2009

Research Update Meeting 2009 - Research Programs at the Cranberry Station

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Cranberry Station Update

Carolyn DeMoranville, Director
UMass Amherst Cranberry Station
Grower support

Grower grant sources

- Cape Cod Cranberry Growers Association
- Cranberry Research Foundation
- Cranberry Institute
- Ocean Spray
- Wisconsin Cranberry Board

2008 - $71,340

In-kind contributions and gifts in 2008

- $17,350
Grant support – mostly competitive government funding

- Hatch Funds from UMass Ag Experiment Station
- IR-4 – support for minor use pesticide registrations
- USDA: NE-IPM, SARE
- Industry (chemical companies)
- MDAR – Ag innovations

- Current value of all active grants - ~$2.2 million
- New awards in 2008 - ~$800,000

- Grant review for past 4 years in the handout
University support

- **Amherst**
  - Faculty salaries
  - Support staff (office, bog)
  - Operations (utilities, etc.)
- **Dartmouth**
  - Technical support for Peter’s program
- **Central administration/Amherst**
  - Operating funds
Thanks for the support

- CCCGA, Cranberry Research Foundation
- Ocean Spray
- Cranberry Institute
- Industry contributors
  - grants
  - meeting support – see the poster near the coffee
- Individual grower cooperators and donors
Phosphorus Management and Reduction Implementation

Carolyn DeMoranville
UMass Amherst Cranberry Station
Why P reduction?

- Pollution concerns for fresh water
- Clean Water Act mandated TMDL process
- P is expensive – we need to use only enough to assure that the plants have what they need
Background

- Actual P requirement based on plant composition/growth is low
  - “trash” plus 200 bbl crop removes 4.2 lb P/acre

- Soil testing is problematic for planning due to lack of calibration ability – acid soils

- Tissue testing should be a better tool (established standard value of 0.1 to 0.2%)

- For best planning, a target P application range should also be established
Tissue P in normal range

Tissue P below normal range
Summary – recent field plots

- Trends indicate that some P may be better than no P, although not much of a rate response.

- At one location P in the tissue was below the standard range and there was a response to >20 lb P/acre.

- Further justification for a target P rate of no more than 20 lb P/acre and some justification for lower rate consideration.
# Fertilizer and yield – whole bog comparison

(P in lb·a⁻¹; Yield in bbl·a⁻¹)

<table>
<thead>
<tr>
<th>Year</th>
<th>Site 1</th>
<th>Site 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P rate</td>
<td>Yield</td>
</tr>
<tr>
<td>2002</td>
<td>17.8</td>
<td>117</td>
</tr>
<tr>
<td>2003</td>
<td>14.4</td>
<td>119</td>
</tr>
<tr>
<td>2004</td>
<td>5.6</td>
<td>172</td>
</tr>
<tr>
<td>2005</td>
<td>16.5</td>
<td>190</td>
</tr>
<tr>
<td>2006</td>
<td>6.4</td>
<td>163</td>
</tr>
<tr>
<td>2007</td>
<td>10.4</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>17.8</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>10.7</td>
<td>160</td>
</tr>
</tbody>
</table>

*pre-reduction*  
*post-reduction*
Fertilizer and yield – whole bog comparison

(P in lb·a\(^{-1}\); Yield in bbl·a\(^{-1}\))

<table>
<thead>
<tr>
<th>Year</th>
<th>Site 3</th>
<th>Site 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P rate</td>
<td>Yield</td>
</tr>
<tr>
<td>2002</td>
<td>28.8</td>
<td>221</td>
</tr>
<tr>
<td>2003</td>
<td>19.8</td>
<td>136</td>
</tr>
<tr>
<td>2004</td>
<td>21.2</td>
<td>218</td>
</tr>
<tr>
<td>2005</td>
<td>26.1</td>
<td>134</td>
</tr>
<tr>
<td>2006</td>
<td>7.1</td>
<td>256</td>
</tr>
<tr>
<td>2007</td>
<td>14.7</td>
<td>197</td>
</tr>
<tr>
<td></td>
<td><strong>pre-reduction</strong></td>
<td><strong>Yield</strong></td>
</tr>
<tr>
<td></td>
<td>28.8</td>
<td><strong>221</strong></td>
</tr>
<tr>
<td></td>
<td>17.8</td>
<td><strong>188</strong></td>
</tr>
</tbody>
</table>

*Insect infestation at this site in 2002
Site 3 has biennial trends so we looked at 2-year periods

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>187</td>
<td>177</td>
<td>196</td>
<td></td>
<td>28.8</td>
<td>20.5</td>
<td>16.6</td>
<td></td>
</tr>
</tbody>
</table>
Cranberry Bog Total Phosphorus – water quality

