. The researchers have been looking at the resistance of beetle adults infesting grain to these two new products, as well as compared to malathion. Beetles are the major stored-grain pests in Minnesota, according to Harein.

The researchers captured live insects and raised them in the lab, periodically exposing them to malathion and the two new products. They found that 13 field populations of red flour beetles were 6



Malathion is the most widely used insecticide for stored grain, but researchers are looking at alternatives.

to 46-fold resistant to malathion, but they were not yet resistant to the new products. "That's good for now. But we did get a different picture with another insect, the saw-toothed grain beetle," says research assistant Bh. Subramanyam. "They have not developed resistance to malathion yet, but some of them are already resistant to Reldan."

The reason why an insect can be resistant to Reldan but not to malathion is due to the nature of detoxifying enzymes in the beetles, Subramanyam explains. "Some insects have an enzyme called carboxyesterase which can break down malathion. But there are other nonspecific esterases and oxidases. The insects that have the nonspecific enzymes are the ones that are going to be a problem to manage. In Australia where these two new chemicals are already being used, resistance has been documented in adult insects infesting grain especially with the saw-toothed grain beetle," says Subramanyam.

"Next year we'll check for resistance again," says Harein. "Then we will be able to plot the potential of these chemicals for the next 5 or 10 years. We can manage resistance build-up, which makes a perfectly good pesticide useless, by using other methods of control. For example, proper sanitation and aeration of a storage bin will go a long way in preventing insect build-up."

Because only five percent of private grain managers now use a fumigant, the selective pressure on the entire beetle population is likely to remain low, Harein says. "In other words, I don't want to blow this out of proportion. We just want to be ahead of what is going to happen."

—Jennifer Obst

Low-Income Housing Operating Costs Are Less for Co-ops than for Rental Units

When low-income people own their own co-op housing rather than renting, their monthly operating charges (including repairs, maintenance, grounds, protection, and administrative fees) are at least $16 less per unit per month, according to a study done by agricultural economist Claudia Parliament.

"This would represent a significant savings to someone who has a limited income," says Parliament, who is a researcher with the University of Minnesota Agricultural Experiment Station. Although the study was done on urban housing, Parliament says that the implications may be similar for suburban and rural housing. "The results suggest that it might be worthwhile for agencies that are responsible for building low-income housing to structure them as co-ops rather than as rental units," she says.

—Anne Gillespie Lewis

Food Science Research Works on Improving Mother Nature

Dairy products are caught in a conundrum these days, alternately praised and condemned. Susan K. Harlander, food scientist for the Agricultural Experiment Station, describes the dilemma:

"Dairy products are one of the few sources in the American diet for calcium. And yet, when people go on a diet, or if they are diagnosed to have high cholesterol levels or coronary disease, they will invariably avoid butter and cheese and whole milk, primarily because these products are perceived to be high in fat and cholesterol."

If you want to be good to both your bones and your heart, what's a person to do? Harlander has set her sights on one potential answer: eliminating the cholesterol in dairy products.

Research has recently demonstrated that you can affect your serum cholesterol level by decreasing the cholesterol in your diet. "The issue of whether or not dietary cholesterol affects serum cholesterol has been a controversy for a long time, because your body makes its own cholesterol. It makes as much and sometimes more than it needs, because cholesterol is an integral part of all your membranes and performs other essential functions in your body. But recent studies demonstrate that you can reduce serum cholesterol levels to be beneficial," she says.

"We figured there had to be a microorganism that could break down cholesterol."

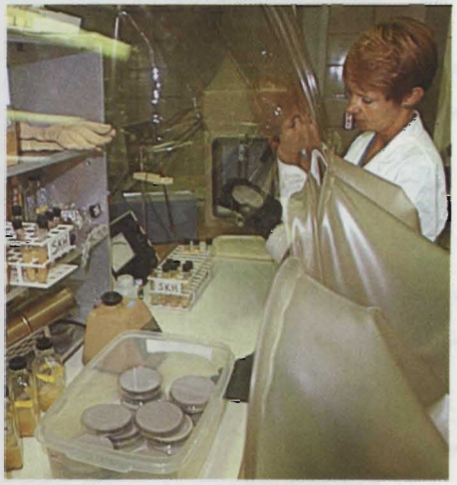
Previous bioengineering research in cooperation with station food scientist Larry McKay led Harlander to look for a solution to the dairy dilemma in the genes of microorganisms. McKay pioneered genetic modification for improvement of dairy starter cultures. Harlander decided to look for microorganisms that would degrade cholesterol without causing harm to the food or to humans. Adding these organisms to dairy fermentations could create products that are low in cholesterol or free of cholesterol.

"There are microorganisms that break down almost any product in nature," she says. "We figured there had to be a microorganism that could break down cholesterol and detoxify it in terms of what would happen in the body."

