PROCEEDINGS:

CROP CONGRESS
At
MINER INSTITUTE

January 30, 2018
<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 AM</td>
<td><strong>Dr. Eric Young, Miner Institute</strong></td>
<td>“Update on tile drainage research.”</td>
</tr>
<tr>
<td>11:00 AM</td>
<td><strong>Joe Lawrence, Dairy Forage Systems Specialist for PRO-DAIRY</strong></td>
<td>“Corn traits and pest management in addition to sharing updates on recently completed corn silage hybrid trials conducted in this area.”</td>
</tr>
<tr>
<td>12:00 PM</td>
<td><strong>Hot Lunch</strong> - sponsored by <strong>Mycogen</strong></td>
<td></td>
</tr>
<tr>
<td>12:45 PM</td>
<td><strong>Kelsey O’Shea, CCE North Country Regional Ag Team</strong></td>
<td>“Crop insurance options”</td>
</tr>
<tr>
<td>1:00 PM</td>
<td><strong>Dr. Gary Bergstrom, Cornell University</strong></td>
<td>“Overview and update on field crop diseases.”</td>
</tr>
<tr>
<td>2:00 PM</td>
<td><strong>Dr. Rick Grant, Miner Institute</strong></td>
<td>“Feeding corn silage to lactating dairy cows.”</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>Adjourn</td>
<td></td>
</tr>
</tbody>
</table>
Update on Tile Drainage Research

E. Young, S. Kramer, L. Klaiber, K. Griffith, C. Hacker, and C. Corrigan
Miner Institute, Chazy, NY

Need for tile
- Higher yields on poorly drained soils
- Less ponding and surface runoff/lower compaction potential (Gilliam et al., 1999)
- Pathway for N & P loss to surface water (Jenns et al., 2001; King et al., 2015)

Forage response to drainage ('81-'84)

Geohring et al., 1985
Small plot runoff research

Small plot runoff: Snowmelt event

Tile drains and total runoff

Rye impacts on corn silage yield and nutrient loss

Klaiber, 2016
Rye impact on corn silage yield

<table>
<thead>
<tr>
<th>Year</th>
<th>Rye tons/ac (35% DM)</th>
<th>Control tons/ac (35% DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>16.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.7&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2017</td>
<td>15.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

- No significant differences in corn quality either year
- Rye yields averaged 1.1 and 2.2 tons DM/ac in ‘16 and ‘17
- CP = 11.8 and 18.5% in ‘16 and ‘17; NDF<sub>D30hr</sub> = 64%

Nutrient losses in surface runoff

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nitrate (kg-N/ha)</th>
<th>SRP (kg-P/ha)</th>
<th>TN (kg-N/ha)</th>
<th>TP (kg-P/ha)</th>
<th>Flow (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>0.38&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>112.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Control</td>
<td>0.53&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>207.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>P-value</td>
<td>0.009</td>
<td>0.03</td>
<td>0.01</td>
<td>0.27</td>
<td></td>
</tr>
</tbody>
</table>

Nutrient losses: surface + tile

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nitrate (kg-N/ha)</th>
<th>SRP (kg-P/ha)</th>
<th>TN (kg-N/ha)</th>
<th>TP (kg-P/ha)</th>
<th>Flow (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>15.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>195.9&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Control</td>
<td>14.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>273.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>P-value</td>
<td>0.68</td>
<td>0.0001</td>
<td>0.45</td>
<td>0.01</td>
<td>0.04</td>
</tr>
</tbody>
</table>

- No difference in tile nutrient losses due to rye
**Edge-of-field monitoring**
- Small paired watersheds (5 & 9 acres)
- 2-year baseline, 4-year treatment period
- Controlled drainage initiated Dec. 2017
- Sediment, N, & P losses

**Objective:**
Measure N, P, and TSS loading in surface runoff and tile flow during baseline period

**Surface water instruments**
- Flow-based sampling: 200 mL/0.70 mm of runoff
- Total suspended solids, total N, nitrate-N, ammonium-N, total P, and soluble reactive P

**Subsurface tile drain setup**
- 4 ft tile depth
- 35 ft lateral spacing
- Installed in 2014-monitoring in fall 2015

**Legend**
- Soil Type
- Low
- Med
- High

**Subsurface tile drain setup**
- Barrel modified with V-notch weir
- Flow module
- Ultrasonic sensor and Hobo
- Autosampler

**Subsurface tile drain setup**
- Barrels
- Flow module
- Ultrasonic sensor and Hobo
- Autosampler

**Subsurface tile drain setup**
- Barrels
- Flow module
- Ultrasonic sensor and Hobo
- Autosampler
Agronomic considerations

- Fields managed as corn for silage
- Soil test P: low-medium (3 to 5 lb/ac)
- 100 lb/ac of 23-12-18 at planting
- 90 lb/ac UAN applied as a sidedress
- Liquid manure in early October 2015 (4,000 gal/ac)
- Composted dairy manure May 2017 (20 tons/ac)
**Nutrient export in runoff**

<table>
<thead>
<tr>
<th>Pathway/field Runoff</th>
<th>SRP</th>
<th>TP</th>
<th>TSS</th>
<th>Total N</th>
<th>Nitrate-N</th>
<th>Ammon-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface T5</td>
<td>120.8</td>
<td>0.21</td>
<td>0.51</td>
<td>155.1</td>
<td>3.9</td>
<td>0.08</td>
</tr>
<tr>
<td>Tile T5</td>
<td>246.0</td>
<td>0.01</td>
<td>0.05</td>
<td>13.1</td>
<td>20.8</td>
<td>17.8</td>
</tr>
<tr>
<td>Surface T9</td>
<td>125.1</td>
<td>0.07</td>
<td>0.49</td>
<td>198.9</td>
<td>3.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Tile T9</td>
<td>161.4</td>
<td>0.01</td>
<td>0.05</td>
<td>10.6</td>
<td>13.7</td>
<td>12.0</td>
</tr>
<tr>
<td>T5 Surface:Tile</td>
<td>0.49</td>
<td>18.9</td>
<td>10.2</td>
<td>11.8</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>T9 Surface:Tile</td>
<td>0.77</td>
<td>7.1</td>
<td>10.8</td>
<td>18.8</td>
<td>0.27</td>
<td>0.11</td>
</tr>
</tbody>
</table>

- P and TSS export dominated by surface runoff
- N export mainly from tile drain flow as nitrate-N
Nutrient inputs & crop removal

<table>
<thead>
<tr>
<th>Year/Field</th>
<th>Total P,O inputs lb/ac</th>
<th>Total N inputs lb/ac</th>
<th>Corn yield tons DM/ac</th>
<th>P,O removal lb/ac</th>
<th>N removal lb/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>12</td>
<td>123</td>
<td>1.60</td>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>T9</td>
<td>12</td>
<td>123</td>
<td>2.56</td>
<td>26</td>
<td>57</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>102</td>
<td>257</td>
<td>3.05</td>
<td>31</td>
<td>68</td>
</tr>
<tr>
<td>T9</td>
<td>102</td>
<td>257</td>
<td>4.23</td>
<td>43</td>
<td>95</td>
</tr>
</tbody>
</table>

