Evaluating the Reuse of Swine Lagoon Effluent and Reclaimed Municipal Water for Agricultural Production

By Dr. Hailin Zhang and Brittany Davis

Significant amounts of water in Oklahoma are used for crop irrigation. Water shortage in Oklahoma and the Southern Great Plains has become a major limitation for crop production and other uses, resulting in major impacts on local economies. Therefore, alternative sources of irrigation water need to be explored. Treated municipal wastewater (TWW) is one of the most readily available alternative water sources; however, infrastructures that use TWW for crop irrigation are lacking in most places. Additional field evaluations in Oklahoma are necessary to improve public acceptance. Currently, most TWW in the state is directly discharged to streams and rivers rather than recycled for crop production. In addition to TWW, treated swine lagoon effluent is also available in western Oklahoma and other regions. Although swine effluent has been used to irrigate crops, additional water use efficient application techniques need to be evaluated and promoted.

Given the abundance of effluent and the need to identify alternative water sources, Dr. Hailin Zhang, director of the Soil, Water and Forage Analytical Laboratory, applied for an Oklahoma Competitive Water Research Grant through the USGS 104(b) program. He was awarded a grant in 2016 to conduct his project, *Evaluating the Reuse of Swine Lagoon Effluent and Reclaimed Municipal Water for Agricultural Production*.

The first objective of this project was to evaluate the impact of continuous subsurface drip irrigation of swine effluent on salt and nutrient buildup and movement in soils. In order to satisfy this, the research team collected soil samples in Stillwater, Oklahoma from a 2-acre grid in the field where the subsurface drip irrigation of swine effluent was installed. The sample profiles were separated into segments: 0-6”, 6-12”, 12-24” and 24-36” from the surface. Soil samples were analyzed for plant available nitrogen, phosphorous, and potassium, as well as pH and electrical conductivity (EC). The quantity and timing of effluent application allowed the team to calculate nutrient input.

Bermuda grass in a field with a subsurface drip irrigation system distributing anaerobically digested lagoon effluent. The strips of grass reflect the orientation of drip tapes.

The team discovered that subsurface drip irrigation is an efficient method of delivering the effluent to bermuda grass pastures. There was no evidence of significant nutrient and salt buildup in the soil or movement to the groundwater in response to the drip rate that had been applied over the previous 12 years. These data indicate swine lagoon effluent should be applied to land whenever feasible due to the supplied nutrients and water as well as the good growth that follows.

The other primary objective was to establish an environmental and agricultural baseline in a newly constructed treated municipal wastewater recycling site. To satisfy this goal, soil and plant health monitoring was conducted in Chickasha at the South Central Research Station where reclaimed municipal wastewater has been used for irrigation since 2017. Treated wastewater was analyzed for irrigation water quality several times. Groundwater monitoring wells were installed at six locations, samples of which were collected and analyzed for common nutrients and salts.

The quality of the treated municipal wastewater from Chickasha is considered acceptable irrigation water for most crops based on the analytes tested and current guidelines for irrigation water quality (OECS factsheet PSS-2401). Appliers should take the presence of some nitrogen and other beneficial nutrients in the water into consideration when determining the amount of fertilizer to apply in order to avoid over application.

This irrigation method is similar to what is used in Chickasha that uses the reclaimed municipal waste water.

This preliminary work has laid a foundation for more studies on how treated wastewater affects soil health and crop production in the future. Both data from the groundwater monitoring wells and data from the properties of the soil designed to receive treated wastewater will serve as the baseline for future reference.