{ *Navigation tools* }

« / » COVER / BACK PAGE

⊕ ENLARGE QUADRANT

⊖ RETURN TO SPREAD VIEW

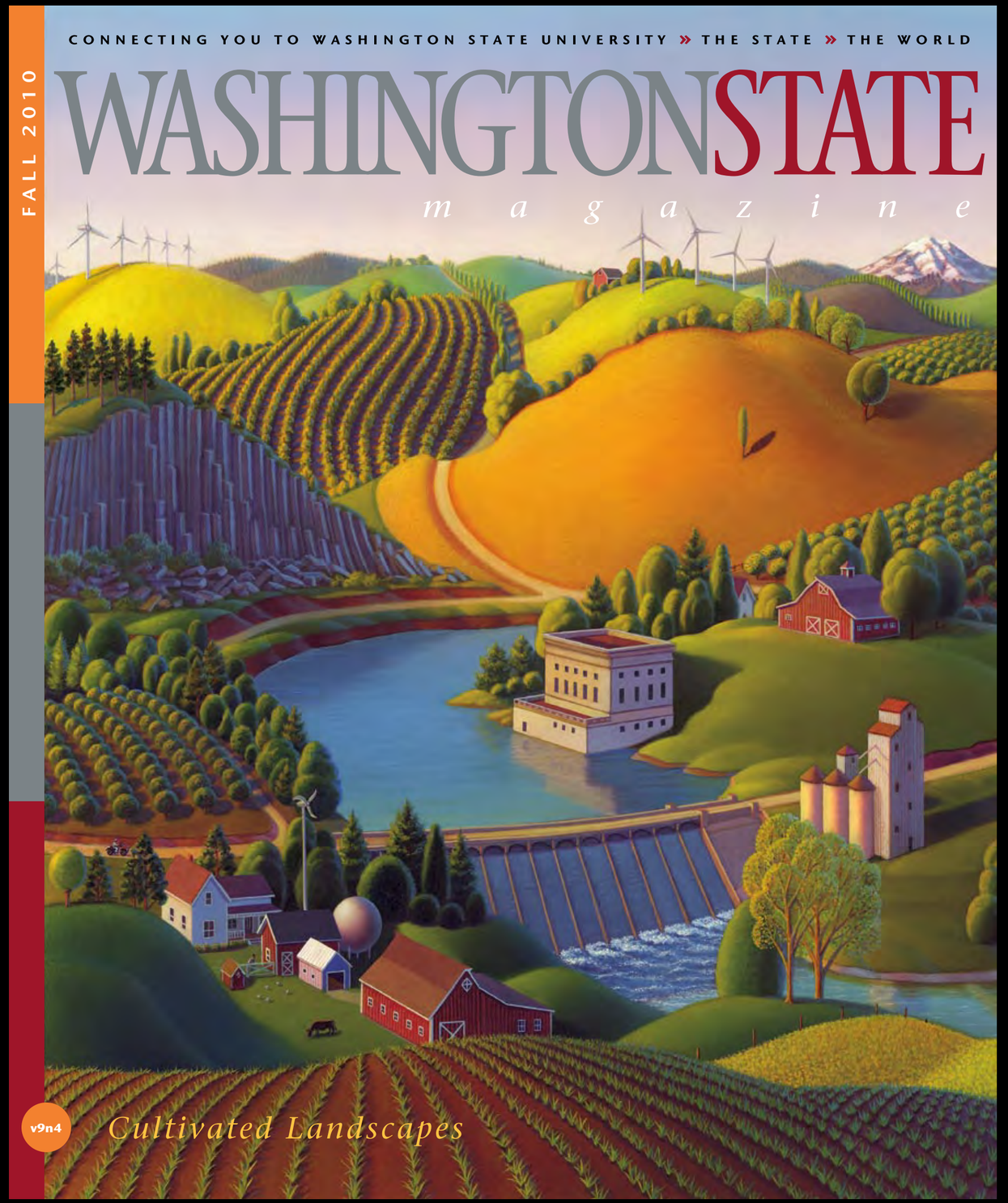
‹ / › PREVIOUS / NEXT PAGE

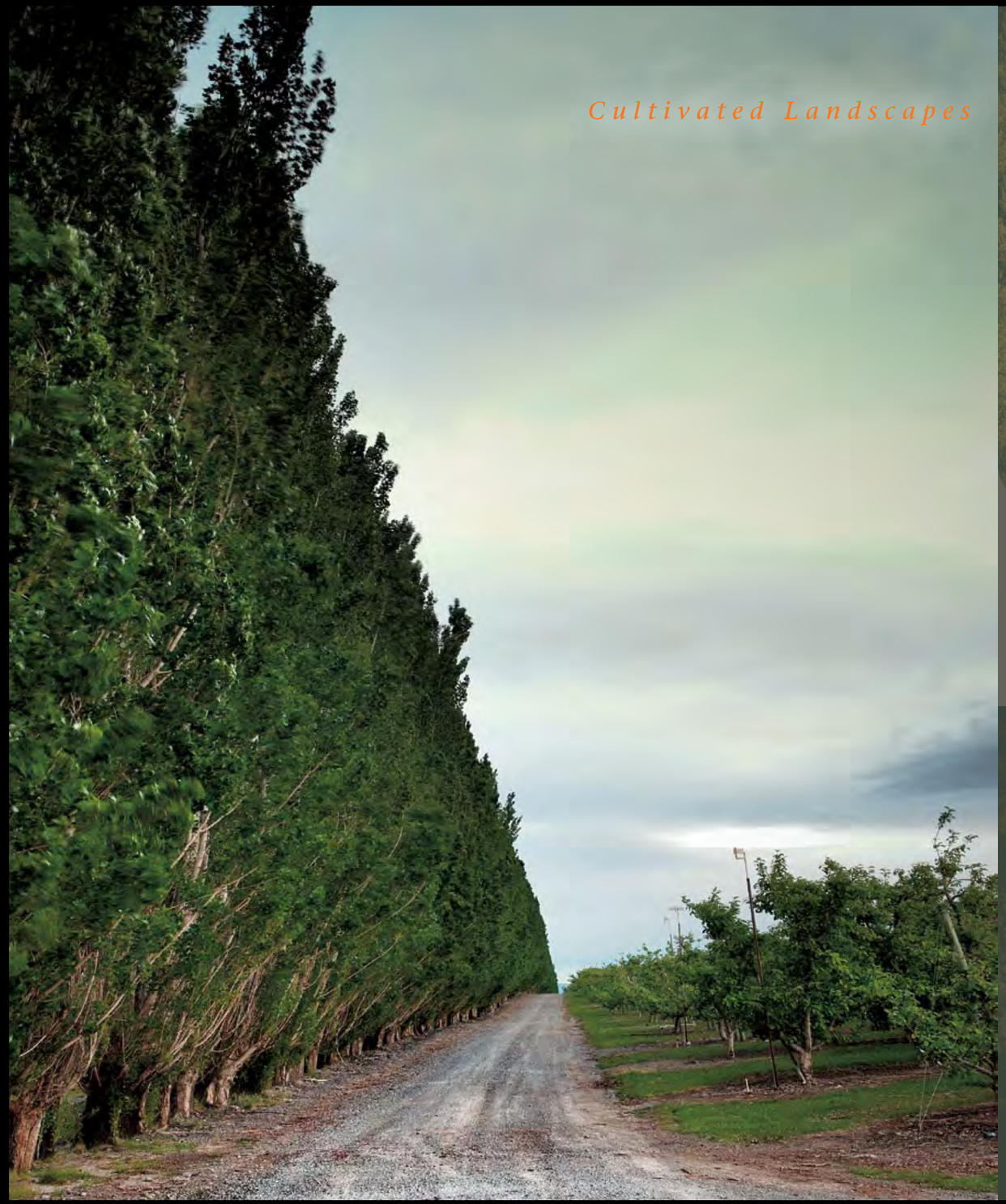
TABLE OF CONTENTS
CLICK ON TITLES TO GO TO STORY

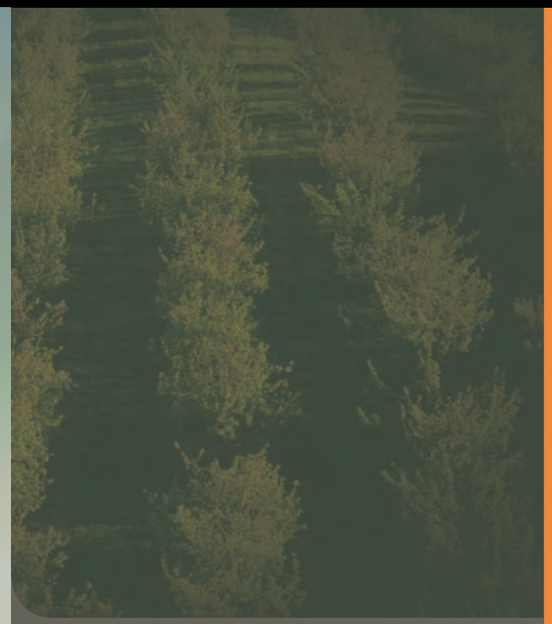
SCROLL PAGE
(IN ENLARGED VIEW)

WEB LINKS
URLS IN TEXT & ADS ALSO CLICKABLE

CLICK HERE TO EXIT
OR USE ctrl/cmd-Q







The kinder, gentler orchard

photos by Zach Mazur

:: Tim Steury ::

MID-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 one 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 those 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.