Flow weighted mean concentrations

<table>
<thead>
<tr>
<th>Pathway/field</th>
<th>SRP mg L⁻¹</th>
<th>TP mg L⁻¹</th>
<th>Total N mg L⁻¹</th>
<th>Nitrate-N mg L⁻¹</th>
<th>Amm-N mg L⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface T5</td>
<td>0.18</td>
<td>0.42</td>
<td>3.2</td>
<td>1.6</td>
<td>0.07</td>
</tr>
<tr>
<td>Surface T9</td>
<td>0.06</td>
<td>0.39</td>
<td>3.0</td>
<td>1.0</td>
<td>0.09</td>
</tr>
<tr>
<td>Tile T5</td>
<td>0.004</td>
<td>0.02</td>
<td>8.5</td>
<td>7.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Tile T9</td>
<td>0.01</td>
<td>0.03</td>
<td>8.5</td>
<td>7.4</td>
<td>0.10</td>
</tr>
</tbody>
</table>

EPA nitrate-N drinking water standard = 10 mg L⁻¹

Percent of nutrients lost in runoff

<table>
<thead>
<tr>
<th>Year/Field</th>
<th>% P loss</th>
<th>% N loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>1.7</td>
<td>16.4</td>
</tr>
<tr>
<td>T9</td>
<td>1.5</td>
<td>11.0</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>0.2</td>
<td>7.8</td>
</tr>
<tr>
<td>T9</td>
<td>0.2</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Summary

- Importance of year-round monitoring
- Field hydrology key driver of nutrient losses
- P loss driven by surface runoff/erosion
- N loss driven by leaching to tile drains
- Winter cover crops: opportunity to reduce particulate P in runoff and nitrate loss in tile flow?
- How will control drainage impact N and P loss?
Corn Silage
Performance & Traits Selection

Joe Lawrence
Miner Crop Congress

NYS & VT Corn Silage Trials

Collaboration of:
- Cornell University
  - PRO-DAIRY, Department of Animal Science
  - Department of Plant Breeding & Genetics
- University of Vermont

A Special Thank You
Tom Overton
Margaret Smith
Heather Darby
Mike Van Amburgh
Mike Davis
Jerry Cherney
Greg Roth

With support from:
- NYS Dairy Producers
- Seed Corn Industry
- Cornell Cooperative Extension

2017 Participants – Thank You

With support from:
- NYS Dairy Producers
- Seed Corn Industry
- Cornell Cooperative Extension
2017 NYS & VT Corn Silage Trials

73 hybrids entered

- Locations
  - 80-95 Day Relative Maturity
    - Albion, NY
    - Willsboro, NY
    - Alburgh, VT
  - 96-110 Day Relative Maturity
    - Aurora, NY
    - Madrid, NY
    - Alburgh, VT

Thank you to host
Jan Greenwood
Hugh Dudley

Timing
Dairy One Study, 2015-16
Slide Credit: S.A. Flis

- Does total rain fall matter or is it when it occurs?
  - 240 hr NDF digestibility
    - Strong correlation with rain in July: increased rain, Decreased NDF digestibility
  - 120 hr NDF digestibility
  - August rainfall: increased rain, Decreased NDF digestibility
  - 30 hr NDF digestibility
    - Trend for more to negatively impact digestibility
    - High-staging relationship

- Relationship with plant development at very specific growth phases?

Picking the Best fit for your farm

- Hybrid Evaluation……not Hybrid Competition

  - How consistent does a hybrid perform across locations?
  - What hybrids perform well under conditions similar to your farm?
    - Soil Type
    - Length of Growing Season
  - What factors impact predicted milk yields the most?
    - Digestible Fiber
    - What affects digestible fiber?
      - Soil Type
      - Weather
      - Yield

Soil Types
Dairy One Study, 2015-16
Slide Credit: S.A. Flis

- Very strong relationship between soil type and NDF digestibility at all time points
- Due to limited sample size, can not tell interaction between hybrid and soil type and NDF digestibility
- From available data, no relationship exists though
- Does this mean there are certain soil types that should not be used for corn silage?
- Do we need agronomic factors we can address to improve NDF digestibility?

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    - Soil Type
    - Length of Growing Season
  - What factors impact predicted milk yields the most?
    - Digestible Fiber
    - What affects digestible fiber?
      - Soil Type
      - Weather
      - Yield
Picking the Best fit for your farm

- **Hybrid Evaluation**.......not Hybrid Competition

- What factors match your needs and feeding program?
  - Yield
  - Acreage constraints
  - Starch
  - Digestible Fiber
  - What other forages are being fed?

---

**Yield & Starch**

Hybrids performing better than plot mean at all 3 locations

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**Yield & uNDF240**

Hybrids performing better than plot mean at 2 of 3 locations

*No hybrids better than plot mean in both factors at all 3 locations*

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Using Public data as comparison

- Average digestibility numbers will vary by hybrid and year
- Public trials provide the range in expected values for a given growing season

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**2017 Plot Means**

<table>
<thead>
<tr>
<th>Location</th>
<th>Yield 35% DM</th>
<th>Starch % of Mean</th>
<th>uNDF240 % of Mean</th>
<th>NDF %</th>
<th>uNDF240 %</th>
<th>NDF %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurora, NY</td>
<td>17.7</td>
<td>51.3</td>
<td>9.9</td>
<td>9.9</td>
<td>33.0</td>
<td>33.0</td>
</tr>
<tr>
<td>Madrid, NY</td>
<td>28.4</td>
<td>33.4</td>
<td>36.0</td>
<td>3.6</td>
<td>38.4</td>
<td>27.4</td>
</tr>
</tbody>
</table>

---

**Plot Means: 2017 NY & VT Corn Silage Trials**

<table>
<thead>
<tr>
<th>Location</th>
<th>Yield % of Mean</th>
<th>Starch % of Mean</th>
<th>uNDF240 % of Mean</th>
<th>NDF %</th>
<th>uNDF240 %</th>
<th>NDF %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurora, NY</td>
<td>26.0</td>
<td>35.0</td>
<td>22.0</td>
<td>36.0</td>
<td>27.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Madrid, NY</td>
<td>31.9</td>
<td>33.4</td>
<td>34.8</td>
<td>7.4</td>
<td>38.0</td>
<td>38.0</td>
</tr>
<tr>
<td>Albion, VT</td>
<td>28.6</td>
<td>33.4</td>
<td>35.3</td>
<td>7.2</td>
<td>38.0</td>
<td>38.0</td>
</tr>
</tbody>
</table>
Tracking performance on your own farm

- Build your own database
- Tracking yield & quality from year to year to understand field and hybrid performance.
- Green Samples at Harvest
  - Labeled by field and by hybrid
  - Fiber Digestibility
  - uNDF240

Yield Stability Mapping
Nutrient Management Spear Program

Pulling it all together

**A common goal of ranking silages is to have one number that encompasses all forage quality parameters.**

**Predicting Milk Yield Utilizing Cornell Net Carbohydrate and Protein System (CNCPs)**

- Develop Base Diet
  - Formulated for an ME & MP allowable milk yield of 100 lbs/day
  - Replace “average” Corn Silage with results from each Hybrid in trial (on a Dry Matter basis)
  - Predicted ME Allowable Milk Yield for each hybrid in that standard diet
- Model adjust DM intake based on Fiber Digestibility of each hybrid

**Final Report with 2017 Predicted Milk Yields Coming Soon**

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14 year study of yield variation

- Q1: consistently high yield
- Q2: variable high yield
- Q3: variable low yield
- Q4: consistently low yield
- Q5: Fields tend to be well drained, moderately high STP and generally higher SOM.
  - This producer pursuing model to increase SOM across farm

Trial Results

**NY & VT Trial Results**
[https://prodairy.cals.cornell.edu/production-management/resources](https://prodairy.cals.cornell.edu/production-management/resources)

**Penn State Trial Results**
[https://extension.psu.edu/2017-results-pa-commercial-grain-and-silage-hybrid-corn-tests-report](https://extension.psu.edu/2017-results-pa-commercial-grain-and-silage-hybrid-corn-tests-report)
Corn Hybrid Trait Selection

Terminology

**Trait** *(noun)* - a distinguishing quality or characteristic

- The term trait gets used in reference to a number of hybrid characteristics.
- Some are naturally occurring, some are the result of genetic engineering.

