Lawn and Gardening our Way to Hell in a Vegetable Basket

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Mention of product names ≠ endorsement
Plant requirements

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)

Other elements include: C, H, O, S, Ca, Mg, Mo, Cu, Co, B, Mn, Fe, Cl, Ni, Zn.
Farm Nutrient Supplements
Home and Garden Nutrient Supplements
Urban

Agriculture

Aesthetics

Economics
Excess P in freshwater = Eutrophication
Hazardous Algal Blooms (HABs) Lake Recreational Advisories, Kentucky Division of Water 2014 - 2016
There is a lot of finger pointing regarding which land use is responsible for water quality impairments.
When Precipitation > Infiltration...

Urban

Stormwater

Increases with development
Development = tax revenue $

Agriculture

Agricultural Runoff

Soil loss = Crop loss
Crop loss = Business loss $

EPA Regulations

Cities/Towns

USDA NRCS Incentives

Farms
Fewer Acres Farmed by Fewer Farmers

Loss of 1 million acres of farmland

Loss of 9000 farmers
Kentucky Population & Household Growth Projections

Population

Households

(~60% are single family homes)
With development we have more impervious surfaces.
STORMWATER: Direct relationship between P inputs and storm drain exports

Hobbie et al., 2017
Urban Kentucky P inputs and outputs

- Compost
- Pet waste
- Residual input

Figures liberally modified (in red) from Hobbie et al., 2017
(MN does not allow P fertilizer)
> 100 MS4 Communities in 32 Counties
Minimum Control Measures

1. Public Education & Outreach
   - Number of soil tests
2. Public Participation/Involvement
3. Illicit Discharge Detection & Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping
UK Extension Conducts Soil Tests

Fertilizer recommendations are based on soil test results and crop calibration studies by the Land Grant University.

~4” depth
Soil Test P

Soil Test P (#/acre)

Water Soluble P

High Risk

??

Soil Test P (#/acre)
Soil Test P (#/acre)

At ~120 # soil test P / acre the water soluble P increases
Soil Test P

Yield/Water Soluble P

Deficit
Optimum range
Excess
High Risk

Soil Test P (#/acre)
Kentucky County Soil Tests
1990 – 2014
(n = 990,162)

Home and Garden (H code)
• Total = 179,184
• Max = 17,691
• Min = 52
• Mean = 1493
• Median = 747

Agriculture (A code)
• Total = 810,978
• Max = 52,245
• Min = 116
• Mean = 6758
• Median = 4886
## 25 year soil test summary for Fayette County

<table>
<thead>
<tr>
<th>1990-2014</th>
<th>Samples (n)</th>
<th>Low (%) &lt;30 #/ac</th>
<th>Med (%) 30-60 #/ac</th>
<th>High (%) 60-120 #/ac</th>
<th>High Risk (%) &gt;120 #/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>12359</td>
<td>6</td>
<td>10</td>
<td>56</td>
<td>28</td>
</tr>
<tr>
<td>Urban</td>
<td>16156</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>84</td>
</tr>
</tbody>
</table>

- **Agriculture**: No benefit to plant growth
- **Urban**: Maximum recommended soil P level
- **High Risk**: Water Quality Risk
Water Quality Risk
Soil Test P levels

Agriculture
34%
> 120 #/ac

Urban
79%
> 120 #/ac
1990 – 2014 Soil Test Phosphorus Levels > 120 #/acre

% Soil Tests with High Risk P Levels

- 0 - 10
- 10.1 - 20
- 20.1 - 30
- 30.1 - 40
- 40.1 - 50
- 50.1 - 60
- 60.1 - 70
- 70.1 - 80
- 80.1 - 90
- 90.1 - 100
Regional Distribution of Soil Test P Levels

Agriculture

Urban

ln(mean soil test P)

Bluegrass
E. Coalfield
E. Pennyrile
W. Pennyrile
M. Embayment
W. Coalfield
Bluegrass
E. Coalfield
E. Pennyrile
W. Pennyrile
M. Embayment
W. Coalfield
Kentucky Soil Test P
(~1 million tests analyzed 1990 – 2014)

Soil test P = -1416.116 + 0.759(Year)
$r^2 = 0.561$

Soil test P = 961.426 - 0.452(Year)
$r^2 = 0.639$

Recommended Soil Test P in Lawns
(~30 #/acre)
How representative are KY results for the urban home and garden soil test P levels?

<table>
<thead>
<tr>
<th>Annual soil tests by county</th>
<th>(soil tests / single family homes in county(^1)) * 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>1.42%</td>
</tr>
<tr>
<td>Min</td>
<td>0.16%</td>
</tr>
<tr>
<td>Mean</td>
<td>0.45%</td>
</tr>
<tr>
<td>Median</td>
<td>0.38%</td>
</tr>
</tbody>
</table>

*We need more soil tests*

\(^1\)2010 Census
Homeowners’ decisions are related to their attitudes, norms and values

Widespread idea that fertilizing will result in a healthier and greener lawn

(Nelson et al., 2008; Cheng et al., 2008)
Some states passed laws for lawn maintenance fertilizer applications.

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
Availability of P–free fertilizer

Scotts drops phosphorus from lawn fertilizer

Marysville company acts to reduce risk of runoff feeding toxic-algae blooms in lakes; competitors likely to follow its lead

*Columbus Dispatch - May 10, 2013*
States that Require Soil Test Prior to Sale of nonAg Phosphorus Fertilizer
Questions?

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