# Dust Control Experiments Seek Way To Retrofit Aging Feedlots

By David Bowser

HEREFORD, Texas — When many of the feedyards were first built in this part of the Texas High Plains, there was little concern about the environmental effects of feeding cattle.

"We've got a lot of old feedyards out there that were not built with environmental quality in mind," says Dr. Brent Auvermann, an agricultural engineer with the Texas A&M University System. "They were built back in the 1960s and 1970s."

At that time, pens were arranged to follow the topography of the land. They avoided moving a lot of dirt because it was expensive.

"They were designed with feeding cattle in mind," Auvermann says, "and not so much protecting the environment."

Over time, those feedyards have gotten bigger and bigger.

"Every time you expand them," Auvermann says, "you make it more expensive to retrofit them with something for environmental quality protection."

There's a lot of pressure on those feedyards now to control dust, Auvermann adds.

Newer feedyards are installing sprinkler systems, but retrofitting a sprinkler system to a 50,000 or 60,000-head feedyard is probably twice as expensive as installing one when the feedyard is being built.

Another option is to go to the downwind edge of the feedyard, he says, and scrub the dust out of the air.

"There are a lot of different ways to think about doing that," Auvermann says, "but we decided that we would start back in 1999 with a little pilot project."

He says they installed a couple of passive wind tunnels end to end.

"They were essentially 20-foot long carports," Auvermann says. "They were about eight feet tall."

End to end, they gave him 40-foot long wind tunnels. Two sets of the carports were set side by side next to a feedyard near Bovina.

"They were parallel to the prevailing wind so that when the winds were blowing off the feedyard, they would naturally blow through those two carports," Auvermann says.

In one of the wind tunnels, Auvermann put a water curtain.

"It was a piece of PCV pipeline along the interior, hanging from the roof, and we put nozzles on the pipe to make a pretty fine spray," Auvermann explains. "It's not a mist, but a fine spray."

They sprayed the water in an overlapping pattern.

"We put dust samplers upwind and downwind of each one of these," Auvermann continued.

The one without the water curtain served as the control.

"We measured dust concentrations upwind and then downwind and compared these two," Auvermann says.

The wind coming out of the wind tunnel that had the water curtain showed lower dust levels.

"We got something like almost 70 percent reduction," Auvermann says.

That, however, was a small-scale experiment.

"It has nothing to do, really, with a real world situation," Auvermann concedes. "We were seven or eight feet in the air with those. A typical dust event in a feedyard might be 40 or 50 feet high."

After the initial experiment, Auvermann scaled up the layout at the Hereford Feedyard, owned by AzTx Feeders of Hereford, beginning in 2001.

Michael Kitten with AzTx Cattle Feeders says he's been impressed by the system.

Hereford Feedyard was built in 1959 and follows the contour of the land here.

"They way it's laid out, it's strung out kind of long," Kitten says. "The contour is such that a permanently set sprinkler system would not work well. There's no way. It would be so cost-prohibitive, it would be unbelievable. Something like this, you can run on the downwind property line and use less water.

"It's a reactive process instead of a preventative process. With a permanent set sprinkler system, you've got to run them all day everyday to prevent the event the next day. This is totally reactive. In the evening, when the cattle get restless and you start having your event, you turn it on. When the event's over, you turn it off. If the event's not there, you don't use the water."

Kitten thinks it's more efficient for their operation than a sprinkler would be.

"With the layout of a feedyard, these permanent sprinkler systems are not always the answer," Kitten says. "You try to look for some kind of alternative."

The water curtain is there to stop the dust from crossing the property line.

"Within our industry, there's a demand for it because it's an increasing issue," Kitten says.

The water curtain is on the east end of the feedyard. The prevailing winds are from the west.

"We ended up with a pretty nice partnership to build this thing," Auvermann says.

The members of the partnership included the Texas Cattle Feeders Association, Deaf Smith County Air Quality Project and the Texas Commission on Environmental Quality.

"AzTx put up in-kind contributions of considerable scale," Auvermann explains. "The Deaf Smith County Co-Op put up the big power poles."

The power poles are about 45 feet tall. Auvermann says they strung high-tension steel cable across the line of poles about 25 feet and 44 feet high.