Terminology

**GMO** – Genetically Modified Organism

**GE** – Genetically Engineered

**Transgenic** - an organism that contains genetic material into which DNA from an unrelated organism has been artificially introduced

- GE/Transgenic are better terms for modern breeding techniques than GMO

**Herbicide Tolerance**
- Roundup Ready
- LibertyLink

**Insect Tolerance**
- Bt proteins
- Rootworm protection
- Lepidoptera protection

**Silage Specific Leafy**
- BMR

**Drought**
- tolerance
### Terminology

**GE Crop** – a crop that has genetic material inserted or a certain plant function turned on/off in it to provide a specific characteristic to the crop
- Commonly done with traits for
  - Herbicide Tolerance
  - Pest Tolerance
  - Drought Tolerance
  - Note - some companies have conventionally derived drought tolerance genes so these would not be considered GMO’s

### Terminology

**Conventional**
- Does not have any genetic material inserted through GE techniques
- May still be genetically modified compared to its ancestors through natural selection and traditional plant breeding techniques
- Leafy / BMR, etc. are considered Conventional in this context

### Terminology

**Conventional**
- GMO Free
  - Meets certain definition as being free of GE material
  - Example: certified to contain less than X% GE material
  - Some companies are testing conventional hybrids and labeling those that meet these criteria
Yield Performance of Traited Hybrids

- Under optimum conditions conventional hybrids have yield potential equivalent to GE
- GE technology has helped to close the gap between yield potential and actual yield - National Academies of Science, Engineering, and Medicine, 2016
  - Reduces incidences of yield loss from stressors
    - Pest
    - Weather

Excellent Resource

The Handy Bt Trait Table
for U.S. Corn Production

http://msue.anr.msu.edu/news/handy_bt_trait_table

Pest Tolerance Traits

Most pest tolerance traits are derived from insertion of Bt proteins
- Bt – Bacillus thuringiensis
  - Naturally occurring bacteria that produces a protein that is harmful to certain classes of insects.
  - Rootworm (beetle)
  - Lepidoptera (moths and butterflies)
    - In most cases adults (moths) lay eggs in corn field and larval stage (worm) feeds on plants
    - Need to look at specific event (protein expressed) to see exactly which pest are covered by each trait
**Parent Companies**

- Bayer
- LibertyLink (LL) (glufosinate tolerance)
- Monsanto
- YieldGard/Genuity
- RR/RR2 (Roundup Ready)
- Dow/Monsanto
- SmartStax
- Dow
- Herculex
- Syngenta
- Agrisure
- GT (glyphosate tolerance)

- All other seed companies (not owned by these) obtain licensing agreements to utilize these traits in their hybrids.

- Some companies may have different hybrids in their lineup containing different packages from this list.

---

**Examples**

*(no endorsement implied)*

- **Genuity**
  - GENVT2P (RIB) = Genuity VT Double Pro
    - Dual modes of action for above ground insects, no below ground protection + RR2
  - GENVT3P (RIB) = Genuity VT Triple Pro
    - Dual modes of action for above and below ground insects + RR2
    - RIB = Refuge in the Bag
    - Refuge Advanced

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**Fitting Option to Situation**

With all of the options available it is necessary to:

- Identify what fields require what level of protection

- Utilize the trait table to identify the package that offers the needed protection

**Trait Stewardship | Input Cost**

---

**Same Hybrid, Different Trait Package**

*(no endorsement implied)*

- **MC**
  - 4880 (Conventional)
  - 4881 (GT)
  - 4884 (3111)

- **NK NS5**
  1. GT (Glyphosate Tolerant)
  2. 31111 (GT, LL, Broad Leaf, Corn Borer, Corn Rootworm [Triple Stack])
    - Requires structured refuge
  3. 3220 E-Z Refuge GT, LL, 2 modes for Broad Leaf and Corn Borer, 80 Rootworm
  4. 5222 E-Z Refuge GT, LL, 2 modes for Broad Leaf, Corn Borer, Rootworm
Asking the right questions

Pest Protection Needs

What is the pest life cycle?
• Affecting crop this year or next year?
• Can GT/RR help with late emerging weed issues?

What pest are problematic in your area
• Western Bean Cutworm populations are spotty in NY
• Localized disease issues
• River Valley area

Predominant Weed Populations
• Annuals vs. Perennials
• Grass vs. Broadleaf
• Time of emergence

Asking the right questions

Field Needs

• Stage of Rotation (Years in Corn)
  • Rootworm
• Grain vs Silage
  • Corn Borer

• Tillage Practices
  • Early season insect pest
  • Biennial, perennial weeds

Sources of information

(Not in order)
• Personal Experience
• Company Data
• NY Corn Silage Hybrid Trials
• NY Corn Grain Hybrid Trials
• Data from other Universities

Important to utilize more than one source
Multiple locations and years of data allows for confidence in decision making.

Asking the right questions

More than just Pest Protection

• Overall Hybrid Performance
• Silage Forage Quality
  • How does it fit with your overall crop rotation and feeding program
• Test Weight
• Stand ability
• Disease Tolerance
• Suitability to soil type

Asking the right questions

Trait Stewardship

• We are already seeing failures of these technologies.
  • Pest developing tolerance to the trait within the plant
  • Corn Rootworm resistance to Cry1A Bt Protein
  • Pest developing resistance to technology used in conjunction with trait in plant
  • Weed resistance to glyphosate used in glyphosate tolerant crops.

• It is absolutely critical that all best management practices are utilized to prevent resistance and keep these traits viable.
**Corn Rootworm (CRW)**

- **Life Cycle of 2 seasons**
  - Yr 1 - Beetle lays egg in corn field
  - Yr 2 - Larvae hatch and feed on corn roots

- **Implication:** Does not affect 1st year corn

- **Development of CRW Resistance to Bt traits**

- **Very Adaptive Insect**
  - Two CRW Variants in the Midwest with "Rotation Resistance"

---

**Western Bean Cutworm (WBC)**

- **Pest was found in NYS in 2009**
- **Populations have increased since that time**
  - NYS IPM Pheromone Trap Network
    - NY - Higher Populations along Great Lakes and St Lawrence River

- **Life Cycle in 1 season**
  - Moths fly into field & lay eggs on tasseling corn
  - Eggs Hatch and Larvae begin feeding
  - Larvae overwinter in soil and emerge as moths following summer

- **Implication:** can be pest on 1st year corn
2017 NYS & VT Corn Silage Trial Program

Western Bean Cutworm and Mycotoxin Screening

- Madrid and Aurora, NY
- Assessed plots for ear damage prior to harvest
- At harvest collected samples for Mycotoxin screening
- 3 toxins showed up in trials
  - Vomitoxin
  - 15-Acetyl DON
  - Zearalenone

