Afternoon in Late April

I head out of Wenatchee on Highway 2. I turn off at Peshastin and cross the Wenatchee River. Much of the apple bloom lower down is already past. But here, upriver, the pears are glorious. Packed into the narrow valley and up every arable draw and cranny are pear trees, every tone of them in full bloom, backed by the crags of the Cascades front.

Later that afternoon, sated by the beauty of the pear bloom, I meet Mike Robinson ’80 in a pub in the Fifth Avenue Mall in Wenatchee. He tells me what it’s like in the pear and apple orchard right now from the economic and management perspective, reflecting, at least to an extent, the harmony of the aesthetic spectacle.

“Here’s an industry that’s losing its old standby number one product for its number one pest,” he says, initially suggesting a very un-idyllic scenario.

“You don’t read about it. You don’t hear about it. Nobody’s upset. Nobody’s even concerned.”

He seems almost blissful as he leans back and takes a sip of beer.

“That’s perfect.”

Robinson is an apple grower and also an orchard manager for Double Diamond Fruit in Quincy. He’s a key player in an industry that expects to produce 100 million boxes of apples this year. Because of a competitive, and picky, world market, every one of those apples has to be perfect. And the greatest threat to perfection is the codling moth.

The larva of the codling moth is your basic worm in the apple. The codling moth is prolific, persistent, and omnipresent. Anywhere there’s an apple tree in North America, you’re going to find codling moths. Despite all that, for the last 40 years, fighting the codling moth was pretty straightforward. Just spray them at appropriate times with azinphosmethyl, trade name Guthion. Azinphosmethyl is a broad-spectrum organophosphate pesticide that is very effective at killing codling moth and other insects. Unfortunately, it isn’t partial only to insects. Like other organophosphates, azinphosmethyl’s roots are in neurotoxin research during World War II. In other words, if misused, it can be toxic to anything with a nervous system.

Still, for decades, the fruit industry relied on it, applying it, for the most part, judiciously, until Congress, reflecting a changing mood in the country, cast a pall over the future of organophosphate control.

In 1996, both houses of Congress unanimously passed the Food Quality Protection Act. The FQPA required the Environmental Protection Agency to re-register, or re-evaluate, all pesticides within 10 years. The act also shifted the EPA’s approach from a risk-benefit consideration of these pesticides to one based entirely on a measure of risk. The EPA initially focused its attention on the organophosphates, which it considered the highest-risk class of pesticide. The result has been a gradual phasing out of the organophosphates. Azinphosmethyl will be history by 2012.

After the passage of the FQPA, growers were understandably afraid they’d lose all their tools, that no new pesticides would be registered, says Jay Brunner ‘75 PhD.

Brunner is director of WSU’s Tree Fruit Research Station in Wenatchee and, even more pertinent to Mike Robinson’s good mood, the director of the Pest Management Transition Project. The PMTP is a primarily educational endeavor that has enabled the Washington tree fruit industry to find its way into a new, very complicated, and initially unsettling era of orchard management.
Mating disruption has thus become a major part of the strategy called integrated pest management, a combination of chemical, behavioral, and biological controls.

**The IDEA of IPM** goes back to soon after World War II. As soon as the pesticides that grew out of nerve gas research during the war were released, scientists started worrying about the development of pesticide resistance in the pests. Although scientists in California had used an early IPM approach in alfalfa, it really hadn’t progressed much beyond theory.

When entomologist Stan Hoyt joined the WSU research station in 1957, he turned his attention to two of the major apple pests at the time, the seemingly eternal codling moth and McDaniel spider mite. The spider mite, though, was not yet a serious problem.

Many of the changes in pest management brought on by the FQPA were difficult. Some pesticides were restricted. Lorosin, for example, which was a standby summer spray for Sun Jose scale, leafrollar, and codling moth, was suddenly restricted to 100 acres, so there would be no residue on fruit. The re-entry period of Guthion, the weapon of choice against the codling moth, was boosted from 3 days to 14 days. Re-entry is the period orchardists must wait before re-entering an orchard after spraying.

The McDaniel spider mite populations exploded. Mites feed by sticking their leaf sucking mouthparts into leaf cells, then sucking out the contents, including chlorophyll. Infested leaves eventually turn bronze. When the mite pressure is severe, it can reduce photosynthesis and fruit quality. At their peak, McDaniel spider mites either.