"There were seven of these poles installed and then the high tension wire across the top," Auvermann says.

They hung center pivot irrigation pipe from the high-tension wire.

Auvermann's initial thought was to try the higher tension wire, but they would have one string of wire at 25 feet if they wanted to install pipe at a lower height.

"We just took six and five-eighths inch standard center pivot pipe," Auvermann says.

He plugged three out of every four holes where a nozzle would ordinarily go.

"We put a gooseneck and a nozzle on every fourth outlet," Auvermann says.

That gave them 10-foot spacing.

"The pipe ended up being about 42 to 43 feet in the air," Auvermann says.

The pipes are on a block and tackle so they can move with the wind.

"The suspension is flexible," Auvermann says, "but at each pole, they're tied to the pole so the wind doesn't beat them up."

The water supply is pumped up the middle of the line of poles and the water is split at a T-joint to the pipes hanging above the ground.

Dust samplers were set up between the water curtain and the feedyard. They were downwind of the yard, but upwind of the water curtain.

"Then we put some samplers downwind of the curtain in what you might call the wetted footprint where the water sprays out and makes a half-oval shaped footprint," Auvermann says. "We put samplers in the middle of that."

The size of the droplets in the spray is crucial.

"We wanted the droplets to go all the way to the ground instead of re-evaporating," Auvermann says. "If the water captures the dust particles and re-evaporates, it releases the particle back into the air. "We didn't want that. We wanted the particle to be large enough to get all the way to the ground."

He says special nozzles had to be installed on the pipes. The regular nozzles didn't give a fine enough spray.

"We had to use precision nozzles to get what we wanted," Auvermann says.

They used nozzles that had been developed for painting automobiles.

"They give you a nice, even droplet size," Auvermann says.

As the water comes down, it gives a uniform curtain of droplets.

The system sprays out about 300 gallons per minute each evening.

"We weren't able to do any monitoring last year because last summer was so wet," Auvermann says. "There really wasn't any dust to speak of."

This summer, Auvermann got quite a bit of data. He has a lot of data from 2003.

"Again, it's still research, but so far, it looks like it does make an impact," Kitten says. "It does make a difference. We still have a long way to go on gathering data and making sure it is all correct."

"Being the cautious type," Auvermann says, "I'm not ready to go out and recommend it."

The reductions in dust so far have been about 30 percent.

"This thing is only 270 some-odd feet long," Auvermann reminds. "The entire feedyard is nearly a mile long. We're not even spitting in a bucket as far as length is concerned."

Because of the short length, Auvermann says there is some wraparound effect with the dust spilling around the ends of the water curtain. If the wind shifts a little bit, it can throw off the measurements.

"If we can get it a little wider, we can keep our collectors in the same spot," Kitten says, "we can knock out that wraparound."

"What we want to do is lengthen it so that we eliminate those end effects," Auvermann agrees. "We've got to come up with some money to do it."

There is no money available at the moment. TECQ can divert money to the project.

"But we haven't seen any activity in that account recently," Auvermann says.

The wetted footprint at the Hereford Feedyard falls on what was in a dryland wheat and sorghum rotation.

The water curtain has ended up being something of an irrigation system for the cropland, or at least part of it.

"It also jacks up the weed pressure," Auvermann shrugs.

There are a couple of caveats with the system, Auvermann says.

"First of all, we would not want to operate this when it's really, really windy," Auvermann says. "This would not be effective when it's really windy."

It works best when the winds are light, which is when the dust problem is at its worst anyway.

"The water will fall relatively close to the structure itself," Auvermann says. "We may be able to recapture that water and recycle it."

"That would be the next step of the research. Especially if we triple the length, we'll try to collect," Kitten says. "That we could collect and reuse."

The system uses fresh water from the Santa Rosa Aquifer, a deep aquifer below the Ogallala Aquifer, which supplies most of the water in the area. The Santa Rosa water tends to be of a lesser quality than the Ogallala water.

"It's coming out of our system for the whole yard," Kitten says. "We've got two Santa Rosa wells for the feedyard. We're not using Ogallala water."

"It's more expensive to pump," Auvermann concedes, "but it's not as if they are putting human drinking quality water out there."

In most areas, Santa Rosa water tends to be salty, but in the finger of the aquifer they've tapped into here, it is sufficiently good to use for livestock water.