Western Bean Cutworm and Mycotoxin Screening

- In this survey, no clear link between WBC Damage and Mycotoxin development.
- It would appear weather conditions were more relevant than WBC damage in Mycotoxin development.
- A very wet year
  - "Given adequate moisture at silk emergence, F. graminearum can infect corn ears through the silk channel without any insect or other type of injury." – G. Bergstrom, 2017

Western Bean Cutworm and Mycotoxin Screening

<table>
<thead>
<tr>
<th>Trait</th>
<th>Aurora</th>
<th>Madrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC Trap Counts (seasonal total)</td>
<td>211</td>
<td>356</td>
</tr>
<tr>
<td>II Hybrids</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>II Hybrids with WBC Damage</td>
<td>14 (28.6%)</td>
<td>32 (65.3%)</td>
</tr>
<tr>
<td>Total Hybrids</td>
<td>17 (34.6%)</td>
<td>19 (38.8%)</td>
</tr>
<tr>
<td>Hybrids with a Positive Mycotoxin Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO WBC Damage</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>WBC Damage Present</td>
<td>4</td>
<td>13</td>
</tr>
</tbody>
</table>

Trait Stewardship through Rotation

Rotation of:
- Crops
- Bt Events
- Technologies
  - Bt Event
  - Planter box Insecticides
  - Seed Treatments
  - Using any of these together has proven not to be effective
- Pesticide Mode of Action
  - Glyphosate vs. Glufosinate
Refuge

Refuge:
• Percentage of plants in field do not carry the trait that controls the pest
• Allows some non-resistant pest to survive and mate with any potential resistant pest to limit chances of offspring carrying resistance.
Read the label!

Refuge Options

Incorporated Refuge
• Percentage of seed in the bag does not contain target trait
• Seed contains multiple events against one pest
  • Need to make sure both traits are working
  • Trade names
    • Refuge in a Bag (RIB)
    • EZ Refuge
    • Refuge Advanced

Refuge Options

Purchase two different hybrids
(one with/one without desired trait)
• Considerations
  • Both have the same herbicide tolerance
  • Match maturity group
  • Match recommended use
    • Grain vs Silage

Thank You!

Joe Lawrence, MS, CCA
Dairy Forage Systems Specialist
jrl65@cornell.edu
315-778-4814
http://prodairy.cals.cornell.edu/
Most corn hybrids planted in the U.S. have one or more transgenic traits for insect management. These traits can increase flexibility and profitability for producers, but can also cause confusion because of varying spectrum of control or refuge requirements. The Handy Bt Trait Table provides a helpful list of trait names (below) and details of trait packages (next page) to make it easier to understand company seed guides, sales materials, and bag tags.

New for 2018

✓ Trait packages are now alphabetized, instead of grouped by seed company.
✓ To make the trait table easier to read, the “Marketed for” and “Herbicide trait” columns were redesigned to replace letter abbreviations for insect names and herbicides with a simple ‘X’.
✓ In 2017, we added a column listing insect x Bt combinations with documented field-failures, confirmed resistance, or cross-resistance in published lab assays &/or field research. For 2018, this column has the same format, but is relabeled “Resistance to a Bt protein in the trait package has developed in:”. This column is intended to alert producers and consultants to potential management problems and encourage field scouting. Growers should check with local extension educators and seed dealers to determine the status of Bt resistance in their local area. Citations for cases of resistance are posted at the web site in the header of this bulletin.
✓ Note that based on strong evidence from lab assays and the field, companies removed western bean cutworm control from the Cry1F Bt protein (i.e., the Herculex trait). Only hybrids with the Vip3A Bt protein provide reliable control of this insect. For all other hybrid packages, western bean cutworm infestations should be managed using a combination of scouting and spraying at threshold.

### Field corn ‘events’ (transformations of one or more genes) and their Trade Names

<table>
<thead>
<tr>
<th>Trade name for trait</th>
<th>Event</th>
<th>Protein(s) expressed</th>
<th>Insect Target + Herbicide Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrisure CB/LL</td>
<td>Bt11</td>
<td>Cry1Ab + PAT</td>
<td>corn borer + glufosinate tolerance</td>
</tr>
<tr>
<td>Agrisure Duracade</td>
<td>S307</td>
<td>eCry3.1Ab</td>
<td>rootworm</td>
</tr>
<tr>
<td>Agrisure GT</td>
<td>GA21</td>
<td>EPSPS</td>
<td>glyphosate tolerance</td>
</tr>
<tr>
<td>Agrisure RW</td>
<td>MIR604</td>
<td>mCry3A</td>
<td>rootworm</td>
</tr>
<tr>
<td>Agrisure Viptera</td>
<td>MIR162</td>
<td>Vip3A</td>
<td>broad Lep control (but not corn borer)</td>
</tr>
<tr>
<td>Herculex I (HXI) or CB</td>
<td>TC1507</td>
<td>Cry1Fa2 + PAT</td>
<td>corn borer + glufosinate tolerance</td>
</tr>
<tr>
<td>Herculex CRW</td>
<td>DAS-59122-7</td>
<td>Cry34Ab1/Cry35Ab1 + PAT</td>
<td>rootworm + glufosinate tolerance</td>
</tr>
<tr>
<td>(None – part of Qrome)</td>
<td>DP-4114</td>
<td>Cry1F + Cry34Ab1/Cry35Ab1 + PAT</td>
<td>corn borer+rootworm+glufosinate tol.</td>
</tr>
<tr>
<td>Roundup Ready 2</td>
<td>NK603</td>
<td>EPSPS</td>
<td>glyphosate tolerance</td>
</tr>
<tr>
<td>Yieldgard Corn Borer</td>
<td>MON810</td>
<td>Cry1Ab</td>
<td>corn borer</td>
</tr>
<tr>
<td>Yieldgard Rootworm</td>
<td>MON863</td>
<td>Cry3Bb1</td>
<td>rootworm</td>
</tr>
<tr>
<td>Yieldgard VT Pro</td>
<td>MON89034</td>
<td>Cry1A.105 + Cry2Ab2</td>
<td>Lepidopteran control</td>
</tr>
<tr>
<td>Yieldgard VT Rootworm RR</td>
<td>MON88017</td>
<td>Cry3Bb1 + EPSPS</td>
<td>rootworm + glyphosate tolerance</td>
</tr>
</tbody>
</table>

### Abbreviations used in the Trait Table

<table>
<thead>
<tr>
<th>Herbicide traits</th>
<th>Insect targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT</td>
<td>BCW black cutworm</td>
</tr>
<tr>
<td>LL</td>
<td>SB stalk borer</td>
</tr>
<tr>
<td>RR2</td>
<td>SCW sugarcane borer</td>
</tr>
<tr>
<td></td>
<td>SWCB southwestern corn borer</td>
</tr>
<tr>
<td></td>
<td>ECB European corn borer</td>
</tr>
<tr>
<td></td>
<td>FAW fall armyworm</td>
</tr>
<tr>
<td></td>
<td>TAW true armyworm</td>
</tr>
<tr>
<td></td>
<td>WBC western bean cutworm</td>
</tr>
</tbody>
</table>
The Handy Bt Trait Table for U.S. Corn Production, updated December 2017

