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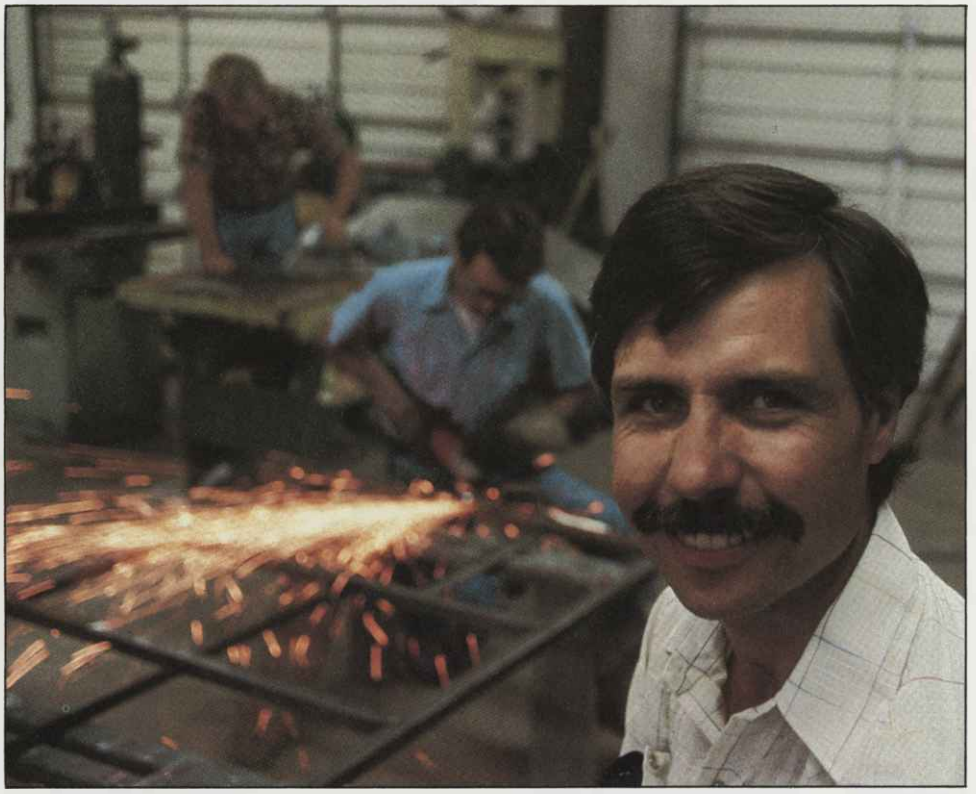


LYNN KETCHUM

Name: Dr. Wayne Coates Occupation: Equipment Designer

by Lorraine B. Kingdon

"You can grow all the plants you want, but they won't be a crop until you find a way to harvest them," says Dr. Wayne Coates.

In today's agriculture, harvesting means machines. And that's where this University of Arizona agricultural engineer enters the picture. Wayne Coates designs machines that cut, shake or knock plants to get at the crop.

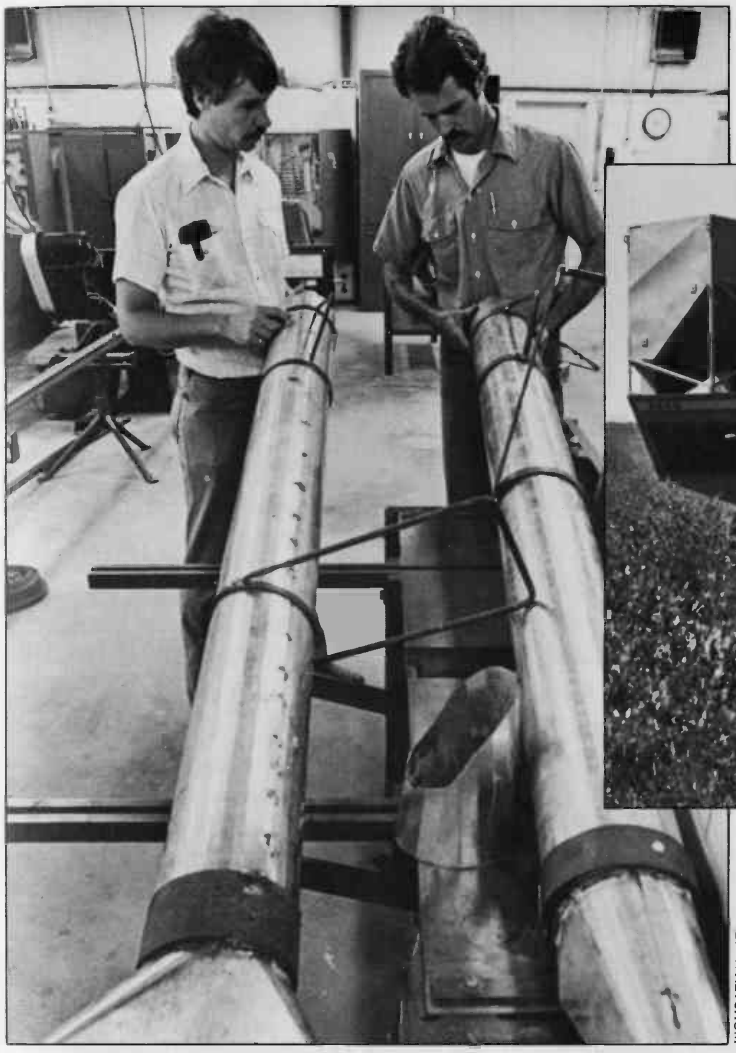
Coates has also designed or improved other types of farm machinery. He's worked on machines that lay irrigation lines. He developed a rotary cutter for soybeans and cereal crops; it replaced a reciprocating one that wasted energy—and shattered soybeans.

