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Soil Nitrogen and Phosphorus Flux from Cattle Excreta Part II: Spatial Distribution in Continuous and Rotationally Grazed Systems

Grazinglands Research Laboratory, El Reno, Oklahoma May 2017

Rationale: Large pastures managed with beef cattle that continuously graze year round typically develop areas where overgrazing is evident. Overgrazing often results from cattle consistently re-grazing areas by selecting immature and more nutritious forage plants in these areas. Forages in the ungrazed areas of the pasture become mature and less nutritious for grazing cattle. Dividing large pastures into smaller paddocks and rotating cattle among paddocks can result in more uniform grazing and utilization of forages and more even distribution of nutrients from urine and feces in paddocks. Feces and urine recycled to pastures by grazing cattle provide important sources of both nitrogen and phosphorus. Limited research has been done comparing the spatial distribution of the fluxes of nitrates and phosphorus in continuously and rotationally grazed systems.

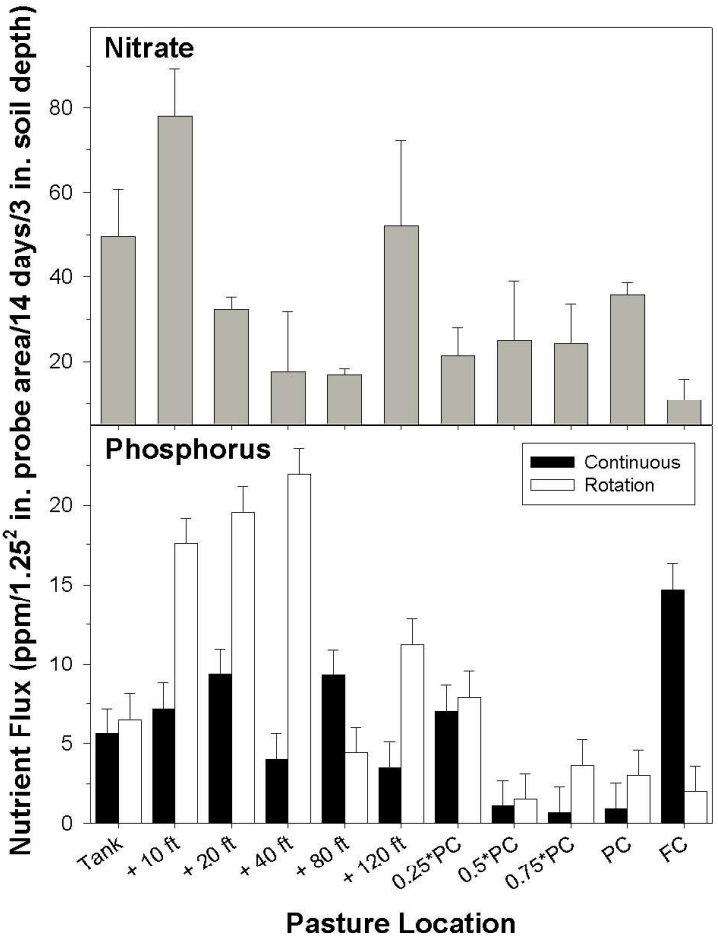
Objective: To compare the spatial distribution of the fluxes of nitrates and phosphorus in paddocks that are grazed year round to fluxes of nitrates and phosphorus in paddocks that are rotationally grazed.

What We Did: Cow/calf pairs were managed year-round on continuous and rotational paddocks beginning in 2009, while rotational pastures were allowed 120 to 180 days of rest between grazing bouts. Numbers of animals applied were: 18 cow/calf pairs on 148 acres (150 lb of cow/acre) for continuous grazing and 25 cow/calf pairs on 190 acres in 10 paddocks (165 lb of cow/acre) for the rotational system. In Spring 2015, transects were laid out from the water source to pasture centers in sets of pastures under the two management treatments. Pairs of anion and cation probes were installed vertically into the soil at 0-3 inch and 3-6 inch depths. The probes were left in place for 2 weeks and then removed and nitrate and phosphorus fluxes determined. Fluxes from the two depths at a given location in the pasture were averaged to represent the 0-6 inch soil layer.

Preliminary Findings—after six years:

- Both forms of pasture management apparently resulted in hot spots of nutrient flux in soils.
- No effects related to grazing treatment could be determined in nitrate flux; indicates that both continuous and rotational grazing had similar effects on level and distribution of nitrate flux within large pastures (top panel of figure).
- Hot spots in nitrate flux close to tanks (tank and 10 ft. from tank), and 120 ft. from water tanks.

- Phosphorus flux was affected by both grazing treatment and location in pastures (bottom panel, figure at right).
- Rotational grazed pastures had hot spots in P flux 10 to 40, and 120 ft., from water tanks.
- Continuous grazed pastures had higher P flux at 20 and 80 ft. from tanks and at far corners (FC) from tanks.
- Lower and more consistent P flux from near pasture centers (PC) to 50 to 75% of distance from tanks to PC under both grazing systems.
- Hot spots in nutrient flux in response to rotational grazing occurred after $6^{1/2}$ months of rest from grazing; hot spots in continuous pastures occurred under year round grazing.



- Such results indicate that after 6 years, both forms of grazing management generated high levels of nutrient flux within both similar and different areas of pastures. However, the pastures in this study were large, so hot spots in nutrient flux could also be due to local variation in soil fertility.
- Additional measurements are being collected to determine if the above distribution patterns in nutrient flux are similar to times immediately after the rotational pastures have been grazed.

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