<table>
<thead>
<tr>
<th>Trait packages in alphabetical order (acronym)</th>
<th>Bt protein(s) in the trait package</th>
<th>Marketed for control of:</th>
<th>Resistance to a Bt protein in the trait package has developed in: *</th>
<th>Herbicide trait</th>
<th>Non-Bt Refuge % (cornbelt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AcreMax (AM)</td>
<td>Cry1Ab, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC</td>
<td>GT RR2 LL</td>
<td>5% in bag</td>
</tr>
<tr>
<td>AcreMax CRW (AMRW)</td>
<td>Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>10% in bag</td>
</tr>
<tr>
<td>AcreMax1 (AM1)</td>
<td>Cry1F, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC CRW</td>
<td></td>
<td>10% in bag 20% ECB</td>
</tr>
<tr>
<td>AcreMax Leptra (AML)</td>
<td>Cry1Ab, Cry1F, Vip3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>AcreMax TRIssect (AMT)</td>
<td>Cry1Ab, Cry1F, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>10% in bag</td>
</tr>
<tr>
<td>AcreMax Xtra (AMX)</td>
<td>Cry1Ab, Cry1F, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Agrisure 3010 and 3010A</td>
<td>Cry1Ab</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Agrisure 3000GT and 3011A</td>
<td>Cry1Ab, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Agrisure Viptera 3110</td>
<td>Cry1Ab, Vip3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Agrisure Viptera 3111</td>
<td>Cry1Ab, Vip3A, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Agrisure 3120 EZ Refuge</td>
<td>Cry1Ab, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Agrisure 3122 EZ Refuge</td>
<td>Cry1Ab, Cry1F, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Agrisure Viptera 3220 EZ Refuge</td>
<td>Cry1Ab, Cry1F, Vip3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Agrisure Duracade 5122 EZ Refuge</td>
<td>Cry1Ab, Cry1F, mCry3A, eCry3.1Ab</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Agrisure Duracade 5222 EZ Refuge</td>
<td>Cry1Ab, Cry1F, Vip3A, mCry3A, eCry3.1Ab</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Herculex I (HXI)</td>
<td>Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Herculex RW (HXRW)</td>
<td>Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Herculex XTRA (HXX)</td>
<td>Cry1F, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Intrasect (YHR)</td>
<td>Cry1Ab, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Intrasect TRIssect (CYHR)</td>
<td>Cry1Ab, Cry1F, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Intrasect Xtra (YXR)</td>
<td>Cry1Ab, Cry1F, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Intrasect Xtreme (CYXR)</td>
<td>Cry1Ab, Cry1F, mCry3A, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Lepta (YHR)</td>
<td>Cry1Ab, Cry1F, Vip3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Powercore a</td>
<td>Cry1A.105, Cry2Ab2, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC</td>
<td></td>
<td>a 5% in bag</td>
</tr>
<tr>
<td>Powercore Refuge Advanced b</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>b 5% in bag</td>
</tr>
<tr>
<td>QROME (Q)</td>
<td>Cry1Ab, Cry1F, Cry34/35Ab1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>SmartStax a</td>
<td>Cry1A.105, Cry2Ab2, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>a 5% in bag</td>
</tr>
<tr>
<td>SmartStax Refuge Advanced b</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>b 5% in bag</td>
</tr>
<tr>
<td>SmartStax RIB Complete b</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>5% in bag</td>
</tr>
<tr>
<td>Trecepta a</td>
<td>Cry1A.105, Cry2Ab2, Vip3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC CRW</td>
<td></td>
<td>a 5% in bag</td>
</tr>
<tr>
<td>Trecepta RIB Complete b</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC CRW</td>
<td></td>
<td>b 5% in bag</td>
</tr>
<tr>
<td>TRIssect (CHR)</td>
<td>Cry1F, mCry3A</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>FAW SWCB WBC CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>VT Double PRO a</td>
<td>Cry1A.105, Cry2Ab2, Cry1F</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>a 5% in bag</td>
</tr>
<tr>
<td>VT Double PRO RIB Complete b</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>b 5% in bag</td>
</tr>
<tr>
<td>VT Triple PRO c</td>
<td>Cry1A.105, Cry2Ab2, Cry3Bb1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>VT Triple PRO RIB Complete d</td>
<td></td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>CEW WBC CRW</td>
<td></td>
<td>10% in bag</td>
</tr>
<tr>
<td>Yieldgard Corn Borer (YGCB)</td>
<td>Cry1Ab</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>SWCB</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Yieldgard Rootworm (YGRW)</td>
<td>Cry3Bb1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>SWCB</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Yieldgard VT Triple</td>
<td>Cry1Ab, Cry3Bb1</td>
<td>B C E F A W C B S A W S C B T A W C R</td>
<td>SWCB CRW</td>
<td></td>
<td>20%</td>
</tr>
</tbody>
</table>

*Check with local extension educators and seed dealers to determine the status of Bt resistance in your particular region.

*Note: Some traits may be labeled with different names, synonyms, or abbreviations in different regions or by different companies. Always consult the latest product information and regulatory guidelines to ensure accurate and up-to-date information.*
An Update on Field Crop Diseases and Their Management

Miner Institute Annual Crop Congress, Chazy, January 31, 2018
Annual North Country Crop Congress, Lowville, February 1, 2018

Gary C. Bergstrom and Jaime A. Cummings
Plant Pathology & Plant-Microbe Biology Section
Cornell University

Soybean Cyst Nematode

• First confirmation in New York from a soil sample in Cayuga County in fall 2016
• Samples from 17 counties since 2013 were negative for SCN – either not present or at low populations

SG Type 7; Race 3
Reproduces on PI888788, major source of resistance in commercial varieties
SCN: Scout, Sample, Test

The Soybean Cyst Nematode has been identified in New York State.

What does that mean for you?

1) Is it in your field?

2) How should you “test” your fields?

3) Why choose the Old MDMA?

http://plantclinic.cornell.edu
607-255-7850

SCN Management

1. Maintain multiple year rotation between soybean crops
2. Plant soybean varieties with non-PI88788 resistance and resistance to SDS and other soilborne diseases
3. Possible future use of nematicidal seed treatments
   a. Clariva biological (Syngenta) – labeled in NYS
   b. Avicta 500 and Avicta Complete Beans 500 Nematicide/Insecticide/Fungicide (Syngenta) - labeled in NYS
   c. ILeVO fluopyram Group 7 fungicide (Bayer) – (labeled in NYS)

   Significant yield saving effects only with moderate to high SCN populations

What we discovered:

Eight soybean diseases ‘new’ to NY

- 2012: Charcoal Rot – Cayuga county
- 2012: Fusarium Wilt – Cortland, Herkimer and Madison counties
- 2012: Sudden Death Syndrome – Cayuga, Columbia, Schoharie, and St. Lawrence counties
- 2013: Brown Stem Rot – Herkimer and Yates counties
- 2015: Powdery mildew – Cayuga county
- 2016: Bacterial Wilt – Yates county
- 2016/17: Soybean Cyst Nematode – Cayuga Co.