<table>
<thead>
<tr>
<th>Bog ID</th>
<th>TP Fertilization (lb·a⁻¹/yr)</th>
<th>TP incoming (lb·a⁻¹/yr)</th>
<th>TP leaving (lb·a⁻¹/yr)</th>
<th>TP export (net) (lb·a⁻¹/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>0.5</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>19.8</td>
<td>1.9</td>
<td>4.6</td>
<td>2.7</td>
</tr>
<tr>
<td>3</td>
<td>20.5</td>
<td>2.1</td>
<td>1.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>4</td>
<td>38.0</td>
<td>1.9</td>
<td>1.7</td>
<td>-0.2</td>
</tr>
</tbody>
</table>
Impact of P reduction on quality of flood discharge water

<table>
<thead>
<tr>
<th>Site</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2007*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.377</td>
<td>0.424</td>
<td>0.237</td>
<td>0.097</td>
<td>0.157</td>
</tr>
<tr>
<td>2</td>
<td>0.384</td>
<td>0.439</td>
<td>0.528</td>
<td>0.408</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.100</td>
<td>0.170</td>
<td>0.118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.109</td>
<td>0.127</td>
<td>0.147</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Limited sample set
Time Course of Phosphate Release

Native Bog

Days
0 1 2 10 20 30 40 50 60
Phosphate Released (µMoles/m²)
-200 0 200 400 600 800 1000 1200 1400 1600 1800 2000

Aerobic Conditions
Anaerobic Conditions
Transitional Period

Low P Application

Days
0 1 2 10 20 30 40 50 60
Phosphate Released (µMoles/m²)
0 5000 10000 15000 20000 25000 30000

Aerobic Conditions
Anaerobic Conditions
Transitional Period

High P Application

Days
0 1 2 10 20 30 40 50 60
Phosphate Released (µMoles/m²)
0 5000 10000 15000 20000 25000 30000

Aerobic Conditions
Anaerobic Conditions
Transitional Period

10-18 lb·a⁻¹ P

>20 lb·a⁻¹ P

Native bog

10-18 lb·a⁻¹ P

>20 lb·a⁻¹ P
Laboratory results were similar to those in water collected from a harvest flood.
BMP recommendations

- Apply no more than 20 lb·a\(^{-1}\) P per season
  - Based on the laboratory study, highest risk for P mobilization - bogs receiving >20 lb·a\(^{-1}\) P

- Allow particles to settle prior to discharge of harvest flood but do not hold the flood for more than ~10 days
Recommendation to use no more than 20 lb/a P
Monitor outcomes when using less

- Generally, in the year of application, the crop can recover 10-30% of that applied

- A 200 bbl crop (with harvest trash) removes 4.2 lb/acre

- Use tissue testing along with yield monitoring
Tissue standard is 0.1-0.2% P

<0.1% --- increase P rate and retest next year

0.1 – 0.11% -- stay the course but retest next year

0.12 – 0.15% -- test again in 2-3 years

0.16% or greater – test again in 3-4 years
Fertilizer choices and P reduction

High P ratio
- 5-15-30
- 3-13-26
- 12-24-12
- 6-24-24
- 8-32-16

Low P ratio
- 15-15-20
- 10-12-24
- 18-8-18
- 15-10-18
- 16-15-21
- 5-5-20 (alternative with low N)

Advantage of 18-8-18:
- Fewer pounds to apply (based on N requirement)
- Lower application cost
Calculations

The number on the bag is not actual P!!

\[ P \times 2.29 \rightarrow P_2O_5 \]

\[ P_2O_5 \times 0.44 \rightarrow P \]

What’s on the bag!
Calculations

Example #1 – 45 lb N

I used 375 lb/acre 12-24-12 – how much P?

$$375 \times 0.24 \times 0.44 = 39.6 \text{ lb/acre}$$

0.24 is the bag number converted to a decimal

0.44 converts $P_2O_5$ to actual P
Calculations

Example #2 – 45 lb N

I used 250 lb/acre 18-8-18 – how much P?

\[ 250 \times 0.08 \times 0.44 = 8.8 \text{ lb/acre} \]

0.08 is the bag number converted to a decimal
0.44 converts P\(_2\)O\(_5\) to actual P
Calculations

Example #3 – 45 lb N

I used 300 lb/acre **15-15-15** – how much P?

300 x 0.15 x 0.44 = **19.8 lb/acre**

0.15 is the bag number converted to a decimal

0.44 converts P$_2$O$_5$ to actual P
<table>
<thead>
<tr>
<th>Material used</th>
<th>Pounds applied</th>
<th>Pounds N per acre</th>
<th>Pound P per acre</th>
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</thead>
<tbody>
<tr>
<td>12-24-12</td>
<td>375</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>18-8-18</td>
<td>250</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>15-15-15</td>
<td>300</td>
<td>45</td>
<td>20</td>
</tr>
</tbody>
</table>
Set fertilizers: Max N applied to maintain P<20 lb/acre

<table>
<thead>
<tr>
<th>Material used</th>
<th>Pounds P per acre</th>
<th>Pounds fertilizer</th>
<th>Pounds N per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-24-12</td>
<td>20</td>
<td>188</td>
<td>22.5</td>
</tr>
<tr>
<td>18-8-18</td>
<td>20</td>
<td>568</td>
<td>102</td>
</tr>
<tr>
<td>10-12-24</td>
<td>20</td>
<td>379</td>
<td>38</td>
</tr>
<tr>
<td>15-10-18</td>
<td>20</td>
<td>454</td>
<td>68</td>
</tr>
<tr>
<td>15-15-15</td>
<td>20</td>
<td>300</td>
<td>45</td>
</tr>
<tr>
<td>19-19-19</td>
<td>20</td>
<td>235</td>
<td>45</td>
</tr>
</tbody>
</table>
Low N materials – how much P in 100 lbs.

