NC STATE UNIVERSITY

CEFS
CENTER for ENVIRONMENTAL FARMING SYSTEMS
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Nutrient management in pastured swine operations

To reduce nutrient losses of nitrogen and phosphorus is one of the main goals of sustainable outdoor pig production

Strategies to reduce outdoor swine operation environmental impact include:

- Adjusting stocking density.
- Reducing length of stay.
- Planning periodic movement of animals and structures.
- Integrating outdoor pig production to the crop rotation.
- Reducing feed wastage.
- Protecting areas more prone to compaction.
- Establishing grassed buffer areas around paddocks.

Introduction

The acceptance of pastured swine operations is based mainly in its sustainable nature. Intensive use of pastures by hogs could lead to a negative impact on the environment. The most serious aspects of outdoor swine production are: vegetative ground cover deterioration, soil compaction, high nutrient input, irregular nutrient distribution and nutrient losses to ground water and to the atmosphere. In consequence, an adequate nutrient management program is of extreme importance.

Different strategies have been implemented to reduce outdoor swine impact these include: lowering animal stocking densities, reduce the length of stay of the animals in the paddocks, periodic movements of huts, feeding and water troughs, and integrating outdoor pig production into crop rotation to ensure nutrient removal by the following crop.

The physical impact and the ecological effect of outdoor hogs to soils are closely related with climate, soil texture, vegetative ground cover and pre-existing soil conditions. Each situation will require a specific analysis.

Homogeneous distribution of the manure is a requirement to obtain efficient nutrient utilization. The manipulation of the excretory behavior of the pigs in the pasture will lead to a reduction of nutrient hot spots.

The extent of the impact to the environment by outdoor pig farming is related with the intensity of the production and in consequence with its management.

Our experience with annual grasses

Feed losses contribute to nutrient hot spots

For economical and ecological reasons, feed wastage must be reduced to a minimum

Performing periodical soil tests is necessary to evaluate the effect of outdoor production on soil nutrient concentrations

At the Center for Environmental Farming Systems (CEFS), two field experiments were performed with the objective of evaluating the effects of a rotational shade, water and feed structure, on the N and P distribution in a finishing hog operation stocked at 30 head/acre during two grow out periods of 12 weeks each. Hybrid sudangrass was use in the first grow out period and a combination of cereal rye/annual ryegrass was used for the second grow out period. Shade/water structures were rotated weekly for 12 weeks within a pasture and compared to a stationary structure system and a managed hay operation. Feed structures were shifted along the fenceline every three weeks for the rotational

One of the goals in management of pasture-raised pigs is to maintain adequate vegetative ground cover. Vegetative ground cover not only provides forage and habitat for pigs, but allows for vegetative uptake and utilization of available nutrients, ultimately minimizing the potential losses of N and accumulation of P in the soil.

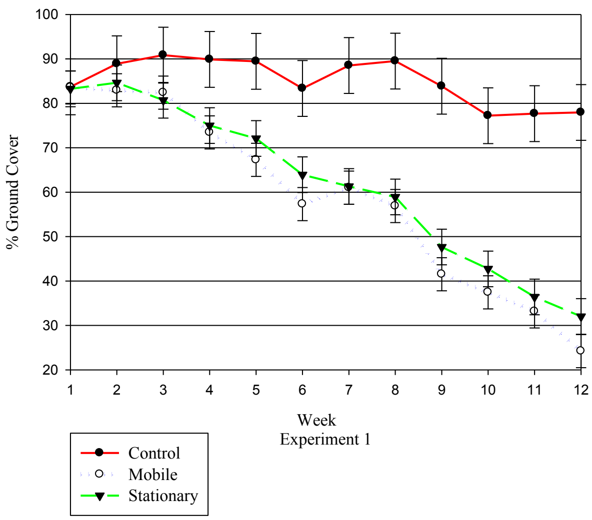
In these studies, the rotation of the structures did not maintain a better vegetative cover over compared with the stationary structure system. At the end of the 12 week occupation, vegetative cover was minimal.

