Measuring the Water Demand for Sprinkler Dust Control on Cattle Feedyards

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BACKGROUND

Measuring the water demand for sprinkler dust control on cattle feedyards can be achieved by measuring evaporation from a feedlot surface. Historically, feedyard surface evaporation has been estimated from soil evaporation data but not directly measured. It would be extremely difficult to measure evaporation from an actual feedyard. The manure lysimeter project is a set of weighing lysimeters designed to measure evaporation from simulated feedyard surfaces. Daily evaporative losses are replaced each day through a micro-irrigation system to maintain a specified moisture content. Similar to irrigation scheduling algorithms, a correlation between daily meteorological data and daily evaporation data would permit us to determine feedyard evaporation from weather data. Knowing the daily evaporation losses would facilitate the precision application of water to a feedyard surface and would help us project regional water demand if sprinkler systems were required for feedyard dust control.

The lysimeters provide a flexible experimental platform for feedyard surface research. Aspects of the manure profile, such as depth, particle size and distribution, moisture content, bulk density, antecedent moisture content, and interfacial layer properties can be manipulated within the lysimeter pans.

OBJECTIVES

Our main objective is to measure evaporation rates from simulated feedyard surfaces and correlate those data with ground-level weather data. Subsidiary objectives are (a) to refine design standards for solid-set sprinkler systems used for feedyard dust control and (b) to project future water demand in response to regulatory dust-control requirements.

RESULTS / BENEFITS

• Preliminary data confirm a positive correlation between lysimeter evaporation and reference grass evapotranspiration (ET), but ET equations currently used for irrigation scheduling need fundamental revision before they are applied to an unvegetated regime like the cattle feedyard surface.

• Continuous lysimeter weighing has verified that hygroscopic behavior, which refers to the passive uptake of moisture from the air when relative humidity is high, contributes significantly to the daily water balance on the feedyard surface.

• Preliminary data confirm that the well compacted, soil/manure interfacial layer is relatively impermeable to water seepage.

• Evaporation data may yield a viable water-management tool for feedyard managers.