He's improved hay balers, but that's a long story that starts in the cold country up North. Coates grew up driving a tractor and repairing equipment for his dad's custom haying business near Edmonton, Alberta, Canada.

Most teenagers save their money to buy a bike, a horse or a car. Coates bought his own welder.

He says his first design was modifying a hay baler to work better. "When a farmer sits on a machine 10 or 12 hours a day, watching how the crop goes in and comes out, he can see how the machine could work better." Coates developed a feel for machines that he's never lost.

His speciality at the UA is designing harvesters for alternative, non-traditional crops—guayule, jojoba, sesame. If guayule is ever needed as a source of rubber, it's obvious that a method of efficiently harvesting it also had better be ready. Coates has



LYNN KETCHUM

Coates and research assistant Charlie DeFer check over components as a new version of a jojoba harvester takes shape at the UA Campbell Avenue farm machine shop. Once completed, the harvester undergoes field testing in western Arizona.

WAYNE COATES

WAYNE COATES

worked out two main designs for a seed harvester.

Guayule plants contain a natural rubber in the roots as well as in the seeds. So Coates developed a hedger that will dig out the entire plant and elevate it out of the ground; the machine can be used to harvest old guayule plants that no longer yield satisfactorily.

Until recently, jojoba was harvested by hand. Large acreages coming into maturity are too much for hand-harvest, but the machinery being used is a Rube Goldberg adaptation of a blueberry harvester. It rides over the bushes, with flail-like wooden paddles knocking the pods onto plates. Some pods shatter when hit—some bushes are too large for the harvest to pass over—all pods or seeds that have dropped to the ground are lost.

Coates wants to start from scratch. He's thinking about a machine with air jets to blow the pods onto the ground where they could be vacuumed up.

Sesame presents a different problem. "I need to figure out how to

His specialty at the UA is designing harvesters for alternative, non-traditional crops — guayule, jojoba, sesame.

improve the windrowing techniques to reduce shattering losses," Coates says.

He says, wryly, that his job would be a lot simpler if plants were bred for easy harvest. "Instead, we're handed a crop and told, 'Now go figure out how to harvest it.' It should be the other way around."

Installing surface drip irrigation lines has been a time-consuming, back-breaking job. A large reel of line is put on the back of a tractor. Two workers grab the end of the reel and stake it to the ground at one end of the field.

After the tractor starts moving, one person on the rig has to try to control the speed with which the line unrolls, but it still gets tangled. At the other end of the field, more workers cut the tubing. The second line is staked to the ground, and the whole process begins again.

Coates' machine can be operated by one person; no staking is needed; it automatically brakes; a mechanized cutter takes care of that operation at the end of the field. Efficiency has been upped 200 percent, he says.

Where does a machine designer start? Thinking. Analyzing. "Look at what you're trying to do," Coates stresses.

What part of the plant has to be separated in the harvest—seeds, pods, stalks, roots? Should the machine cut? Shake? Hit? How much energy is involved? What is the operating environment?

For example, guayule has to be harvested close to the ground, near the soil surface. When cut, the plant stems exude a sticky sap that gets mixed with the soil to form an abrasive mud. Blades soon become dull.

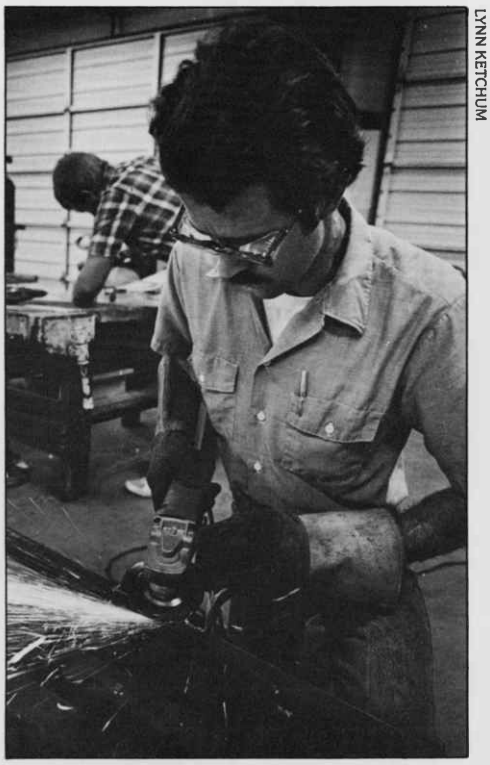
The solution? Coates avoids the problem. He uses two counter rotating coulter blades; one is notched, the other smooth. The blades overlap and "cut like a continuing pair of scissors." They don't have to be sharp to work.

Once the thinking is done, the building starts. Models, first. Coates hasn't used the computer very often in the past, but he sees how it could be applied to developing models on the screen and testing them in slow motion.

He says the mathematics and geometry of models are too complicated to fiddle with without a computer. Usually, when Coates wants to check how an idea might work, he tears the back cardboard off a paper pad. He builds a working model from the cardboard, using pins to stick running parts together.

Coates has a machinist and graduate students who do the actual cutting and welding to put the designed machine together. But, he says, he can't really make the machine work unless he actually sees it. He still has his old skills in the machine shop, but he admits ruefully, "Once I get started putting things together, I can't stop."

Machinery design never ends, he points out. "I design, go build, make changes, try in the field, make more changes, try it again. There are always further refinements that could be made." That's part of the fun.



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Research assistant Charlie DeFer (foreground) and ag engineering graduate student Bruce Lorenzen fabricate Coates' designs.

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