



Title: Land Application of Livestock Manure in Hawaii and the American Pacific

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Theme: Animal Waste Management

Situation: Management of livestock manures and effluent is a serious concern for Hawaii and the American Pacific due to limited land for disposal and the need to reduce environmental impacts. Environmental impacts include the contamination of groundwater and surface water with nutrients like nitrogen and phosphorus and with disease organisms contained in manures. Solid manure and effluent from manure holding ponds accumulates in many dairy and hog operations. Land application and crop utilization are among the cost effective disposal options, however, information is inadequate for such uses in diverse soil and cropping systems in tropical islands. Research is required to determine how nutrients from manures become available to crops and how these nutrients are retained, released, and utilized when applied to tropical soils.

Objectives: This project is designed to (1) determine the maximum application rates of livestock waste (effluent and manure) which can be safely used over time, (2) the interactions of nutrients (especially phosphorus) in tropical soils to which manures are applied, and (3) contribute to the development and adoption of environmentally sound, comprehensive nutrient management plans (CNMPs) on livestock farms in Hawaii and the American Pacific.

Methods: The procedures used in this project will be (1) to determine the fate and movement of nitrogen and phosphorus when manure or effluent is applied to various tropical soils which are representative of the region; (2) to examine the potential phosphorus build-up from manure applications and the soil test levels corresponding to excessive phosphorus in the soil; (3) to estimate the ability of different soils to retain and release phosphorus after livestock effluent and manure application to year round production of tropical grasses; (4) to develop nutrient management planning procedures which can be easily used by farmers ; (5) to deliver these planning materials to farmers and agencies which assist farmers in Hawaii and the Pacific Basin; and (6) to incorporate these applied research findings and practical experiences in classroom instruction at the University of Hawaii and sister land grant colleges in the American Pacific.

Partnerships: The primary partners in this project are the Cooperative Extension Service of the University of Hawaii (as project leader) and the College of Agriculture and Life Sciences at the University of Guam and the American Samoa Community College (as project partners in dissemination of information). Also, project personnel are working closely with the Natural Resources Conservation Service (NRCS) in Hawaii to develop common procedures and educational materials on Comprehensive Nutrient Management Planning.

Research: The project team incorporates researchers, extension specialists and agents in a series of coordinated activities that are jointly planned and carried out. The project research on manure characterization, lab analyses and field studies of P and N dynamics in tropical soils is the primary responsibility of the two project research scientists (Yost and Hue). The outreach and public education aspects of the project are the primary responsibility of the four project extension agents (Fukumoto, DuPonte, Powley, and Ching). Overall project coordination and interaction with partners is the responsibility of the project PI and extension specialist (Evensen). However, despite these individual responsibilities, all project research, outreach and coordination activities are carried out with assistance from all project members whenever possible. Project coordination is accomplished through regular e-mail correspondence and through quarterly project meetings.

Resources: Leveraging of resources has included joint activities with our project partner, the NRCS, since our CNMP work is with the same livestock farmers and we have been able to partner with them to hold workshops. Also the extension agents obtained \$60,000 in additional grant money from the Hawaii Dept. of Health to hold more producer workshops and produce planning materials.

Results: Nutrient contents of animal manure, compost, and lagoon effluent were determined from over 300 samples collected throughout Hawaii and manure sampling and handling protocols were developed. Experiments on P availability were carried out on three tropical soils using six rates of manure application. About 4 to 5 times as much manure-P application was required to reach the same extractable P level on the Andisol studied as on the Mollisol or Oxisol. Preliminary phosphorus runoff studies were also conducted in the greenhouse on a Mollisol and Oxisol. Studies of nutrient uptake by various tropical grasses indicate high nutrient uptake potential and improvement of forage quality. Large expanses of range and abandoned sugarcane land in Hawaii are extremely depleted in nutrients and effluent from livestock lagoons could substantially improve the production and quality of forage grasses grown on these soils. Five grasses were selected for subsequent effluent application studies: Signal Grass (*Brachiaria decumbens*), Suerte Paspalum (*Paspalum atratu*), Puerto Rican Stargrass (*Cynodon nlemfuensis*), Dwarf Napier (*Pennisetum purpureum*), and Guinea Grass (*Panicum maximum*). Three sites were selected for field studies of nutrient and effluent application to forage grasses. A series of livestock producer workshop were held in December 2002, May 2003 and July 2003 to acquaint producers with preliminary project results, changing environmental regulations and the need to develop nutrient management plans. Project partners from Guam and American Samoa attended the December workshops, toured Hawaii farms and discussed common needs with project personnel. Development of P risk evaluation and GIS planning aids were also initiated.



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