1-30-2019

2019 Update Mtg: Setting the (Fertilizer) Record Straight

Casey Kennedy
USDA ARS, Casey.Kennedy@ARS.USDA.GOV

Follow this and additional works at: https://scholarworks.umass.edu/cranberry_extension
Part of the Agriculture Commons

Recommended Citation
Kennedy, Casey, "2019 Update Mtg: Setting the (Fertilizer) Record Straight" (2019). Cranberry Station Extension meetings. 280.
Retrieved from https://scholarworks.umass.edu/cranberry_extension/280

This Article is brought to you for free and open access by the Cranberry Station Outreach and Public Service Activities at ScholarWorks@UMass Amherst. It has been accepted for inclusion in Cranberry Station Extension meetings by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.
Setting the (Fertilizer) Record Straight

Casey Kennedy
USDA-ARS
Outline

• Nitrogen fertilizer use
  • Principles
  • Forms
  • Methods
  • Rates

• Water quality
  • Modeling nitrogen losses
  • Wareham River

• Recommendations
Major concepts

• A little as ~5% of fertilizer nitrogen directly allocated for fruit production (Roper et al. 2004)

• However, it promotes new vegetative growth that supports photosynthesis, an essential component of fruit production

• Managing vegetative growth is key
  • Overly vigorous vines may lead to shading, reduced effectiveness of pollinators, or conditions that promote rot

• As a result, nitrogen fertilizers are best used in conjunction with pruning/sanding and fungicide applications

100 yrs of nitrogen fertilizer field trials...

Increase in Nitrogen Fertilizer (kg N ha\(^{-1}\) yr\(^{-1}\))

- Howes
- Early Black
- McFarlin
- Ben Lear
- Stevens
- Searles

Cranberry Yield Response (%)

- Beckwith 1919
- Franklin 1919
- Chandler 1961
- Doughty 1965
- Dana 1968
- Eaton 1971
- Eaton and Meehan 1973
- Eck 1976
- Davenport 1996
- Davenport and Vorsa 1999
- Sandler 2011
Diminishing returns – or worse

- Diminishing returns in most crops, including corn and wheat
- Cranberry is different
  - Too much nitrogen can suppress yield in native and first gen hybrids
  - Nitrogen fertilizer use is largely about managing tradeoffs
Nitrogen fertilizer application rate

Nitrogen fertilizer applied to 1000 acre of bog in the Wareham River watershed

N application rate (kg ha\(^{-1}\) yr\(^{-1}\))

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>a</td>
<td>a</td>
<td>b</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>
## Nitrogen fertilizer recommendations

<table>
<thead>
<tr>
<th>Cultivar Group</th>
<th>Chart Book (2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KG N ha⁻¹ yr⁻¹</td>
<td></td>
</tr>
<tr>
<td>Small-fruit natives</td>
<td></td>
</tr>
<tr>
<td>‘Early Black’, ‘Howes’</td>
<td>28-40</td>
</tr>
<tr>
<td>Older hybrids and large fruit natives</td>
<td></td>
</tr>
<tr>
<td>Super hybrids</td>
<td></td>
</tr>
</tbody>
</table>
Forms of nitrogen fertilizer

Fertilizer applied as urea or ammonium to ~1000 acre of bog

Percent

0 10 20 30 40 50 60 70 80 90 100


Urea Ammonium
Urea vs. ammonium

• Cranberry prefers ammonium, making ammonium based fertilizers (ammonium sulfate, monoammonium phosphate) attractive
• Clumping of ammonium fertilizers has been reported
• Urea is more concentrated (e.g., 46-0-0), more cost effective, and generally easier to handle than ammonium based fertilizers
Application of nitrogen fertilizer

- **Helicopter**
  - Cost effective, especially for large growers
  - Limited availability and, in some cases, accessibility

- **Ground rig**
  - Readily available to all growers
  - Applicable to many fertilizer combinations
  - Physically demanding and time consuming
  - Uniformity issues

- **Sprinkler**
  - Readily available to most growers
  - Limited to small applications and soluble compounds of nitrogen
  - Uniformity issues
  - Potential for subsurface leaching
Watershed nitrogen loads to Buzzards Bay

- Model developed to evaluate long-term (1985-2013) N loads
- Applied to 28 estuaries within Buzzards Bay
- Majority of bogs are located in two watersheds: Weweantic and Wareham
- Weweantic ranked first in N load, Wareham ranked fourth

Sources of nitrogen in the Wareham River

Williamson et al. 2017

- Atmospheric Deposition
- Turf Fertilizer
- Horticultural Fertilizer
- Cranberry Fertilizer
- Septic
- Landfill

Kennedy, in review

- Atmospheric Deposition
- Turf Fertilizer
- Horticultural Fertilizer
- Cranberry Fertilizer
- Septic
- Landfill
- Sewage
Nitrogen fertilizer application rate

Williamson et al. (2017) = 84 kg ha\(^{-1}\) yr\(^{-1}\)
Fertilized bog area

Wareham River watershed

Bog area (acre)

- Wiliamson et al., 2017
- Kennedy, in review
Cranberry bog delineations
Nitrogen load from cranberry bogs to the Wareham River estuary

- Williamson et al. (2017)
- Kennedy, in review
Recommendations

• Nitrogen fertilizer use
  • More is not always better
  • All things being equal, use ammonium N rather than urea N
  • Some research suggests higher yields with more frequent smaller doses compared to fewer larger doses
• Managing tradeoffs
  • Sand to suppress vegetative growth and push N fertilizer amounts
  • Integrate N fertilizer use, sanding/pruning, and fungicide applications
Recommendations, cont.

• Water quality
  • $4 billion to sewer Cape Cod – cranberry agriculture will *always* be a target
  • Rethink what *is* cranberry fertilizer in N load models
    • Applied fertilizer (fertilizer N applied in a given year)
    • Stored fertilizer (fertilizer N retained in decomposed plant tissues stored in the bog)
  • If most fertilizer is “stored”, then reducing N fertilizer amounts may not result in immediate water quality improvements
  • Massive amounts of N stored in old swamp deposits that form peat
  • Regardless, drainage management is one solution – less water equals less nitrogen loss
  • Can we enhance retention of N in the bog system – YES! I think so.
Thank You

Questions?