

Cleaner Air in the Desert

New technology measures dust emissions in agricultural settings

By Joanne Littlefield

The agencies responsible for monitoring air quality standards in Arizona based on the federal Clean Air Act continue to look at dust particulates that have the greatest potential to compromise human health. PM-10, or particulate matter smaller than 10 microns, is considered a source of air pollution throughout the state. Combustion of diesel fuel, emissions from fossil-fuel-powered electrical plants, aerosolized soils, and soil movement operations in mining, transportation, agriculture and other industries can contribute to PM-10 concentrations in the air and reduce air quality.

In the early 1990s researchers at the University of Arizona began monitoring emissions from agricultural tillage equipment to find out exactly how much particulate matter they discharged and to figure out how to reduce that amount. At that time Wayne Coates (a research professor with the UA Office of Arid Lands Studies) constructed a monitoring device that could be mounted on the back of various agricultural implements. He determined that a stalk puller and a USM (uprooter/shredder/mulcher) tractor implement produced the fewest emissions during cotton plowdown operations.

Since then, James Walworth, an extension soils specialist in the Department of Soil, Water and Environmental Science, Robert Roth, director of the Maricopa Agricultural Center (MAC) and Frank "Ed" Eaton, a research associate in the Department of Agricultural and Biosystems Engineering, have continued research in this area. Eaton has developed and modified equipment for taking PM-10 measurements behind the tractor in the field.

"Currently we are just trying to measure what is actually stirred up with the agricultural implements," Eaton says. "The ideas behind the study we are doing now and the one conducted earlier are somewhat different although we are using similar measuring devices such as dust suction motors."

The new monitoring system includes four tiers of intake pipes feeding to four



J. Littlefield

PM-10 dust monitor, on tractor and close up.

separate electronic counters. Mounted on the back of a tractor implement, such as a tiller, disk, or plow, the device extracts a sample of air while the implement is in motion on the ground and sends it past a laser beam which measures the concentration of PM-10 particles in micrograms per cubic meter.

"The amount of PM-10 we're stirring up with these implements is very low," Eaton says. "The EPA maximum is 1.5 micrograms per cubic liter, and very rarely will we exceed that. The fields we're working in at Maricopa and Marana Agricultural Centers, show about .010 to 1.00 micrograms per liter."

During this last year of the current three-year study, Eaton is comparing PM-10 measurements from four different till methods, including conventional tillage equipment, the Sundance tiller developed by Sundance farms in Coolidge, the Bingham Paratill and a Pegasus plow. The Pegasus system, which pulls cotton stalks and buries them in one pass through the field, showed lower PM-10 readings and was the most fuel efficient of the four systems.

"If you can reduce the trips through the field, you're going to reduce the amount of dust you kick up," Eaton says. "In addition to PM-10 measurements we are noting fuel or energy consumption along with cotton yields for each



J. Littlefield

plowdown method." By taking soil samples prior to running the equipment Eaton is able to correlate PM-10 readings with weather and soil conditions. His measurements will help show the amount of PM-10 actually resulting from cotton tillage as opposed to other activities. "It is pretty much accepted knowledge that a lot of our dust comes from unpaved roads, but how much, we don't know," Eaton says. This apparatus, which has been modified to fit eight different combinations of tractor implements, could be also be adapted for use with road grading equipment. 🌱

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