

Soil nutrient and pH dynamics in an integrated crop-livestock production system

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Efficient use of soil nutrients is essential to concurrently achieve production and environmental goals in integrated crop-livestock systems (ICLS). Unfortunately, there is a lack of published findings on soil nutrient dynamics for ICLS, particularly in semiarid regions.

To address this need, a study was conducted to determine effects of residue and grazing management on soil nitrate, available phosphorus, and soil pH over a 12 year period for an ICLS experiment conducted at the USDA-ARS Northern Great Plains Research Laboratory, Mandan, ND.

From 1999 to 2011, soil nitrate and phosphorus were measured in three residue management treatments (grazed, mechanically harvested, and no residue removal) every third year across a four foot depth, while soil pH was measured prior to deploying ICLS treatments in 1999 and again in 2011.

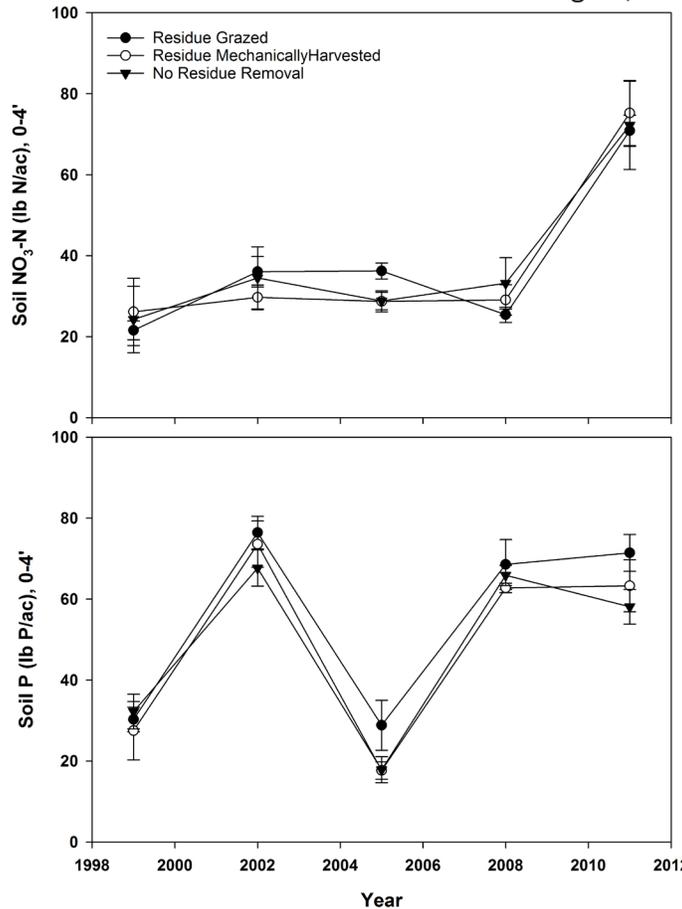
Residue management had no effect on soil nitrate or phosphorus at any depth for any year, implying no accumulation of either nutrient under grazing compared to cropping. Similarly, no differences in soil nitrate or phosphorus were observed across grazed sampling zones.

Soil nitrate and phosphorus, however, increased or fluctuated greatly over the 12 year sampling period, suggesting a need for adaptive nutrient management. Following an adaptive approach to nutrient management is underscored by projected increases in winter and spring precipitation throughout the Northern Plains region, as the potential for N and P loss

by leaching is expected to increase.

Soils became more acidic between 1999 and 2011, with the greatest decreases in soil pH at 0-3 inches under grazing and mechanical harvest.

Findings from the study suggest management interventions targeting N and P conservation may serve to reduce nutrient loss and soil acidification in ICLS. Continued long-term evaluations of ICLS treatments are needed to test adaptive nutrient management practices, including increased crop rotation complexity, inclusion of cover crops, and precision application of N and P.



Soil nitrate and phosphorus at 0-4' under three residue management treatments, 1999-2011.

Adapted from Liebig, M.A., J. Ryschawy, S.L. Kronberg, D.W. Archer, E.J. Scholljegerdes, J.R. Hendrickson, and D.L. Tanaka. 2017. Integrated crop-livestock management effects on soil N, P, and pH in a semiarid region. *Geoderma* 289: 178-184.

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