Bacteria called *eubacteria*, which live in nature and are also found in the human gut, degrade cholesterol to a harmless compound called coprostanol. Pure cultures of the bacterium reduce cholesterol to coprostanol with over 90 percent efficiency. Coprostanol isn't absorbed very readily, and if it is absorbed it's broken down by normal pathways in the digestive system; and it doesn't contribute to the formation of plaque in arteries as excess cholesterol does.

There is no indication that changing cholesterol to coprostanol would affect the flavor of dairy products. Harlander's research focus, therefore, is to isolate the DNA which codes for the cholesterol-reducing genes and, using genetic engineering techniques, to clone that DNA into dairy streptococci used for the production of cheese, yogurt, and capable of reducing cholesterol in dairy products.

"But successful cloning of the cholesterol-reducing genes opens the possibility of alternative uses for the enzyme," she adds. It could be used, for example, not just in cultured dairy products, but to pretreat milk. Someday you may find the milk in your grocer's refrigerator case has been "filtered" during processing to remove the cholesterol.



Susan Harlander, food scientist, checks a culture of eubacterium, *part of research to clone cholesterol-reducing agents.*

Harlander also sees potential for inoculating dairy products with engineered organisms that not only would reduce or eliminate the cholesterol in those products, but would be capable of implanting in the human gut, where they would be able to assimilate at least part of the cholesterol ingested in the diet. To help evaluate this potential, she has set up a cooperative study with the University of Texas Health Sciences Center. The reduced cholesterol products would be tested with baboons, the animal model system for coronary heart disease studies.

So far, Harlander has developed

IN PRINT

A sampling of new Minnesota Agricultural Experiment Station publications:

Orchid Lights—A New, Hardy, Compact Azalea for Northern Areas (AD-MR-3038) describes the growth and flower characteristics of a recent University of Minnesota Agricultural Experiment Station release.

Prediction of Available Energy in Dairy Cow Rations from Dietary Fiber (AD-SB-3188) presents and evaluates for accuracy six equations that predict dietary energy from dietary crude or acid detergent fiber. The equations estimate total digestible nutrients, digestible energy, metabolizable energy, or net energy of lactation diets.

Redwing Raspberry (AD-MR-3191) and *Summercrisp Pear* (AD-MR-3195) will be useful to home gardeners and commercial fruit growers. They describe the University of Minnesota's new primocane-fruiting ("fall-fruiting") red raspberry and cold-hardy pear.

A Risk Analysis of Farm Program Participation (AD-SB-3255) reports the results of a study on how participation in commodity programs established by the 1981 and 1985 farm acts performed as a risk management option relative to nonparticipation strategies used by corn and soybean producers in southern Minnesota. This bulletin will be of most interest to agricultural economists and policymakers.

Soil Erosion and the Loss in Productivity: An Example of the Terril Soil Series in Minnesota (AD-SB-3200) reports the results of a study in which two regression models were used to

by reducing the amount you eat, and even a relatively small reduction appears

buttermilk. Harlander sees a time when all dairy starter cultures could be

techniques for measuring the conversion

Cholesterol *continued on back page*

BWCA *continued from p. 2*

Clifford and Isabel Ahlgren have been studying the ecology of the BWCA for almost 40 years.

Forest fire creates an obvious and dramatic change in the wilderness environment. The rapid recovery of some areas from devastating fire has been documented by the Ahlgrens' combined efforts. They found that the populations of soil fungi and bacteria return to normal soon after a fire, especially if there is sufficient post-fire rainfall. Previously it was believed that these organisms could be destroyed, leaving the ground sterile and delaying the start of larger plant life.

The Ahlgrens' long-term monitoring has shown that many burned areas recover completely. For example, a severely burned jackpine-spruce forest may re-establish itself and return to pre-fire status after 25 years.

"However, this will not happen in red or white pine areas, because too many of the large seed trees were cut when loggers went through the area at the turn of the century," Cliff Ahlgren explains.

Another source of change is a white pine disease known as blister rust, which came into the United States in 1909 on European seedlings and gradually spread west.

The large, stately white pine used to be the landscape's dominant species in the BWCA. Its decline is altering the ecology of northeastern Minnesota. The center began a long-term research and breeding program in 1949 aimed at developing blister-rust resistant white pine.

"The first task was to establish a breeding orchard at Basswood Lake. Shoots from disease-free trees were grafted onto native seedlings. As these produced cones they were hand-pollinated, a job that continued for about 25 years," Cliff Ahlgren says. "The first seedlings of the second generation hybrids are now being planted and we think that these will be more resistant to blister rust than the natural population of white pine in the BWCA."

