Pasture pH and Liming Issues Affecting Forage Yield

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Range Cattle REC
UF/IFAS, Ona, FL
Soil Acidity & pH

- Concentration of active hydrogen ions ($H^+$)
- Measured by an index called pH
- pH of 7 is neutral ($H^+ = OH^-$) e.g. distilled water but too high for forage growth. Causes deficiencies of Fe, Zn, Mn and Cu.
- pH of 5 to 6 slightly acidic but satisfactory for forage growth.
- pH of 4 is too low or very acid and results in poor forage root growth. Causes deficiencies of S, Mo and B.
Soil Acidity

The pH Scale

Most soils fall within the pH range of 5 to 8, which is considered neutral to slightly acidic.
Blue 1974 \( @ \) 4.5 t/ha lime to pH 5.5 in 1961; 112 kg N/ha/yr

<table>
<thead>
<tr>
<th>N-Source</th>
<th>DMY (10 yr avg.)</th>
<th>Soil pH</th>
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<tbody>
<tr>
<td></td>
<td>t/ha</td>
<td>1963</td>
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<tr>
<td>AN</td>
<td>7.5 a</td>
<td>5.5</td>
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<tr>
<td>AS</td>
<td>7.0 ab</td>
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<td>CN</td>
<td>7.5 a</td>
<td>5.3</td>
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<td>Urea</td>
<td>6.8 b</td>
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Soil Acidity

- Tends to increase with repeated use of ammonium N-fertilizer because of nitrification:

  1) \[2\text{NH}_4^+ + 3\text{O}_2 = 2\text{NO}_2^- + 2\text{H}_2\text{O} + 4\text{H}^+\]  
    (Nitrosomonas)

  2) \[2\text{NO}_2^- + \text{O}_2 = 2\text{NO}_3^-\]  
    (Nitrobacter)
Bahiagrass Performance Under Changing Soil pH
Effect of Lime and Fertilizer on Annual DMY Hardee 87

Dry matter yield, t/ha

No lime Lime

Lime treatment
N NPK NPKM Cont

30% better response to N
2003 Spring Green Canopy Cover

% Ground cover

No-lime
Lime
Lime treatment

N
NPK
NPKM
Cont

NS

0
10
20
30
40
50
60
70
80
90
100

Lime
2003 Spring Dead/Yellow Canopy Cover for Pasture 87

% Ground cover

No-lime Lime
Lime treatment
N NPK NPKM Cont

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Lime treatment
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Pioneer weeds
Effect of Fertilizer on Annual DMY

Dry matter yield, t/ha

Hard 71A    Manatee    Pasco
County

N          NPK         NPKM    Cont
2003 Spring Green Canopy Cover
Pasture 71A

% ground cover

No-lime Lime
Lime treatment
N NPK NPKM Cont

Lime treatment

% ground cover

0 10 20 30 40 50 60 70 80 90 100

Legend:
- N
- NPK
- NPKM
- Cont
2005 Spring Canopy Cover Pasture 71A
Conclusions

• N key to bahiagrass pasture production.
• Increase due to P & K cost-effective under grazing?
• Repeated N fertilization will drop soil pH, increase spring grass yellowing and stand loss to weeds.
• Monitor soil pH every 2-4 years and lime to maintain pH of 5-6.
• Alternate N-fertilizer and limed-sludge use.