MANAGED DRAINAGE SYSTEM FOR CROP PRODUCTION

Kelly Nelson
Research Agronomist

Clint Meinhardt
Research Specialist

Randall Smoot
Superintendent

Managed drainage has been utilized as a best management system to reduce NO_3-N loss through subsurface drain tiles. Regulated water flow through the winter months has reduced NO_3-N loading of streams up to 75%. Field research will be conducted on claypan and silty clay soils to evaluate the impacts of managed drainage systems for crop and livestock production from 2009 to 2012. Enhanced efficiency fertilizers may further reduce NO_3-N loss through subsurface drainage systems that utilize managed drainage for corn production. The hypothesis of this research is that managed drainage and enhanced efficiency fertilizer (polymer-coated urea) will synergistically increase corn yields and reduce NO_3-N loss, and managed drainage will reduce NO_3-N loss from an intensive annual forage production system. This research will 1) determine the effects of managed drainage systems and enhanced efficiency nitrogen fertilizer (polymer-coated urea) on corn production, nitrogen use efficiency, and nitrogen loss through the drainage system; and 2) evaluate the effects of managed drainage on forage production, nitrogen use efficiency, and non-point source nitrogen loss through the drainage system.

Experimental sites:

- **Greenley site (claypan).** Two subsurface drain tiles will be placed on 20 ft centers with a water level control structure installed in four of the six plots (Figure 1). Treatments will include drainage only, managed drainage, and a non-drained control in a factorial arrangement with an enhanced efficiency fertilizer, (polymer-coated urea) or non-coated urea. A plastic barrier will be installed between the non-drained controls, drainage only, and managed drainage treatments. A levee plow used to construct rice levees will be used to separate plots and prevent surface water movement between treatments.
- **Bee Ridge site (silty clay).** Subsurface drain tiles will be installed on 20 ft centers with a four water level control structures installed per replication (Figure 2). There will be a 40 ft spacing between treatments since the soil permeability is very slow. Fertilizer treatments will be similar to the Greenley site.
- **Forage site (silt loam).** Subsurface drain tiles will be installed on 60 ft centers with a non-treated control, managed drainage, and drainage only treatments (Figure 3). No enhanced efficiency fertilizer applications will be made to the experimental site since forage yields have not increased using this fertilizer source in Missouri (Nelson et al., 2008)

The objectives will be met to determine the effects of managed drainage systems and enhanced efficiency fertilizers on row crop and forage production, nitrogen use efficiency, and nitrogen loss in field plots specifically established for rigorous comparison of managed drainage systems. Soil and water conservation systems for productivity and environmental protection are key components of this managed drainage project. In order for rural communities to remain competitive in a rapidly changing agricultural environment, technology that integrates current best management practices will maintain a highly productive, safe, and efficient food supply. Water conservation, reduced fertilizer loss, increased nutrient use efficiency, and reduced

sediment loss while improving crop production using managed drainage that is based on solid research is a win-win situation for farmers, consumers, and the environment. It is expected that there will be a reduction in NO_3-N loading of up to 75% (Zucker and Brown, 1998; Frankenberger et al., 2006; Drury et al., 2009), and an additive effect of the enhanced efficiency fertilizer on reducing N loss in the crop production system and increasing corn grain yield. Managed drainage has not been studied in livestock production systems. This research will evaluate the impact of managed drainage on water quality and soil compaction in an annual forage production system with management intensive grazing. This research will be utilized to demonstrate the impact of managed drainage on improved water quality, crop and forage production, and transfer this knowledge through field day events, field day reports, and written and broadcast media outlets.

References:

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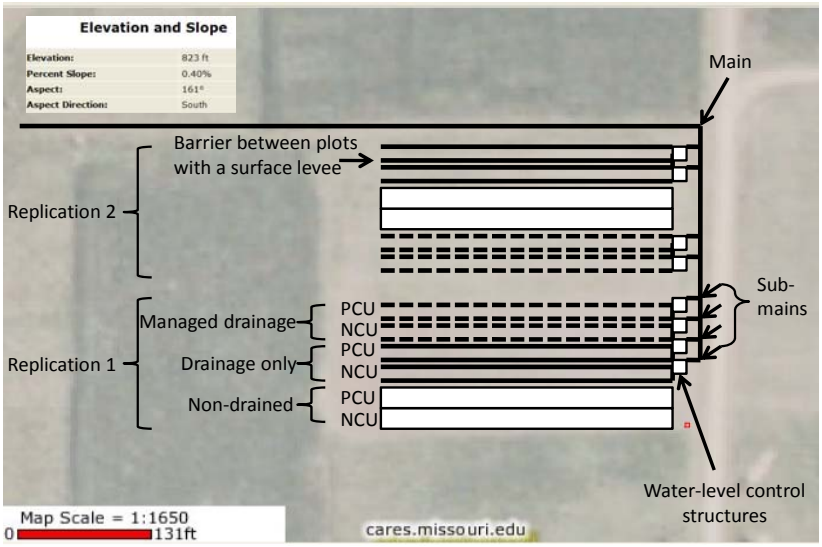

Figure 1. Managed drainage (dotted lateral tile lines), drainage only (solid lateral tile lines), and non-treated control (white boxes) main plots at the Greenley site. Laterals will be installed on 20 ft centers. Sub-plots include polymer- (PCU) and non-coated urea (NCU). Barriers and surface levees will be placed around all treatments. Individual water-level control structures will be utilized for each subsurface drainage treatment.

