Considerations for Developing non-GMO Dairy Rations

DR. L. E. CHASE
CORNELL UNIVERSITY

Thanks To:

Jennifer Simpson  Rick Canfield
Alex Lundstrom  Ashley Audet
Chip Hyde  Bella Stahl
Dan Button  Dave Gast
Jeff Tikofsky  Joe Lawrence

Background

- There are at least 2 dairy processors in the U.S. that are sourcing non-GMO milk from dairy farms (Dannon, Fage).
- Primary use is for yogurt production.
- There are a number of New York and Northeast dairy farms that are changing cropping programs to transition to non-GMO forages for feeding their herds.
- It is unclear how much the demand for non-GMO milk will grow.
- This is a market differentiation approach.

Special Thanks To:

Kiira Heyman
Heather Walker
What Does Science Say?

- Dr. A. L. Van Eenannam – University of California – Davis:
  - Data from >100 studies feeding GE crops did not reveal unfavorable or perturbed trends in livestock health and productivity.
  - Genetically engineered crops are digested in animals in the same way as conventional crops.
  - Genetically engineered DNA, or the novel proteins encoded therein have never been detected in the milk, meat or eggs derived from animals fed genetically engineered feedstuffs.
  - There is no reason to suspect that genetically engineered DNA will behave any differently than any other sources of DNA.

National Academy of Science – 2017

“There was no substantial scientific evidence that foods from GE crops were any less safe when compared to foods from non-GMO crops”

The Other Side of the Coin

- To date, there have been no epidemiological studies investigating the effects of GMO food on human health.
- A comprehensive review of peer-reviewed animal feeding studies of GMO's found a roughly equal number of research groups raising concerns about GE foods and those suggesting that GMO's are safe.
- Most studies finding GMO's safe were performed by biotechnology companies or their associates.
- A growing body of evidence connects GMO's with health problems and environmental damage.

Who is Setting the Standards?

- The Non-GMO Project.
- Publishes a standard publication.
- Most recent was September 22, 2017.
- Not sure how much they really understand animal agriculture.
- Seem receptive to interaction.
Verified Products Must Have Systems in Place For
- Testing
- Traceability
- Segregation
- Formulation
- Labeling
- Quality assurance

Key Questions
- How does going non-GMO affect:
  - Available forages and feeds.
  - Ration formulation strategy.
  - Herd management.

GM and Isogenic Corn Hybrids
- Meta-analysis.
- Compared nutrient composition and milk production.
- Studies used had a GM corn hybrid and its isogenic hybrid.
- 21 means for isogenic 13 means for GM hybrids

### Nutrient Composition

<table>
<thead>
<tr>
<th>Item</th>
<th>Isogenic Hybrids</th>
<th>GM hybrids</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP, % of DM</td>
<td>8</td>
<td>8</td>
<td>0.88</td>
</tr>
<tr>
<td>NDF, % of DM</td>
<td>39.2</td>
<td>40.4</td>
<td>0.10</td>
</tr>
<tr>
<td>Lignin % of DM</td>
<td>2.6</td>
<td>2.7</td>
<td>0.73</td>
</tr>
<tr>
<td>Starch, % of DM</td>
<td>34.5</td>
<td>33.1</td>
<td>0.02</td>
</tr>
<tr>
<td>Ash, % of DM</td>
<td>4.8</td>
<td>4.8</td>
<td>0.79</td>
</tr>
</tbody>
</table>
Animal Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Isogenic Hybrids</th>
<th>GM Hybrids</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI lbs.</td>
<td>53.5</td>
<td>53.5</td>
<td>0.55</td>
</tr>
<tr>
<td>Milk, lbs.</td>
<td>77.0</td>
<td>76.6</td>
<td>0.50</td>
</tr>
<tr>
<td>3.5% FCM, lbs.</td>
<td>78.3</td>
<td>77.7</td>
<td>0.38</td>
</tr>
<tr>
<td>Milk fat, %</td>
<td>3.62</td>
<td>3.61</td>
<td>0.67</td>
</tr>
<tr>
<td>Milk true protein, %</td>
<td>3.19</td>
<td>3.19</td>
<td>0.58</td>
</tr>
<tr>
<td>MUN, mg/dl</td>
<td>17.1</td>
<td>17.1</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Ingredient Classes

- **Major** - > 5% of total ration DM. Must be verified or tested.
- **Minor** - At least 0.5% but <5% of total ration DM. Are exempt from evaluation. Can use multiple minor ingredients.
- **Micro** - <0.5% of total ration DM. Any added nutrient, vitamin or other active compound = non-GMO.
- As of May 2019, all minor and micro ingredients in livestock feeds are exempt from evaluation.

