

Phosphorus Export from Aerated Grasslands

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INTRODUCTION

Surface-applied manures are of particular concern in the Southern Piedmont (USA) because of a high concentration of broiler production. As these manures can contribute to P in runoff and potentially accelerate eutrophication of surface waters, a study was conducted to examine the water conservation potential of mechanical aeration of grasslands. Aeration has potential to reduce P transport by increasing the roughness of the soil surface and thus slowing runoff and increasing the infiltration of rainfall. Increased contact of manures and runoff water with exposed soil may increase binding of P with clay minerals, further reducing the amount of P in runoff.

OBJECTIVE

To compare the effectiveness of three mechanical aeration treatments (disking perpendicular to the slope, aeration by spikes, and aeration by cylindrical cores) to a control of no aeration in reducing the loss of P in surface runoff from grasslands fertilized with broiler litter.

MATERIALS AND METHODS

- Plots (0.75 x 2 m) were established on a Cecil soil series.
- Tall fescue (*Festuca arundinacea*) vegetation on 8 to 12% slopes.



Fig. 1. Runoff plots along the hillslope

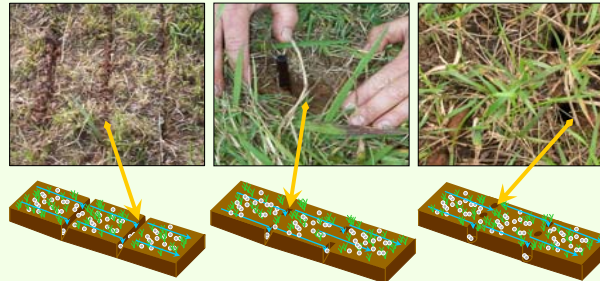


Fig. 2A. Disk aeration Fig. 2B. Spike aeration Fig. 2C. Core aeration

- Simulated rainfall was applied at a rate of 75 mm h⁻¹ to evaluate baseline conditions.
- Plots arranged into 4 blocks according to runoff volume.
- Plots then aerated and poultry litter applied at a rate of 30 kg P ha⁻¹, prior to additional rainfall simulations.
- Runoff collected every 5 min until 30-min of runoff had occurred.

RESULTS

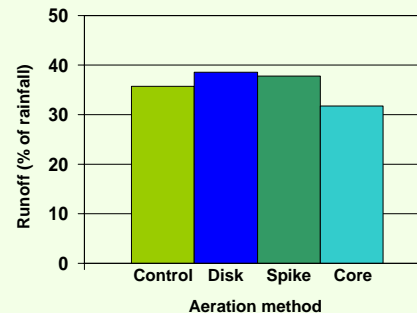


Fig. 3. Mean runoff volume (as percentage of rainfall) during 30 min of runoff as affected by aeration (no significant difference ($P < 0.05$) between runoff volumes)

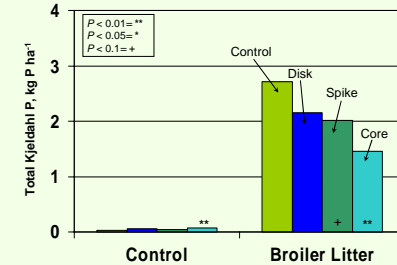


Fig. 4. Total Kjeldahl Phosphorus (TKP) export during 30 min of runoff as affected by aeration (within groups, bars indicated by asterisks are significantly different from the control of no aeration)

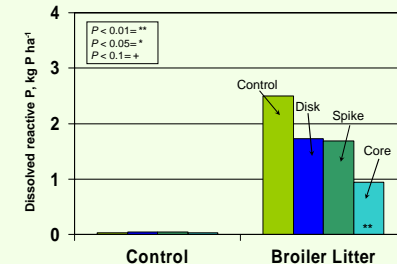


Fig. 5. Dissolved Reactive Phosphorus (DRP) export during 30 min of runoff as affected by aeration (within groups, bars indicated by asterisks are significantly different from the control of no aeration)

CONCLUSIONS

Results indicate that core aeration decreased TKP and DRP loads ($P < 0.05$) from applied broiler litter by 46 and 62%, respectively. Because Cecil soil is common in pastures receiving broiler litter in the Southern Piedmont, these results suggest that core aeration could have a widespread impact on water quality in the Southern Piedmont region. Spike aeration has also shown potential as an effective conservation practice.

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