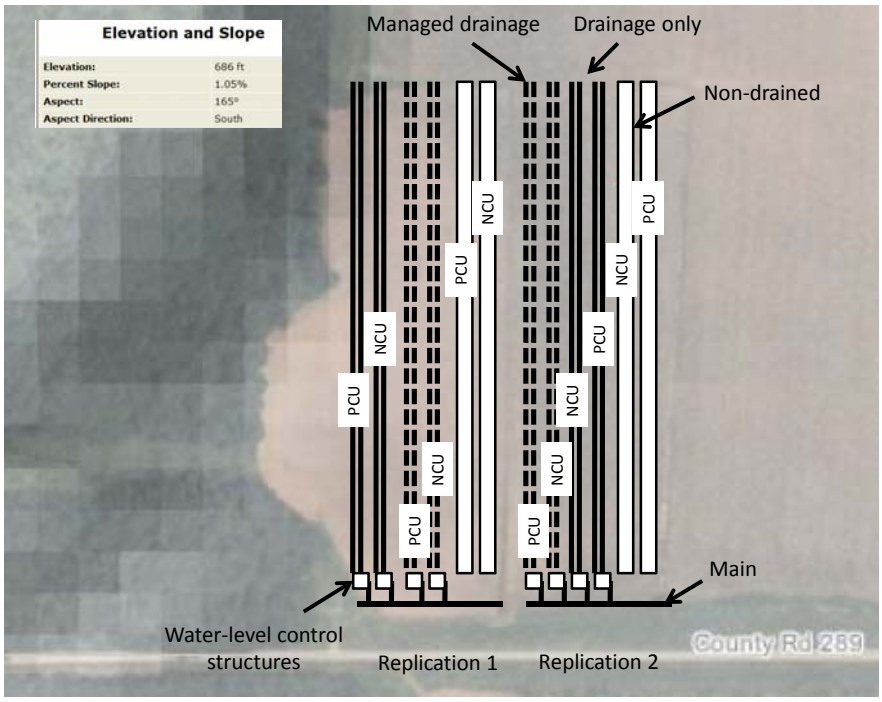

Figure 2. Managed drainage (dotted lateral tile lines), drainage only (solid lateral tile lines), and non-treated control main plots at the Bee Ridge site. Laterals will be installed on 20 ft centers with 40 ft between treatments. Sub-plots include polymer- (PCU) and non-coated urea (NCU). Individual water-level control structures will be utilized for each subsurface drainage treatment.

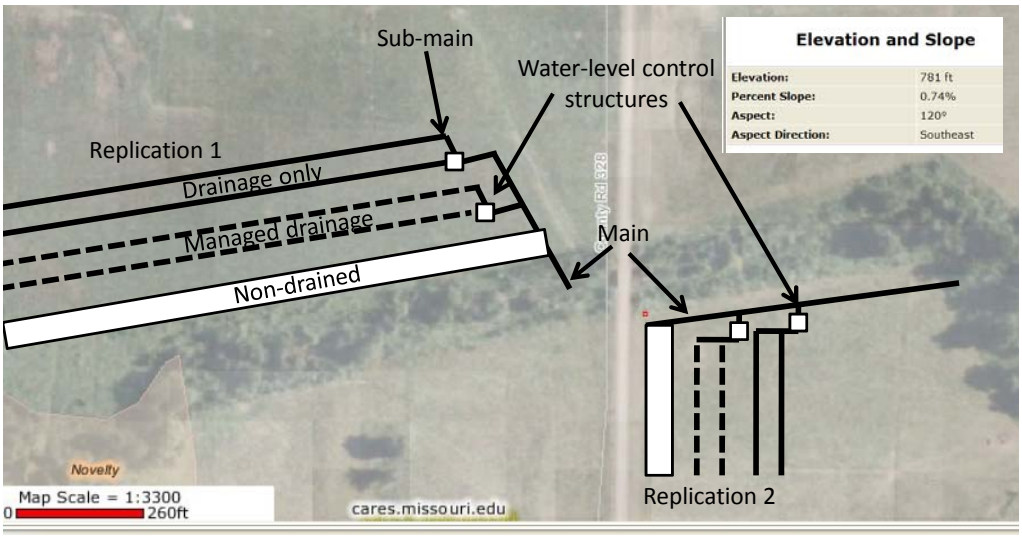

Figure 3. Managed drainage (dotted lateral tile lines), drainage only (solid lateral tile lines), and non-treated control treatments at the forage site. Laterals will be installed on 60 ft centers. Individual water-level control structures will be utilized for each subsurface drainage treatment.