Soil and Water Science
Research Brief

POTENTIAL OF SILVOPASTORAL PRACTICES TO REDUCE NUTRIENT LOSS FROM FLORIDA SOILS

V.D. Nair, S.C. Allen, R.S. Kalmbacher, and D.A. Graetz

The issue of N and P loss from sandy soils in Florida could be particularly serious in coarse-textured, poorly drained soils with either surface or tile drainage in which soil drainage water ultimately enters surface waters. Silvopastoral systems are theorized to minimize nutrient losses from the soil in part because of enhanced nutrient uptake by tree and forage crop roots from varying soil depths compared with more localized and shallow rooting depths found in pasture without trees.

Three pastures were selected for this study at the Ona, Florida REC (27°23'N, 81°57'W). Two of the pastures consist of bahiagrass (*Paspalum notatum*) with legumes *Desmodium heterocarpon* and *Vigna parkeri*. One of the two pastures has slash pine (*Pinus elliottii*) initially planted at 1100 trees ha^{-1} in double rows, 2.4 m apart with a 12.2 m alley (silvopasture). The third pasture consists of native vegetation (native silvopasture) with the same configuration as the bahiagrass silvopasture, but never having received lime or fertilizer.

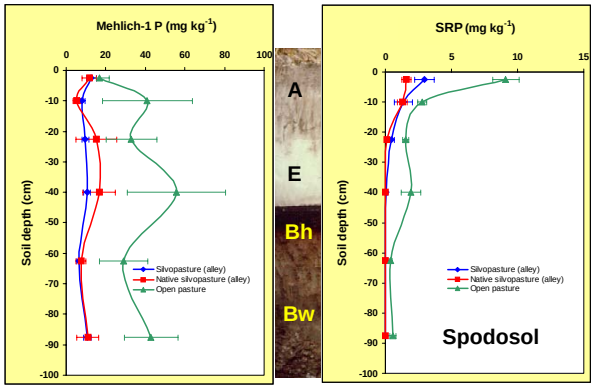
All pastures are on Spodosols, Ona fine sand (sandy, siliceous, hyperthermic Aeric Alaquod). Spodosols typically have a sandy A horizon, followed by an eluted E horizon, below which is a highly P-retentive spodic (Bh) horizon. The open pasture is 20 years older than the silvopasture. The open pasture

Double rows of slash pine (*Pinus elliottii*) with native vegetation (e.g., saw palmetto) alleys (12.2 m)

Double rows of slash pine with predominantly bahiagrass (*Paspalum notatum*) alleys (12.2 m)

Pastureland species of bahiagrass and the legumes *Desmodium heterocarpon* and *Vigna parkeri*

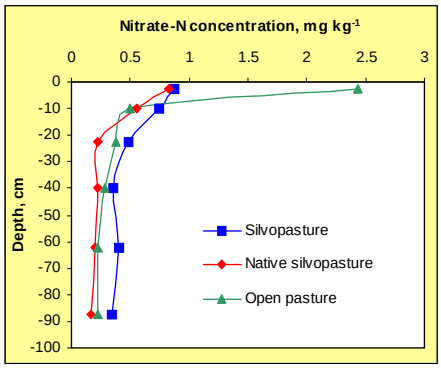
has had a single inorganic P application (6 kg P ha^{-1}) in 2003, which was the only P application during the past 20 years. The silvopasture has been fertilized annually with ~6 kg P ha^{-1} since 1998. The native silvopasture was never fertilized, but has been subjected to grazing activities for the past five years. Historically, cattle have grazed the native periodically for >60 years. Pines were planted in Dec. 1988 - Jan. 1989 and grazing was deferred until ~1997. At all three pastures, 10 soil profiles each were sampled by depth, 0-5, 5-15, 15-30, 30-50, 50-75, and 75-100 cm. For the silvopasture and native silvopasture, the soil sampling was in the alley of the silvopastoral systems. All soils were analyzed for Mehlich 1-P (soil test P), soluble reactive P (SRP), NO_3-N and NH_4-N.

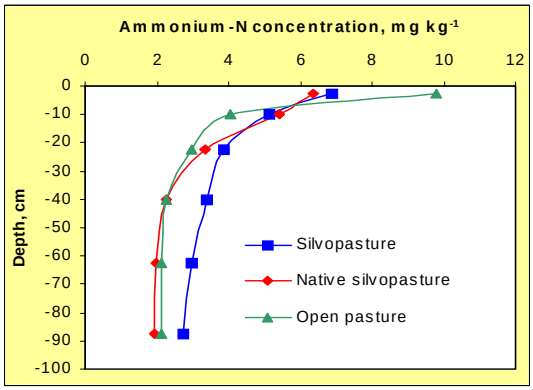


Results from the study showed that Mehlich 1-P and SRP concentrations were higher throughout the soil profile of the open pasture compared with either the silvopasture or native silvopasture. Note that the eluted E horizon with minimal P retention capacity had high P concentration in the soil solution.

Soil nutrient concentrations and Bh-horizon were projected by depth using ARCVIEW®. The nutrient retentive Bh-horizon for the soil profile was at a depth between 30 and 50 cm. Typical of Spodosols, there were breaches in the spodic horizon, which resulted in P movement below the horizon. Measurement of nutrient concentrations in 10 soil profiles within each pasture showed that P concentrations were in the order: open pasture > silvopasture > native silvopasture.

In addition, nitrate-N and ammonium-N concentrations were generally higher in the surface horizon of the open pasture than in the soils of the silvopasture and native silvopasture. The trend was not clear at lower depths likely due to low N concentrations.





Overall, the differential rooting zones of the pine and forage crops may absorb the nutrients (especially phosphorus) more completely in the silvopastures than in the open pasture system, suggesting that the silvopasture association is better than the open pasture in reducing nutrient loss from soil to the surface water. However, differences in nutrient concentrations between the three different systems due to historical nutrient management practices cannot be ruled out. Further research is needed in order to support our initial observations.

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For more information, please contact:

Soil and Water Science Department
Institute of Food and Agricultural Sciences
University of Florida
P.O. Box 110510
Gainesville, FL 32611-0510
(352) 392-1803

V.D. Nair: vdna@ifas.ufl.edu
S.C. Allen: scallen@ufl.edu
R.S. Kalmbacher: rskalmbacher@ifas.ufl.edu
D.A. Graetz: dag@ifas.ufl.edu