Opposite and below: The new softer pesticides have reduced re-entry time for workers from as much as 14 days to four hours.

Many of the changes in pest management brought on by the FQPA were difficult. Some pesticides were restricted. Lorsban, for example, which was a standby summer spray for San Jose scale, leafrollers, and codling moth, was suddenly restricted to pre-bloom, 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.

But the positive developments of the FQPA, if not obvious at first, eventually far surpassed the oppressive restrictions.

"What did happen over the last decade," says Brunner, "lots of new pesticides were registered that targeted key pests that organophosphates were targeting, but at low risk to birds and wildlife."

And humans.

ROBINSON AND HIS FELLOW APPLE-GROWERS likely would not be so calm about the looming loss of their codling moth weapon were it not for a couple of developments over the decades: integrated pest management and mating disruption.

Mating disruption is the controlled release of synthetic pheromones, or sex attractants, in an orchard to prevent or delay reproduction. Although it's not entirely clear how this works, the omnipresence of the pheromone seems basically to confuse the males. The intensity of the pheromone is about 10,000 times what the female moths emit, says Brunner, a long-time pheromone researcher who has been instrumental in getting growers to adopt mating disruption as a regular management practice. Although the male codling moth can find the female by sight at close range, smell is the primary means of finding the female, and the male simply cannot find his way amidst the overwhelming presence of the synthetic pheromone.

Better than 80 percent of Washington's apple acres are treated with mating disruption, says Brunner. When used at the recommended density, mating disruption is very effective. Although 100 percent control of codling is not feasible with the pheromones, it is sufficient to dramatically ease the need for additional chemical control.

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.

"We had a brand new miticide called Kelthane," says Hoyt. "So things didn't look too bad."

But by the following year, some McDaniel populations had already developed resistance.

"Well, we still had another one, Aramite."

But then, Aramite was found to be a carcinogen at high rates and was withdrawn from the market

"So it quickly went to a difficult situation," says Hoyt.

McDaniel spider mite populations exploded. Mites feed by sticking their 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 worst, says Hoyt, McDaniel infestation can denude a tree in midsummer.

Without predators present, he says, spider mite populations could increase in one month from an average of fewer than one mite per leaf on average to over 200. Also, their lifecycle is as rapid. A spider mite can go from hatching from an egg to laying eggs in eight days.

The McDaniel spider mite is a native species that is a pesticide-induced pest, says Hoyt. They developed resistance to the pesticides, while their predators died under the onslaught.

While doing some of his codling moth studies, Hoyt noticed that one treatment, involving a lower dose of spray, stood out. There was no mite problem. Hoyt found some predators. Not many. But not many spider mites either.

The next year he tried the treatment on a larger area. It wasn't very effective against codling moth, so he switched to Guthion.

But at the standard rates, the mites increased again. So they lowered the application rate to a level that controlled codling moth, but allowed predatory mites, *Typhlodromus occidentalis*, in the orchard to survive. It worked. The McDaniels population dropped to tolerable levels. But selling the approach to growers was another story.

"There were people who called it 'Hoyt's Folly,'" he says. Even though Hoyt knew the way to increase control of spider mites was to decrease the amount of pesticide to a level that spared the predators, it was a hard concept for an anxious grower to swallow. But Hoyt persisted.

Then in 1965, the area was hit with severe frosts. Growers, faced with small crops, suddenly were eager to save money in any way possible, particularly pesticide applications, and turned over large acreages to Hoyt's experiment.

"When we started applying lower rates of Guthion, our actual costs for pesticide for a box of fruit was like 20 cents," says Hoyt. Growers who continued to spray conventional mite control were spending five or six times as much.

By 1966, growers were using Hoyt's system on 9,000 acres of apples. By 1967, the program had grown to 40,000 acres.

Eventually, says Brunner, growers adopting Hoyt's program 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 Vince Jones, a research entomologist currently at the Tree Fruit Research Station.

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 continuing shift from organophosphates to softer pesticides, and "right now we're at a teachable moment," says Jones.

The situation gives us more chances to use more biocontrol, he says. "We need more ways of incorporating natural enemies into the system. The problem is, most people don't think biocontrol is important until it's gone."

For example, he says, "You don't think of spider mite management generally because of work that Stan did unless you disrupt that system—and suddenly you have spider mites everywhere."

An unintended consequence of the transition to the newer generation of pesticides has in fact been a disruption 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.

"With the new materials, the effects are not as obvious," says Jones. "They're not always just increased mortality."

The problem is that the new generation of pesticides works with much 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.

"Some are more acutely toxic than we thought, just through contact," says Brunner.

"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 have nine. All are active in slightly different ways.

"Some of those products control just codling moth. Others control codling moth and Pest A, others codling moth and Pest B, depending

on when they're used. Weaving that all together in a program is what's complex."