Soybean Diseases

Supported by NYCSGA and NNYADP

Survey areas may represent multiple fields near that location.
Northern stem canker

The Disease
- *Diaporthe caulivora*
- Extended periods of wet weather favor disease
- Infection occurs during vegetative growth stages, but symptoms appear during reproductive stages
- Obvious lesions or ‘cankers’ on stems, often near nodes
- Overwinters on soy debris

Management
- Select varieties with resistance (Rdc1 and Rdc4 genes)

Corn Diseases

<table>
<thead>
<tr>
<th>Gray leaf spot</th>
<th>Northern leaf spot</th>
<th>Eyespot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than usual</td>
<td>Moderate levels</td>
<td>Locally severe</td>
</tr>
</tbody>
</table>

Corn Diseases

Northern leaf blight less than expected; common rust prevalent in ‘17
Northern leaf blight

Common rust

Why less in a wet season?
Less inoculum after drought year?
Cooler temps, spores washed out?

Recurrence of head smut in Northern New York
Corn ear rots and toxins?

Ontario Survey Results Courtesy of Dr. Albert Tenuta

Effects of western bean cutworm injury on mycotoxin levels?

A Farmer’s Guide Series

- Extensive compilation of corn and soybean diseases
- Hundreds of images
- Available through APS Press
- $30 each

http://www.apsnet.org/apsstore/shopapspress

Alfalfa Diseases

Varietal differences are being documented and inoculation experiments are under way

G.C. Bergstrom and J.A. Cummings, Plant Pathology and Plant Microbe Biology Section, School of Integrative Plant Science, Cornell University

Oat Diseases

Crown rust epidemics widespread in 2017

G.C. Bergstrom and J.A. Cummings, Plant Pathology and Plant Microbe Biology Section, School of Integrative Plant Science, Cornell University
Oat Diseases

Crown rust severity in 2017

Fungicides at flowering

Averaged Across Four Winter Wheat Varieties, Musgrave Farm, Aurora, NY 2017

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Leaf rust (%)</th>
<th>Stripe rust (%)</th>
<th>Leaf blotch (%)</th>
<th>FHB Index</th>
<th>DON (ppm)</th>
<th>Yield (Bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Spray control</td>
<td>1.0 a</td>
<td>0.3 a</td>
<td>3.8 a</td>
<td>1.0 a</td>
<td>2.2 a</td>
<td>64.8</td>
</tr>
<tr>
<td>Prosaro SC (6.5 fl oz) FGS</td>
<td>0.0 b</td>
<td>0.0 b</td>
<td>1.6 c</td>
<td>0.3 bc</td>
<td>0.8 c</td>
<td>70.6</td>
</tr>
<tr>
<td>Caramba (17 fl oz) FGS</td>
<td>0.1 b</td>
<td>0.0 b</td>
<td>2.0 bc</td>
<td>0.2 c</td>
<td>0.7 cd</td>
<td>69.1</td>
</tr>
<tr>
<td>Prosaro SC (6.5 fl oz) FGS</td>
<td>0.0 b</td>
<td>0.0 b</td>
<td>1.8 bc</td>
<td>0.1 c</td>
<td>0.4 d</td>
<td>68.4</td>
</tr>
</tbody>
</table>

Wheat diseases

Fusarium head blight and DON (vomitoxin) contamination was low to moderate in winter wheat in 2017

Newly discovered leaf spot of wheat caused by fungus in the Alternaria infectoria complex

First confirmation of a wheat disease in the US caused by a fungus in this species group

Genetically similar to, yet distinct from, Alternaria species causing blight diseases on wheat reported from Argentina, Hungary, and India – but symptoms much different!

Biology and potential management of the disease currently unknown

Suspect that it might be harbored by grasses in the vicinity of wheat fields, but no evidence to date

Not clear whether this is a threat to wheat y bears watching
Wheat diseases

**Stripe Rust of Wheat**

Occurring more frequently in Eastern and Central US – earlier arrival of spores from South and West

Many of the varieties we plant are susceptible; we may need to choose varieties with resistance in future

Fungicides applied at flowering (FHB timing) achieved excellent control in 2016

If spores arrive earlier, it may warrant fungicide application at flag leaf appearance or earlier growth stage

---

Malt Barley Diseases

**13 Barley Diseases Diagnosed in NYS**


---

**Wheat Variety Reaction to Stripe Rust in 2016**

**Stripe Rust Severity**

Soft Red Winter Wheat

[Graph showing stripe rust severity]

**Stripe Rust Severity**

Soft White Winter Wheat

[Graph showing stripe rust severity]

---

**Malt Barley Diseases**

**Fusarium head blight**

[Image of fungal infection]
Winter Barley Disease Reactions

<table>
<thead>
<tr>
<th>Variety</th>
<th>Rows</th>
<th>Scald</th>
<th>Leaf Rust</th>
<th>Powdery Mildew</th>
<th>Fusarium Head</th>
<th>Blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles</td>
<td>2</td>
<td>MS</td>
<td>S</td>
<td>R</td>
<td>MR</td>
<td>MS</td>
</tr>
<tr>
<td>Endeavor</td>
<td>2</td>
<td>R</td>
<td>R</td>
<td>MR/R</td>
<td>MR</td>
<td></td>
</tr>
<tr>
<td>Flavia</td>
<td>2</td>
<td>S</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>KWS Scala</td>
<td>2</td>
<td>S</td>
<td>R</td>
<td>R</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>Nectaria</td>
<td>2</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>SY Tepee</td>
<td>2</td>
<td>R</td>
<td>R</td>
<td>MS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wintmalt</td>
<td>2</td>
<td>S/MS</td>
<td>R</td>
<td>NA</td>
<td>MS</td>
<td></td>
</tr>
</tbody>
</table>

Spring Barley Disease Reactions

Two-row winter:
- Endeavor
- Flavia
- KWS Scala
- LCS Calypso
- LCS Odyssey
- LCS Violetta

Two-row spring:
- AAC Synergy
- KWS Tinka
- Newdale

Six-row spring:
- Quest

Spring Barley Disease Reactions

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Rows</th>
<th>Spot Blotch</th>
<th>Leaf Rust</th>
<th>Powdery Mildew</th>
<th>Fusarium Head Blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC Synergy</td>
<td>2</td>
<td>R</td>
<td>MS</td>
<td>R</td>
<td>MR</td>
</tr>
<tr>
<td>Cerveza</td>
<td>2</td>
<td>MR</td>
<td>MR</td>
<td>R</td>
<td>MR</td>
</tr>
<tr>
<td>Conlon</td>
<td>2</td>
<td>MR</td>
<td>MS</td>
<td>R</td>
<td>MS</td>
</tr>
<tr>
<td>Craft</td>
<td>2</td>
<td>MR</td>
<td>MR</td>
<td>MS</td>
<td>MS</td>
</tr>
<tr>
<td>KWS Tinka</td>
<td>2</td>
<td>S</td>
<td>MR</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>ND Genesis</td>
<td>2</td>
<td>MS</td>
<td>MR</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Newdale</td>
<td>2</td>
<td>MR</td>
<td>MR</td>
<td>R</td>
<td>MR</td>
</tr>
<tr>
<td>Pinnacle</td>
<td>2</td>
<td>S</td>
<td>MR</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Quest</td>
<td>6</td>
<td>R</td>
<td>MS</td>
<td>S</td>
<td>MR</td>
</tr>
</tbody>
</table>