"It's excellent quality for Santa Rosa water," Auvermann says. "In this case, it's pretty good."

Eventually, Auvermann hopes to recycle some of the water, but that will come later.

"We did not want to put research dollars into concrete here," he says. "We wanted to evaluate the technology first."

A couple of feedyards in Nebraska have decided to go ahead and replicate his system.

Auvermann worries that they may have jumped the gun.

"God bless them," he says. "I hope it ends up being as effective for them as they think it will be."

Auvermann, however, worries that there is not enough data yet.

"A 30 percent reduction is nothing to write home about," he points out.

If a wind gust came from a different direction, it could have thrown the measurements off and the reduction may be better than 30 percent.

"I think we can do better than that," Auvermann says. "There are a couple of enhancements that we could make to it. We could add a misting stage just upwind of it."

Generating a mist would result in 10 or 20 times as many droplets, which would improve the odds that each droplet would contact a dust particle.

Even thoough those might re-evaporate, the spray curtain with its larger drops would take the dust particles to the ground.

A misting stage upwind might help," Auvermann says.

It may also help to inject a wetting agent into the mist.

"It would decrease the surface tension of the water," Auvermann explains, "and when a droplet contacts a dust

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particle, it's more likely to go along there."

There have been suggestions of using a wetting agent that could include a fertilizer of some kind.

"Going up higher and going out longer would certainly improve it."

Auvermann says he's been pleasantly surprised with the data he's gotten.

"I wasn't sure it was going to work," he says. "So far, it's worked pretty well."

The commercial cost of such a system is still unknown.

"I think the cost is going to be pennies on the dollar of what a permanent set sprinkler is going to cost," Kitten opines.

While this was put together before EQIP money was available, Kitten thinks that such a project might qualify for EQIP funds.

"Originally, the Cattle Feeders Association took the stance that EQIP money should be spent on dust control," Kitten says.

Ben Weinheimer, Texas Cattle Feeders Association regulations manager in Amarillo, says that for 20 years the industry has been sponsoring research to get to this point and is now working to build these programs.

"We're making big progress as far as dust control," Weinheimer says.

"I can't price one of these things off what we spent for the pilot program," Auvermann says. "Commercially, you'd be able to do it cheaper per linear foot than we were able to do it."

The cost of the project, including in-kind contributions, would put it close to $100,000.

"I know we spent more than $50,000 cash on it," Auvermann says.

Add on to that they're pumping from 1000 feet instead of 200 feet.

"Santa Rosa water is deep," Auvermann notes.

Up in Nebraska where water is much shallower, that shouldn't be a problem.

Auvermann is considering using lagoon water mixed with fresh water.

"That's a possibility except that you might exchange one air quality problem for another," Auvermann says. "You might be exchanging dust control for a more intense odor effect."

To the extent that the current system removes dust from the air, the water curtain holds down odor.

"If you walk outside the wetted area, there is a pronounced, obvious difference in odor," Auvermann says. "There is an effect there."

Auvermann is considering saving some fresh water by blending some holding pond effluent with it.

"Maybe we couldn't go straight effluent," he says, "but we could blend them and not worry too much about adding to the odor problem."

"If you scrub dust out of the air," Auvermann insists, "you will help with the odor, during the dry season anyway."

The operating cost of the system will be seasonal because of the weather. This area can have hard freezes. Besides, Auvermann points out, dust is usually a problem in the summer when it's hot and dry.

"We'll drain this thing Oct. 1," Auvermann says. "We won't even think about it again until March."

That's essentially the same schedule as feedyards with sprinkler systems, he adds.

"You don't use it all day," Auvermann says. "We run our tests beginning about five or six p.m., when the dust really starts to build. During the afternoon, the wind speeds are higher and there's a lot of turbulence; the dust doesn't get confined to that layer we see in the evening. When the atmosphere is trapping that layer for us, that's when we want to come in and scrub it out of the air. That's when the nuisance problems downwind really occur."

When winds are light, temperatures are decreasing and the atmosphere is becoming more stable, that's when the system works best.

"This is tailor-made for that," Auvermann says "We let the atmosphere squeeze the layer down there and we scrub it. Maybe we'd run it from six in the evening to 10 at night."