The center also selected over 900 rust-free white pine growing throughout the area, and collected and planted their seed. Now, over 45,000 seedlings are growing in a test area exposed to severe natural rust conditions. The trees that survive after 15 to 20 years will be promising breeding stock for future tree breeders. "These efforts should give new life to the species," Isabel Ahlgren says.

The almost forty years the Ahlgrens have dedicated to wilderness research seem short when measured by the life of the forests they love. They are retiring this year, but hope to stay involved until the next generation of trees they have worked with so long is ready for planting.

"The BWCA is a maverick among wilderness areas in the United States."

Their dedication has complemented the generosity of the center's benefactor, Frank B. Hubachek, Sr., who died last year at age 92. A canoe area wilderness enthusiast for 70 years, he established the Wilderness Research Foundation "to protect wilderness areas... for the physical, mental, and spiritual health of people."

—Dave Hansen

estimate relationships between soil characteristics and yields for corn, soybeans, and wheat in southeastern Minnesota. It also examines the circumstances necessary for strip cropping and terracing to be profitable.

Minnesotans may obtain single copies of any of these publications from a county extension office or branch experiment station. Persons who live outside Minnesota or want more than one copy should write to the Distribution Center, 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108.

—Sam Brungardt

Popcorn and Sweet Corn Make Good Silage

Popcorn, sweet corn, and high-sugar corn make good silages for growing dairy steers and dairy heifers, according to a University of Minnesota study.

"There's interest in growing popcorn and sweet corn since they don't count as corn acreage under government farm programs," says George Marx, researcher with the university's Northwest Experiment Station, Crookston. His study compared popcorn, sweet corn, high-sugar corn, and conventional dent corn silages.

"All four silages preserved well in storage. They performed equally well in the feeding trials," Marx says. Yields of sweet corn were 32 percent lower and popcorn yields were 11 percent lower than dent corn.

Under the farm program, popcorn and sweet corn can be grown on cropland outside of corn base acres, but not on set-aside acres. The crops can be harvested for livestock feed.

—Jack Sperbeck

Cholesterol *continued from p. 4*

of cholesterol to coprostanol, and has shown that certain strains of *eubacterium* will reduce cholesterol to coprostanol in a model milk system. "We have identified a very good strain and are now isolating the enzymes and the fragment of DNA which codes for cholesterol-reducing ability. This will then be subcloned into cheesemaking strains of lactic streptococci and evaluated for cholesterol-reducing ability during fermentation," she says.

It's a complex process, and consists of manipulating pieces of naturally occurring organisms to take advantage of their native ability to degrade cholesterol. Other recent research has found that drugs can do the same thing. However, Harlander believes that while these may help people facing severe coronary health problems, the "natural" solution is better for the normal person concerned about his or her health.

Harlander is optimistic about the future of microorganisms and biotechnology in food processing. This is just one of the ways she sees to improve on Mother Nature, and one that may eventually help a lot of people stay healthier.

—Jennifer Obst

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University of Minnesota Regent Stanley Sahlstrom spoke at the dedication of a new dairy building at the Northwest Experiment Station, Crookston. The ceremony was part of the crops and soils field day held July 15. The new building houses a 93 head holstein herd and is used for station research, extension programs, and by classes at the U of M Technical College, Crookston.

Potato Beetle *continued from p. 3*

But the rule is to avoid the development of pesticide resistance by minimizing selective pressure in the first place. Extension entomologist Dave Noetzel was doing a good job of telling the growers not to spray unless the pest exceeds the economic threshold, and we've given them some guidelines. Dave said one year that in the Red River Valley only 5 percent of the fields had populations high enough to justify treatment, but 95 percent of the fields were being treated. So growers were putting that insect population through the selective screen unnecessarily. If the pesticide had a useful lifetime of a certain number of insect generations, they are using up some of those.

"The other rule is to keep a reservoir of susceptible populations. Treating the entire acreage doesn't leave any susceptible left."

What Radcliffe found is this overkill was not only dangerous but unnecessary. Though the pest causes conspicuous defoliation, the potato has a high tolerance to that kind of injury. "It looks a lot worse than it really is. We did some studies that showed that a 30 percent defoliation, if it happened before blooming, resulted in a yield *increase*. The defoliation would cause axillary budding, and open up the plant canopy a little to give it more light.

Meanwhile, concern over the Colorado potato beetle is overshadowing another pest—the leafhopper—which Radcliffe believes is a bigger problem in Minnesota potato fields. The leafhopper is less conspicuous than the Colorado potato beetle and, usually, by the time it is spotted it's already done its damage. Radcliffe advocates integrated pest management strategies to control both the Colorado potato beetle and the leafhopper.

For if there is one lesson the return of the Colorado potato beetle has taught, it is that insect pests are resilient. Managing them requires not only a thorough understanding of their interaction with and effect on their host crop, but also strategies as flexible and adaptable as the pests themselves.

—Jennifer Obst

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