Report card on grain quality improvement in NYS commercial barley fields

2014
2015
2016
2017
Commercial field surveys

<table>
<thead>
<tr>
<th>Year</th>
<th>DON &lt;1.0 ppm</th>
<th>Protein 9-12%</th>
<th>Protein &lt;9%</th>
<th>Protein &gt;12%</th>
<th>Germination &gt;95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>59%</td>
<td>55%</td>
<td>4%</td>
<td>41%</td>
<td>.</td>
</tr>
<tr>
<td>2015</td>
<td>38%</td>
<td>52%</td>
<td>40%</td>
<td>8%</td>
<td>40%</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>51%</td>
<td>14%</td>
<td>35%</td>
<td>92%</td>
</tr>
<tr>
<td>2017</td>
<td>77%</td>
<td>77%</td>
<td>0%</td>
<td>23%</td>
<td>81%</td>
</tr>
</tbody>
</table>

DON in malting

Viable *Fusarium* in kernels may produce more DON during malting

Mycotoxins in 2017 barley grain

All 31 samples, all 13 varieties (16 spring & 15 winter)

Ingredients for Success: Disease and Toxin Management

- Plant barley following soybean or vegetable crop; not after corn, small grain, hay or fallow with grasses
- Choose variety based on malt quality potential, adaptation, and disease resistance
- Sow fungicide-treated, certified seed
- Apply Caramba or Prosaro fungicide at full head emergence
- Additional fungicide application if warranted by early season foliar diseases
Empire State Barley and Malt Summit
December 13, 2017

• Focus on 'Ingredients for Success'
• Sessions on barley growing, malting, and beer supply chain
• Sharing of ideas and recommendations
• Will be repeated in December of 2018!!!
**Hemp Diseases**

**Botrytis Gray Mold**

- Prevalent in many locations
- Likely to result in seed quality and processing issues

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**Questions and Discussion**

G.C. Bergstrom, J.A. Cummings, and K. Myers, Plant Pathology and Plant Microbe Biology Section, School of Integrative Plant Science, Cornell University

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**2017 Hemp Variety Trials**

**Seed Pathology**

(No significant differences)

Other fungi commonly identified: *Penicillium, Epicoccum* and *Phoma*
The Cow’s Perspective: Making Milk with Corn Silage

Rick Grant
W. H. Miner Agricultural Research Institute

Concepts to Understand

- NDF and NDF digestibility
- Particle size – meh...
- Give her time to eat
- Starch and starch digestibility
- Fat content??
- SOL – maximizing her response

Corn silage NDF digestibility and cow performance

- For each 1%-unit increase in NDFD:
  - +0.26 lb/d DMI
  - +0.31 lb/d 3.5%FCM

>40% corn silage in diet DM

Importance of rumen digestion: corn silage NDF (47-h in situ)

(Jung et al., 2010)
Measure NDF Digestibility and Indigestibility – Lignin/NDF is not Accurate Enough!

<table>
<thead>
<tr>
<th>NDF, %</th>
<th>Lignin, %</th>
<th>30-h NDFD</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0</td>
<td>3.52</td>
<td>46.0</td>
</tr>
<tr>
<td>45.0</td>
<td>3.26</td>
<td>48.4</td>
</tr>
<tr>
<td>45.0</td>
<td>3.32</td>
<td>54.4</td>
</tr>
<tr>
<td>45.1</td>
<td>3.18</td>
<td>55.0</td>
</tr>
<tr>
<td>45.0</td>
<td>3.43</td>
<td>67.3</td>
</tr>
</tbody>
</table>

Corn silage data set from Van Amburgh (2005)
Similar relationships from 36.5 to 51.8% NDF

Measured NDFD or Estimation from Lignin?

<table>
<thead>
<tr>
<th>Type</th>
<th>Fast</th>
<th>Slow</th>
<th>uNDF240</th>
<th>Fast Kd</th>
<th>Slow Kd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional CS</td>
<td>60.7</td>
<td>18.7</td>
<td>20.6</td>
<td>0.072</td>
<td>0.016</td>
</tr>
<tr>
<td>BMR corn silage</td>
<td>73.8</td>
<td>13.1</td>
<td>13.1</td>
<td>0.087</td>
<td>0.023</td>
</tr>
<tr>
<td>Grass</td>
<td>54.5</td>
<td>24.4</td>
<td>21.1</td>
<td>0.094</td>
<td>0.016</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>48.8</td>
<td>8.7</td>
<td>42.5</td>
<td>0.134</td>
<td>0.023</td>
</tr>
</tbody>
</table>

Pool size and rates by forage type
(Raffrenato and Van Amburgh, 2010)

Corn silage data set from Van Amburgh (2005)
Similar relationships from 36.5 to 51.8% NDF
NNY corn hybrid study
Fast NDF yields

Measured ranges in uNDF$_{240}$
(source: Dairy One, 2015)

- **Corn silage**
  - 8.7% of DM
  - Range: 2.0 to 25.5%

- **Legume silage**
  - 17.6% of DM
  - Range: 5.5 to 31.7%

- **Grass silage**
  - 15.5% of DM
  - Range: 2.3 to 44.8%

Tremendous variation in uNDF that we need to capture when formulating diets and predicting cow response!

NNY corn hybrid study
Slow NDF yields

Forage Fiber and Time Budgets
Fiber influences eating behavior...

- As ration fiber content increases:
  - Increased time spent eating
  - Longer meal length
  - More sorting

- ~5% of energy provided by feed can be used for chewing with higher NDF, lower digestibility forages.

[Alhadrami and Huber, 1991]

Dietary forage (% of DM) and behavior responses (Jiang et al., 2017)

<table>
<thead>
<tr>
<th>Item</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, lb/d</td>
<td>49.4</td>
<td>47.4</td>
<td>44.8</td>
<td>41.2</td>
<td>-8.2 lb/d</td>
</tr>
<tr>
<td>Eating, min/d</td>
<td>286</td>
<td>292</td>
<td>342</td>
<td>393</td>
<td>+107 min/d</td>
</tr>
<tr>
<td>Rumination, min/d</td>
<td>426</td>
<td>454</td>
<td>471</td>
<td>461</td>
<td>+35 min/d</td>
</tr>
<tr>
<td>Total chewing, min/d</td>
<td>712</td>
<td>745</td>
<td>813</td>
<td>853</td>
<td>+141 min/d</td>
</tr>
<tr>
<td>Resting, min/d</td>
<td>728</td>
<td>695</td>
<td>627</td>
<td>587</td>
<td>-141 min/d</td>
</tr>
</tbody>
</table>

✔ Corn silage-based rations
✔ Increased chewing time (mostly longer eating time) at expense of resting

Forage NDF, uNDF, and time spent eating...

<table>
<thead>
<tr>
<th>Item</th>
<th>Low CCS</th>
<th>High CCS</th>
<th>Low BMR</th>
<th>High BMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>53% forage</td>
<td>49%</td>
<td>35%</td>
<td>50%</td>
<td>71%</td>
</tr>
<tr>
<td>67% forage</td>
<td>43%</td>
<td>36%</td>
<td>71%</td>
<td>95%</td>
</tr>
<tr>
<td>49% forage</td>
<td>36%</td>
<td>31%</td>
<td>71%</td>
<td>91%</td>
</tr>
<tr>
<td>64% forage</td>
<td>44%</td>
<td>39%</td>
<td>81%</td>
<td>105%</td>
</tr>
<tr>
<td>TMR NDF, % of DM</td>
<td>32.1</td>
<td>35.6</td>
<td>31.5</td>
<td>35.1</td>
</tr>
<tr>
<td>TMR 24-h NDF, %</td>
<td>56.3</td>
<td>54.0</td>
<td>62.0</td>
<td>60.3</td>
</tr>
<tr>
<td>uNDF240h, % of DM</td>
<td>8.2</td>
<td>9.6</td>
<td>6.9</td>
<td>7.6</td>
</tr>
</tbody>
</table>

- Higher forage diets with slower fermenting forage-NDF take longer to process.
- Time budget challenge when overstocked at feed bunk or mixed parity pens.