<table>
<thead>
<tr>
<th>Material used</th>
<th>Pounds fertilizer</th>
<th>Pounds N per acre</th>
<th>Pounds P per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-13-26</td>
<td>100</td>
<td>3</td>
<td>5.7</td>
</tr>
<tr>
<td>5-15-30</td>
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<td>5</td>
<td>6.6</td>
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<td>5-10-10</td>
<td>100</td>
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<td>4.4</td>
</tr>
<tr>
<td>6-24-24</td>
<td>100</td>
<td>6</td>
<td>10.6</td>
</tr>
<tr>
<td>8-32-16</td>
<td>100</td>
<td>8</td>
<td>14.1</td>
</tr>
<tr>
<td>5-5-20</td>
<td>100</td>
<td>5</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Sanding and Pruning

SARE Project
C. DeMoranville, H. Sandler, J. Vanden Heuvel,
A. Averill, M. Sylvia, F. Caruso, B. Suhayda
UMass Amherst Cranberry Station
Side - by - Side Comparisons

- Sanding, followed by pruning at some set interval
  - 2 yr, 3 yr, or 4 yr+
# Treated in 2006 – Evaluated in 2006 and 2007

<table>
<thead>
<tr>
<th>Location</th>
<th>Years since sand</th>
<th>Pruned?</th>
<th>Yield</th>
<th>Yield - following year</th>
<th>Cumulative yield</th>
<th>density year of pruning</th>
<th>density year after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site #2</td>
<td>2</td>
<td>Yes</td>
<td>230</td>
<td>361</td>
<td>591</td>
<td>108</td>
<td>132</td>
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<tr>
<td></td>
<td>2</td>
<td>No</td>
<td>333</td>
<td>188</td>
<td>521</td>
<td>106</td>
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<td>Site #3</td>
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<td>Yes</td>
<td>319</td>
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<td>643</td>
<td>97</td>
<td>107</td>
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<td></td>
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<td>100</td>
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<td>Site #5</td>
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<td>Yes</td>
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<td>289</td>
<td>609</td>
<td>99</td>
<td>85</td>
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<td>No</td>
<td>224</td>
<td>458</td>
<td>682</td>
<td>77</td>
<td>111</td>
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<td>Site #1</td>
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<td>298</td>
<td>297</td>
<td>595</td>
<td>110</td>
<td>94</td>
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<td>211</td>
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<td>??</td>
<td>90</td>
<td>101</td>
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<td>Site #4</td>
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<td>Yes</td>
<td>455</td>
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<td>838</td>
<td>101</td>
<td>127</td>
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<td>No</td>
<td>383</td>
<td>400</td>
<td>783</td>
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<td>98</td>
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<td>Site #7</td>
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<td>419</td>
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<td>96</td>
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<td>4+</td>
<td>No</td>
<td>224</td>
<td>153</td>
<td>377</td>
<td>115</td>
<td>94</td>
</tr>
</tbody>
</table>
Sanding vs. Pruning Experiment

Graduate Project

Brett Suhayda
C. DeMoranville and J. Vanden Heuvel, Advisors
Levels

Pruning
- Control (none)
- Light (single pass)
- Medium (2 passes)
- Heavy (3 passes)

Sanding
- Control (none)
- Light (1/2 inch)
- Medium (1 inch)
- Heavy (1.5 inch)
Effect of ’06 Sanding and Pruning on canopy

A

2006

Upright no.

Control Light Moderate Heavy

Q*

NS

2007

B

Leaf Area (sq. cm)

0

200 400 600 800 1000 1200

Pruning Sanding

Q**

Q*

NS

A

2006

Leaf Area (sq. cm)

0

200 400 600 800 1000 1200

Pruning Sanding

Q*

Q*

NS

B

Leaf Area (sq. cm)

0

200 400 600 800 1000 1200

Control Light Moderate Heavy

Q**

NS

Q*
Effect of ’06 Sanding and Pruning on Yield

![Graphs showing the effect of sanding and pruning on yield in 2006 and 2007.](image)
Conclusions - yield

- In the first year, pruning treatments show higher yield than sanding (in foot square sampling)
- Low intensity treatment plots had best yield but after that yield declined with intensity
- By year 2, yield remained lower in two high intensity treatments – especially with sanding
SARE Grower Survey

- Extensive survey in 2006
- Following up today with a second mini-survey
Questions?