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NONPOINT SOURCE PHOSPHORUS FROM GRAZINGLANDS

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Background. Phosphorus (P) is an essential element for plant growth and its input has long been recognized as necessary to maintain profitable crop production. Similar to crop production, P inputs can increase the biological productivity of algae and cyanobacteria in surface waters. Although nitrogen (N) and carbon (C) are essential to the growth of aquatic biota, P concentration in surface water has been the focus of recent regulatory statutes. The P concentration in lakes and streams is often the limiting element for algal growth and its control is of prime importance in protecting the quality of fresh waters. The sequence of rapid algal growth, death, and decay in surface water leads to problems for fisheries, recreation, industry, drinking, or other human uses. The increased growth of undesirable algae and aquatic weeds and the oxygen shortages caused by their death and decomposition is termed eutrophication.

One of the main challenges to sustainable P management in agriculture is balancing P inputs in fertilizers, manure and feed with P outputs in farm produce. In areas where large numbers of animal feeding operations are present, manure P, once considered a resource, is increasingly seen as waste. Consequently, farmers often underestimate the P content of manure in planning their fertilizer P requirements, leading to surplus P in the soil.

Current Information. Soil extraction and chemical analyses for P have been part of the standard method for evaluating P status for crop and pasture production. However, routine soil extraction and analytical methods have not been fully evaluated in relation to P concentrations in surface runoff from the soil. Even less information about the relationship between soil P and bioavailable P in surface runoff and eroded sediments is available. The bioavailable P consists of dissolved P and a fraction of the P attached to sediment, which are available for uptake by algae.

Several states have identified critical or threshold levels of extractable soil P (200 mg kg^{-1} in Texas) above which the potential for unacceptable P losses in runoff exceeds any requirements and benefits for crop production. State regulations have based manure and nutrient management recommendations on these soil P levels. Public concerns about deposition of fertilizer and animal waste nutrients on land and water quality can create a sense of urgency for these regulatory limits, with or without factual data relating nutrient management to water quality. Currently, the federal government is enforcing provisions of the Clean Water Act that require states to estimate and manage the maximum allowable nutrient load entering a body of water, termed total maximum

daily loads (TMDL), for a prioritized list of water bodies. Advisory committees of stakeholders are already meeting to establish TMDLs for nutrients and other contaminants in selected water bodies of water on Texas watersheds. Although the Natural Resources Conservation Service (NRCS) has already proposed nutrient management policies (Federal Register 98-10548), more information about nutrient amounts and relationships is needed for grazing lands to help livestock producers evaluate and manage nutrients, including P. Interdisciplinary research and information are needed to inform producers, stakeholders on advisory committees, and regulators to ensure that the TMDL process does NOT jeopardize the future of beef production systems.

Project Objective. Existing data from studies of nutrient inputs, plant and animal responses, nutrient cycling in pastures, and runoff and leaching losses will be collected, analyzed, and summarized to evaluate potential contributions of intensive grazing systems to nonpoint source pollution of water. For example, P loss in surface runoff has been monitored during a rainfall event shortly after manure and fertilizer sources of P were applied to common bermudagrass (Table 1). Once developed, the nutrient database can be used to evaluate recommendations for management of nonpoint source contributions of animal agriculture to TMDLs of water bodies on Texas watersheds.

Table 1: Phosphorus in soil, plant and a single runoff event for common bermudagrass treated with different manure and fertilizer P rates.

P treatment	Soil	Plant	Water
	----------lb/acre----------		
Control	85	2.23	0.41
Fert., 22 lb/acre	217	3.39	3.99
Fert., 45 lb/acre	370	3.39	7.20
Manure, 45 lb/acre	137	2.05	1.34
Manure, 90 lb/acre	188	2.68	2.36