Example Dairy Ration

<table>
<thead>
<tr>
<th>Feed</th>
<th>Lbs. of DM</th>
<th>% in Ration DM</th>
<th>GMO</th>
<th>Non-GMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMR CS</td>
<td>12.2</td>
<td>22</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Conv. CS</td>
<td>9.25</td>
<td>17</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Alfalfa haylage</td>
<td>8</td>
<td>14</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Corn grain</td>
<td>10</td>
<td>18</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SBM</td>
<td>1.9</td>
<td>3.6</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>Soy hulls</td>
<td>2.2</td>
<td>4</td>
<td>X</td>
<td>x</td>
</tr>
</tbody>
</table>

Example Ration - 2

<table>
<thead>
<tr>
<th>Feed</th>
<th>Lbs. DM</th>
<th>% of Ration DM</th>
<th>GMO</th>
<th>Non-GMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola meal</td>
<td>1</td>
<td>Feed</td>
<td>Lbs. DM</td>
<td>% of Ration DM</td>
</tr>
<tr>
<td>Roasted soybeans</td>
<td>2.5</td>
<td>4.6</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Expeller SBM</td>
<td>2.5</td>
<td>4.6</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bypass fat</td>
<td>0.5</td>
<td>0.9</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Min-vit</td>
<td>2.3</td>
<td>4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPAA</td>
<td>0.05</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Non-GMO Feeds Available (if verified or tested)
- Corn, hominy, distiller’s, CGF, CGM.
- SBM, expeller SBM, soy hulls, roasted soybeans.
- Beet pulp.
- Canola meal, expeller canola meal.
- Alfalfa pellets.
- Sunflower meal.
- Linseed meal.

Non-GMO Feeds - 2
- Wheat, oats and barley grains and their processed products should be non-GMO since there are no GE varieties of these grains.
- There has been an increase in number and availability of non-GMO feeds in the last year or so.

Soybean Example
- There are non-GMO soybean varieties available.
- There has been difficulty in getting large quantities of non-GMO soybean products.
- One reason is a lack of a consistent supply of non-GMO beans.
- A second reason is the segregation requirement -
  - Either a dedicated processing facility.
  - Or a complete clean out of an existing facility.
- An estimate is that non-GMO SBM is priced at $100-150/ton > GM SBM.

Testing
- There are about 8 labs in the U.S. approved for testing non-GMO ingredients.
- Testing is done using PCR techniques.
- Strip tests are available for on-farm testing of corn, cotton, alfalfa and soybeans.
Feed Companies
- The best situation would be to source ingredients that have been tested, verified and have documentation to verify this.
- If an ingredient is sourced that doesn’t have this, it must be stored separately sampled and samples sent for testing.
- It cannot be used until test results are returned and product is verified and approved.
- This may take 1-2 weeks.
- If it doesn’t meet test requirements then it cannot be used in non-GMO rations.

What Records Are Required?
- Forage and feed purchases -
  - Supplier and date of purchase.
  - Quantity purchased and storage location.
  - Save invoices, feed tags, weight slips and information on forage seed bags.
- Verification – Requires letters from suppliers if they are providing non-GMO certified products.
- Feed ingredients -
  - GMO or non-GMO status of each feed must be recorded.

Forages
- Track the hybrids or varieties purchased.
- Field maps as to where planted.
- Planting and harvest dates.
- Quantity harvested and storage location.
- Segregation.
- Aerial maps of storage facilities?

Rations
- The quantity of each feed in the ration needs to be recorded.
- List of GMO and non-GMO ingredients in the ration.
- Percent of the ration dry matter from each feed.
- Actual dry matter intakes are needed.
- Need to track quantity of feed fed and refusals.
- Adjustments for forage dry matter changes.
- Best way to do this is the use of an electronic feed management system.
Herd Management

- Dairy calves – no changes to current feeding programs.
- Heifers – Can be fed GM based rations for most of the growing period. However, they must be fed a non-GMO ration for at least 30 days before milk can be verified as non-GMO. This may require a change in heifer housing and rations. What if she calves early?
- Dry and lactating cows – Must feed non-GMO rations continuously once they have calved for the first time.

3rd Party Verification

- There are 4 companies currently approved as 3rd party auditors.
- In general, they use the Non-GMO Project Standards as the base.
- However, the may also have some variation in the interpretation of the standards and auditing procedures (similar to milk inspectors).
- It is imperative for the feed company and/or dairy producer to know who the 3rd party auditing firm is and what their specific standards and guidelines are.

Third Party Verification

- Each milk processor will contract with a 3rd party firm to conduct audits and verification.
- Need to know the specific requirements from the specific 3rd party auditor working with your farms.
- The basic requirement is to have the records and documentation required by the 3rd party auditing firm.
- May include on-farm audits and visits.

Traceability Example – Corn Silage Hybrid

1. Seed purchased should be non-GMO tested and verified by hybrid company.
2. Need to obtain a letter or seed tag information and keep it on file.
3. Need to have records on which fields it was planted on and planting date.
4. Need a record of any other cultural practices.
5. Need to record harvest date and where the material is stored.
6. Need to address any segregation concerns.
7. Record feed out data.
8. Might be needed to have aerial photos of storage facility.
Summary

- Non-GMO rations will need to be developed on a number of New York and Northeast dairy farms.
- Ration feed cost will be increased due to higher ingredient costs.
- Ration formulation parameters will be similar to what you currently use.
- Increased management time will be needed on the farm to do the record keeping required to meet the non-GMO requirements.
- There needs to be a milk pricing contract that provides a premium to the farm to cover added costs.
- It will take time to get the whole forage and feed supply chain in place.

Thanks!