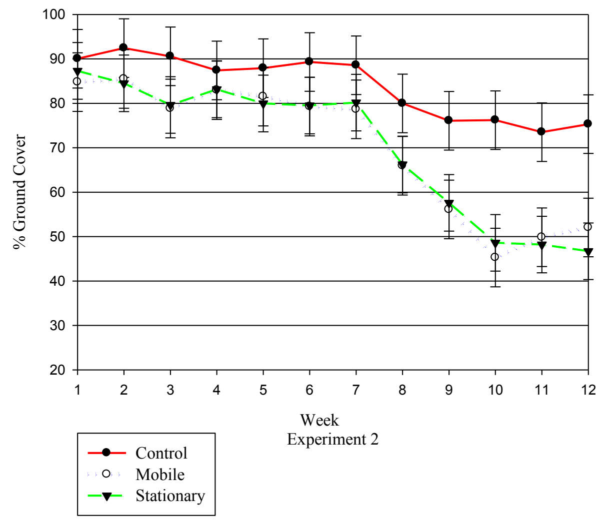
Evolution of Sudangrass cover after twelve weeks managed with a stocking rate equivalent to 30 hogs/acre

Results obtained

Integrating pigs to the crop rotation allows soil nutrient removal

The graphs below demonstrate the decline in vegetative cover over each twelve week period of the two phases of this study.



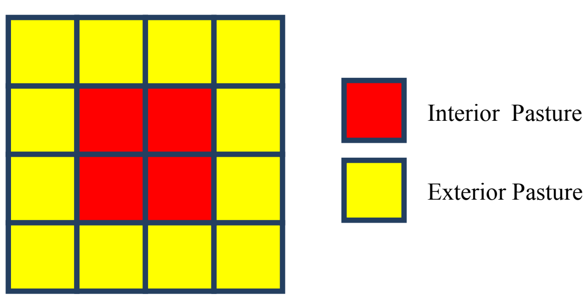


Effects of treatment on changes in percent ground cover across experiments . Error bars represent standard error.

Both mobile and stationary structure treatments showed similar weekly vegetative ground cover percentages. The cereal rye/annual ryegrass (Expt. 2) cover sustained a longer period of cover above 75% than did the sudangrass. During the spring experiment, when the cereal rye began to die, the annual ryegrass began to flourish, providing an extended period of forage and prolonged vegetative cover, and nutrient scavenging. Although this prolonged growth may have been influenced somewhat by the additional organic matter or soil conditioning from the previous pig occupation, it is reasonable that compatible species of vegetation provide maximum opportunity for the utilization of nutrients.

An evaluation was performed to determine if the distribution of pig waste, and ultimately N and P, were different between rotational and stationary structure treatments by comparing nutrient concentrations from interior pasture positions to exterior pasture positions.

Concentrated pig waste in pasture



Interior vs. Exterior pasture position evaluation

Excessive stocking rates, permanent paddocks and unsuited locations are some of the main aspects that causes environmental problems

The pattern of N distribution was higher in the exterior positions regardless of treatment (mobile vs. stationary infrastructure) for the sudangrass experiment. This pattern was not sustained and no differences in nutrient concentrations were found between interior or exterior pasture locations during the 2nd experiment with the cereal rye/annual ryegrass. Therefore, rotation of infrastructure did not consistently affect N distribution based on this type of evaluation. Similarly, P concentrations were unaffected by rotation of infrastructure within pastures.

Soil compaction limits vegetative root growth and thus plant productivity. This, in turn, can limit the plant ability to uptake and utilize available nutrients. Soil compaction was measured within the pastures, and it was determined that areas under the shade/water structure in the stationary treatment were more compacted than the same areas under the mobile structure treatment. This suggests that rotation of structures may be beneficial in reducing compaction. However, it was noted that the vegetation under the shade structure on the mobile treatment would not regenerate once the structures were moved, reducing the overall vegetative cover and its ability to scavenge nutrients.

Soil compaction tests must be included as part of the soil monitoring routine

Based on the outcome of this study, rotation of infrastructure showed little benefit in maintaining vegetative cover or improving nutrient distribution when sudangrass or cereal rye/annual ryegrass was the vegetation. Some reduction in soil compaction levels was realized, but the rotation may have affected vegetative regrowth and nutrient utilization.

However, based on this research and other studies, it is recommended that consideration be given to utilizing established perennial vegetation where ever possible to maintain adequate vegetative cover and nutrient utilization when stocking density is at 30 pigs/acre. A shorter occupation period may also be considered for each pasture, allowing vegetation time to recover. More land will be incorporated as a result of a shorter stocking period (whole-pasture rotation), equating to a reduction in the stocking density. A stocking density of 15 pigs/acre may reduce the pressure on the vegetation, particularly when using annual forage crops in pastured pig operations.

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