Add to an already complex situation the problem of resistance.

"You need to mix them around.

"Ten years ago people didn't worry about resistance," continues Brunner. "Now, we go to meetings and we say use this product or use this product, and growers ask, well how does this fit in resistance management?"

The members of the PMTP have been communicating not only with growers and managers, but with farm workers also. One of the main messages carried by team members such as postdoc Nadine Lehrer to this group is that the new products they're working with really are safe.

With the older chemicals, sprays would be applied and then workers were able to go back into the orchard for anywhere from three to fourteen days.

"Now it's four hours," says Brunner.

A powerful tool that Jones, Brunner, and others have developed for growers and managers to navigate the new, softer-but-complex strategy is the web-based Decision Aid System. Jones offers me a chair next to him behind the two large computer screens he spends much of his day behind and logs on to the DAS.

The DAS basically tells growers "this is what insects are doing, and this is what you need to do," says Jones. The DAS "imports weather data, uses the data to drive insect and disease models and then integrates that information with physiological time-based pest status and management messages." The system contains ten different insect models, offering information on their seasonal development, when they are active, when they reproduce, and so forth. It also contains three disease models (for fireblight, scab, and powdery mildew) and one horticultural model.

The DAS system is linked to AgWeatherNet, the localized weather system directed by WSU's Gary Grove and others, which has 132 stations throughout the region. The DAS also uses NOAA and Weather Service 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 codling moth, for example. What spider mite predators are vulnerable to spray right now? Have there been enough degree-days of heat to make spraying 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.

Although the new pesticides are far safer, their application demands more complex timing and coordination. Entomologists Elizabeth Beers, Vince Jones, and Jay Brunner and postdoctoral researcher Nadine Lehrer have led grower education through the Pest Management Transition Project.

Brunner estimates there are between 200 and 250 consultants working in the industry. A few are private. Some work with the warehouses. Some work with chemical distribution companies.

"They're highly trained," he says. "They're taking our information and they integrate it into the needs of every grower."

"ONE HUNDRED MILLION BOXES" is the first topic of conversation at breakfast the next morning. I've met Harold Schell and Nick Stephens at Smitty's on Wenatchee Avenue, the main drag. A hard wind is still driving out of the Cascades, and it's cold enough for a warm jacket. But Schell and Stephens are upbeat.

Stephens, a private consultant, you met earlier. Schell '77 is the lead horticulture fieldman for Chelan Fruit, one of the main packing warehouses in the region.

The hundred million boxes is the size of this year's projected apple crop. In spite of what might seem a potential oversupply, prices are good and holding firm, says Schell.

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. No one comes close. And Stephens and Schell aim to keep it that way. Not only is the pressure of producing perfect fruit intense, so of course is the economic pressure.

Later that morning I drive up to Wenatchee Heights. The apples and cherries at that elevation are still in full bloom. The roads between orchards go on forever. Orchard upon orchard spread down toward the valley, a panoramic landscape of enormous scale, of fruit, of beauty, and of livelihood.

Earlier, Brunner had given me a quick tour of the investment and risk landscape.

WSU recently planted a new research orchard south of Wenatchee at a density of 1,452 trees per acre. "And that's not highest density," he says. Some orchards on dwarfing rootstocks and trellis systems push 2,000 trees per acre. Figure $7-8 a tree. Then there's irrigation and other infrastructure.

"These guys are investing, in the first three years, anywhere from $25-27,000 an acre with no return. They have to have a full-bearing crop by year six or seven to pay back investment. The capital intensity is huge compared to wheat or almost any other agricultural crop.

"There's opportunity for great reward, but it's a huge risk. You used to be able to produce a lot of fruit with two-thirds of it high quality. Now you've got to have 90 percent high quality fruit and still produce a big yield," he says.

Schell and Stephens know that risk inside out. It's their job to ensure that 90 percent high quality.

Still, even before our pancakes arrive, they're talking about how beautiful it is out there this year.

"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 … snowcapped peaks in the background and the pears in full bloom."

They both talk about how great the smell is this year.

"I've always thought if you could bottle the smell, you'd make a mint," says Schell. Then he talks about how his grandfather came out from Louisiana and planted 40 acres of golden delicious, taking a huge risk, without a buyer and before anyone knew what a golden delicious was. But he made it. And now here's his grandson talking about how much he loves going to work and how beautiful it all is.

"Anyway," says Stephens, "this time of year it's … the point where not only are there all sorts of horticultural activities taking place, you're thinking about the implications, the ramifications of the kind of weather … and it's just another odd year in a row, and cold, wind, hot, flowers opening up, the stigma, will they still be receptive when the wind stops blowing, full bloom, and then you start thinking when are we going to set a biofix on codling moth?" ⊗

More orchard photos are available at wsm.wsu.edu.