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EVALUATION OF LAGOON EFFLUENT FROM CAGED LAYING HENS AS A NUTRIENT SOURCE FOR RYEGRASS PASTURE

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Background. Many caged layer operations in the southeastern U.S. dispose of holding pond effluent from egg production houses by irrigation onto farm fields. Effluent in these holding ponds increases in concentration of salts due to continuous recycling of effluent as flush water through the manure dropping channels under the caged hens. Concentration of salts also occurs due to evaporation of water from the pond surface without adequate irrigation withdrawal of effluent and replenishment with fresh water to the pond to dilute the effluent. The resulting effluent is a dark-colored liquid that contains salts and plant nutrients in much greater concentrations than found in fresh pond water.

Frequent irrigation of individual fields by center-pivot application can lead to excessive buildup of salts and plant nutrients, particularly nitrogen (N) and phosphorus (P). Excess soil N, when converted to nitrate-N (NO_3^--N) will move through the soil readily with water. Normally, P added as fertilizer remains in the soil surface because little more than the present crop need is applied. Increasing the P concentration in the surface soil by applying effluent based on its N concentration will eventually saturate the soil's P fixation capacity and increase movement of P in the subsoil. Evidence of P movement below the surface 6-inch depth exists in some fields in East Texas due to excess application of effluent or poultry litter. This study was designed to evaluate ryegrass response to application of lagoon effluent from caged layer houses and to determine nutrient concentrations in run-off water leaving these plots during precipitation events in excess of the infiltration capacity of the soil.

The experimental site was located in a Coastal bermudagrass pasture on a Bowie fine sandy loam. Plot size was 4 ft wide by 8 feet long. Plots were bordered by aluminum flashing installed across the up-slope and on both sides. At the down-slope end of each plot, a metal, 2x4x1 ft deep runoff-catchment box was installed and cemented into the ground. Ryegrass was seeded in respective plots in fall of 1994. Effluent from an East Texas egg production facility was applied to selected plots at rates equivalent to 0, 68.5, or 137 lb of N/ac on 23 Feb. 1995. Runoff water samples were collected from the boxes six times until the first harvest of ryegrass on 20 March. Two additional effluent treatments at the same rates were applied for succeeding ryegrass harvests. Harvests were made on 10 April and 4 May.

Research findings. Analysis of a sample of effluent is shown in Table 1. The N-P_2O_5-K_2O ratio in this effluent is 9-2.3-20. The salt content measured as electrical conductivity was 19.1 mmhos/cm. The sodium adsorption ratio (SAR) was 15.2. Effluent at a rate of 69 lb of N/ac applied February 23, April 6, and May 10, 1995 produced more than 3 t of ryegrass/ac in three cuttings (Table 2). Effluent applied at double this rate did not increase dry matter yield.

Table 1. Analysis of lagoon effluent and fresh water from an associated pond[1].

Sample	N	P	K	Ca	Mg	Na	SAR
	%	%	%	%	%	ppm	
Effluent, Lagoon #2	0.0629	0.007	0.117	0.004	0.000	350	15.2
Freshwater Pond	0.0019	0.000	0.002	0.000	0.000	30	

[1]E.C. of lagoon effluent = 19.1 mmhos.

Table 2. Effect of effluent applied for specific rates of nitrogen on production of ryegrass.

N rate	Ryegrass dry matter yield			
	Harvest 1	Harvest 2	Harvest 3	Total
lb/ac	---lb/ac---			
0	1341	1631 b[1]	1441	4413 b
69	2047	2326 a	1791	6164 a
137	1693	2265 a	1601	5559 a
R^2	0.80	0.97	0.54	0.91
C.V.	17.7	4.5	20.7	6.3

[1]Yields within a column followed by similar letters are statistically similar.

Application. Hen effluent as an occasional application appears to be a good source of nutrients for forage crops grown on well-drained and permeable soils in high rainfall regions. These salt and sodium concentrations are excessive for routine use of this effluent for irrigation. Where hen effluent is used as a nutrient source for crops, routine sampling and analysis of field soils should be done to monitor nutrient and salinity buildup.