The McDaniel spider mite is a native species that is a pesticide-induced mite problem. Hoyt found some predators. Not many. But not many spider mites either.

Eventually, says Brunner, growers adopting Hoyt’s system were able to eliminate sprays for spider mites. He estimates that since its implementation, Washington growers have saved over $120 million in pesticide cost alone.

**Essentially, his (Hoyt’s) ideas are what have driven how management occurs for the last 50 years,” says Hoyt.**

Jones is the project director on a federally funded project, “Enhancing Biological Control in Western Orchards”, a cooperative effort with UC Berkeley, the USDA Agricultural Research Service, and Oregon State University.

Combine Hoyt’s work, the additional decades of modifications, mating disruption and the seemingly eternal codling moth, but allowed predatory mites, Typhlodromus occidentalis, in the orchard to survive. It worked.

The McDaniel population dropped to tolerable levels. But selling the approach to growers was another story.

But then, Aramite was found to be a carcinogen at high rates and “Well, we still had another one, Aramite.”

By 1967, the program had grown to 40,000 acres. Eventually, says Brunner, growers adopting Hoyt’s program were also worried about the codling moth. Hoyt knew the way to increase control of spider mites was to decrease the amount of pesticide in a way that spared the predators, it was a hard concept for an anxious grower to swallow. But Hoyt persisted.

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Because of work by Hoyt, Brunner, and others, the effect of Guthion on the insect interactions is fairly well understood. If you apply just enough at appropriate intervals to control the codling moth but not kill off the predators, you end up with a fairly good balance.

“For the new material to get off the shelf, it’s not always just increased mortality.”

The problem is that the new generation of pesticides works with different mechanisms. While they have been designed to be generally harmless to mammals, it turns out that they’re not so benign toward non-target insects.

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Among the unintended consequences of the transition to the newer generations of pesticides has been a change in the balance of the orchard ecosystem. Because of work by Hoyt, Brunner, and others, the effect of Guthion on the insect interactions is fairly well understood. If you apply just enough at appropriate intervals to control the codling moth but not kill off the predators, you end up with a fairly good balance.

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Some of the new pesticides are steroidal,” adds Jones. “They alter sex ratios, make them all males, reduce fecundity, reduce longevity. All of these factors really affect population dynamics.”

Also, says Brunner, “instead of having one product for codling moth, now we want to use as many as we can. We all act in slightly different ways. Some of these products control just codling moth. Others control codling moth and Pest A. Others codling moth and Pest B, depending...
Ten years ago people didn’t worry about resistance,” continues Brunner. “Now, we go to meetings and we say we can’t use this product or use this product, and growers ask, well how does this fit in resistance management?”

Jones offers me a chair next to him behind the two large computer screens he spends much of his day looking at. “This is what you need to do,” says Jones. The DAS “imports weather data, forecasts to look into the future. It links to a wealth of supplemental material on insect behavior and phenology and usage information on all the next pesticides.”

“The DAS has changed my life,” says private pest management consultant Nick Stephens. He now joins most of the region’s growers and consultants in logging into the DAS every morning. “It does not do their work for them, but rather helps them decide which among the many choices to apply when for cooling moth, for example. What spider mite predators are vulnerable to spray right now? Have there been enough degree-days of heat to make opening for fireblight necessary?”

As powerful as the DAS is, Brunner also stresses that there is no cookbook recipe for managing an orchard. “Every site is different. The permutations are huge.”

The Washington fruit industry is an enormously complex web of packinghouses, fieldmen, private consultants—and WSU scientists.

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Yeah, everyone’s feeling good. But you can feel the intensity of what these guys do. Washington is the largest apple growing state in the country. “This is the kinder, gentler orchard,” says Schell. Then he talks about how his grandfather came out from Louisiana and planted 40 acres of golden delicious, taking a huge risk, the stigma, will they still be receptive when the wind stops blowing, the conditions... the aroma... the aesthetic. It’s all there.

When your office is your truck,” says Stephens, “and you’re going up and down the highway, and that’s all you’re looking at, it’s a real funny dichotomy of emotion we have. You’re so keyed into these bloom stages and the appropriate timing of these different activities you have to get done by growers—but then there’s just the aesthetics... the beauty... the beauty of what you’re doing in the background and the pears in full bloom.”

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