Particle size of ingested feed (Schadt et al., 2011)

<table>
<thead>
<tr>
<th>Item</th>
<th>% NDF</th>
<th>Feed, mm</th>
<th>Bolus, mm</th>
<th>Chews / g NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMR</td>
<td>37.7</td>
<td>13.1±</td>
<td>0.2</td>
<td>12.5±</td>
</tr>
<tr>
<td>Grass silage</td>
<td>53.1</td>
<td>13.8±</td>
<td>0.3</td>
<td>11.6±</td>
</tr>
<tr>
<td>Corn silage</td>
<td>48.1</td>
<td>12.0±</td>
<td>0.3</td>
<td>11.2±</td>
</tr>
<tr>
<td>1.18 PSPS hay</td>
<td>54.2</td>
<td>9.7±</td>
<td>0.2</td>
<td>8.1±</td>
</tr>
<tr>
<td>8-mm PSPS hay</td>
<td>59.1</td>
<td>25.1±</td>
<td>0.2</td>
<td>10.8±</td>
</tr>
<tr>
<td>19-mm PSPS hay</td>
<td>57.9</td>
<td>43.5±</td>
<td>1.3</td>
<td>10.7±</td>
</tr>
<tr>
<td>50-mm rye “hay”</td>
<td>58.6</td>
<td>42.2±</td>
<td>2.7</td>
<td>9.9±</td>
</tr>
<tr>
<td>Long rye grass hay</td>
<td>57.1</td>
<td>...</td>
<td>...</td>
<td>10.9±</td>
</tr>
</tbody>
</table>

- Higher forage diets with slower fermenting forage-NDF take longer to process.
Corn Silage Particle Size

- Ferraretto and Shaver (2012) meta-analysis; 24 peer reviewed articles
  - TLOC range: 0.48 to >3.2 cm (0.18 to >1.25 in)
  - TLOC had minimal effect on DMI, milk yield, and digestibility
- Particle size has minimal impact on rumination and milk fat% in most studies.

Suggested PSPS targets: Miner Institute (2017)

<table>
<thead>
<tr>
<th>Sieve mm</th>
<th>POPS 2013 %</th>
<th>Miner 2017 %</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 19</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>Sortable material, too long, increases time needed for eating; especially if &lt;10%</td>
</tr>
<tr>
<td>Mid 1 8</td>
<td>30-50</td>
<td>&gt;50</td>
<td>Still long and functional pef, more so than 4 mm material. Maximize amount on this sieve 50-40%</td>
</tr>
<tr>
<td>Mid 2 4</td>
<td>10-20</td>
<td>10-20</td>
<td>Functions as pef sieve, no recommendation for amount to retain here other than total on the top 3 sieves = pef</td>
</tr>
<tr>
<td>Pan ---</td>
<td>30-40</td>
<td>25-30</td>
<td>40-50% grain diet results in at least 25-30% in the pan</td>
</tr>
</tbody>
</table>

Optimize starch digestibility of corn silage

➢ <3% fecal starch is the goal

Importance of starch for corn silage digestibility (Owens, 2005)

For typical corn silage ~65% of digested nutrients comes from starch
Starch is important!

Contributions to Corn Silage True Digestion

- Very high grain corn silage
- Typical corn silage
- Low grain corn silage
Important factors determining starch availability (Hoffman, 2008)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Correlation with starch availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle size</td>
<td>-0.70</td>
</tr>
<tr>
<td>Moisture</td>
<td>-0.53</td>
</tr>
<tr>
<td>Endosperm type</td>
<td>-0.46</td>
</tr>
</tbody>
</table>

- Maturity at harvest
- Length of time in fermented storage

Optimizing corn silage starch digestion

- All kernels crushed and broken, especially silage >33 to 35% DM
- 0.75-in (19 mm) TLC, 2-3 mm roller clearance; Penn State Particle Separator
  - 10-15% top screen
  - 50+% second screen
  - <35% pan
- Corn silage processing score – use it!

Corn Silage Processing Score

Corn silage processing score = % starch passing through 4.75-mm screen

- >70% = optimal processing
- 50-70% = average
- <50% = inadequate (too coarse)

Corn Silage Processing Score

Corn silage processing score = % starch passing through 4.75-mm screen

- >70% = optimal processing
- 50-70% = average
- <50% = inadequate (too coarse)

CPS and fecal starch

(Braman and Kurtz, 2015)

\[ y = 12.90487 - 0.15066x \]

Prediction equation: \( y = 12.90487 \pm 0.15066x \) at 0.015

y = fecal starch, \( x = \) kernel processing score, \%
Fecal starch and total tract starch digestibility

\[ \text{Total tract starch dig., } \% = 100 - (1.25 \times \text{fecal starch}) \]
\[ R^2 = 0.94 \]

Fredin et al., 2014

Cows varying in milk yield and stage of lactation vary greatly in response to corn silage digestibility!

Relationship between starch digestibility and milk yield

1%-unit decrease in fecal starch results in 0.7-1.1 lb of milk per day (Firkins et al., 2001; Ferguson, 2006).

Fredin et al. (2014)

High versus low NDF digestibility corn silage hybrids

<table>
<thead>
<tr>
<th></th>
<th>Low NDFd</th>
<th>High NDFd</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, %</td>
<td>36.2</td>
<td>35.7</td>
</tr>
<tr>
<td>NDF, % of DM</td>
<td>45.2</td>
<td>52.8</td>
</tr>
<tr>
<td>Starch, % of DM</td>
<td>25.7</td>
<td>22.5</td>
</tr>
<tr>
<td>48-h NDFd</td>
<td>58</td>
<td>67</td>
</tr>
</tbody>
</table>

(Ivan et al., 2005)
Milk response: all cows

<table>
<thead>
<tr>
<th></th>
<th>Low NDFd</th>
<th>High NDFd</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, lb/d</td>
<td>58.3</td>
<td>59.7</td>
</tr>
<tr>
<td>Milk, lb/d</td>
<td>76.3</td>
<td>78.3</td>
</tr>
</tbody>
</table>

Is this all we get from improved NDF digestibility? (Ivan et al., 2005)

Don’t Forget Fat …

- High corn silage and milk fat depression
  - Rapidly fermented starch
  - Low peNDF?
  - Amount and availability of C18:2

Response to high-NDFD corn silage varies by milk production (Ivan et al., 2005)

Range in Corn Silage C18:2

- Sufficient to cause milk fat depression; consider hybrid and amount in diet (Harvatine, 2016)
  - 30-54% corn silage in diet DM
  - 0.9 to 1.6% C18:2 in corn silage (% of DM)
  - 90 g/d variation based on normal CS hybrids and amounts in the diet
- How available is the FA?
  - Germ proteins protect the oil
  - Ensiling: breakdown and hydrolysis occurs, poor fermentation, yeast and ethanol effects?
Concepts to understand: Making milk from corn silage...

- NDF and NDF digestibility
- Time at the feed bunk
- Starch and starch digestibility
- Corn Silage Processing Score
- Particle size
- Properly allocate the silage

Thank you!
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