ALFALFA BREEDING AND TRAIT DEVELOPMENT

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ALFALFA BREEDING AND TRAIT DEVELOPMENT

- Variety Development
  - Yield
  - Disease Resistance
  - Persistence
- Reduced Lignin
- Salt Tolerance
Spaced plant nurseries are used to evaluate vegetative vigor of individual alfalfa plants.

Vigor notes are taken each cutting on 100,000’s of plants.

Breeding nurseries are normally evaluated for a period of 3-5 years.

Selection from long term nurseries has been successfully used to improve both forage yield potential and persistence.
Small plot replicated trials are used to evaluate forage yield of alfalfa varieties and experimentals.

Trials are managed according to local recommended practices (i.e. seeding rate, fertility).

Varieties are normally evaluated at several locations to look at stability of yield over environments.

Forage yield is generally measured for a period of 3-4 years.
ALFALFA FORAGE TESTING

Research Stations:
Mt. Joy, PA
West Salem, WI
Boone, IA
Nampa, ID
Touchet, WA
Davis, CA
Western Testing

1. High forage yield and forage quality.
2. Good winterhardiness and persistence are important in certain regions.
3. Resistance to Stem Nematode is critical for good persistence in this region.
4. Two to Five harvests are “typical” over most of this region.
Breeding for Improved Persistence

Seedlings that survive sequential screening to key diseases are used to establish spaced plant breeding nurseries.

All breeding nurseries are cut on an aggressive schedule to increase stress and encourage stand decline.

Persistent selections are made after the fourth or fifth winter after check varieties have thinned significantly.
Major Pests in Alfalfa

- Bacterial Wilt
- Fusarium Wilt
- Verticillium Wilt
- Phytophthora Root Rot
- Aphanomyces Root Rot
- Anthracnose
Major Pests in Alfalfa

- Spotted Alfalfa Aphid
- Pea Aphid
- Blue Alfalfa Aphid
- Cow Pea Aphid
- Potato Leafhopper
- Stem Nematode
- Root Knot Nematode
- Root Lesion Nematode
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- Stem Nematode
- Root Knot Nematode
RESISTANCE RATINGS (% RESISTANT PLANTS)

- HR – High Resistance = 51% or more
- R – Resistance = 31-50%
- MR – Moderate Resistance = 16-30%
- LR – Low Resistance = 6-15%
- S – Susceptible = 0-5%
ALFALFA IS A POPULATION

- An alfalfa variety is made up of a population of genotypes rather than a single genotype (like hybrid corn or soybean varieties).

- Alfalfa is like an extended family. Siblings and cousins may share one or more common grandparents but no two are totally alike.
Fall Dormancy and Winterhardiness

- Fall Dormancy
  - Recovery Rate
  - Production Potential
- Winterhardiness
  - Stand Life
The Traditional Alfalfa Dilemma

Alfalfa products have traditionally been positioned based primarily on fall dormancy.

The later dormant types have generally had higher forage yield potential, but poor persistence.

Alfalfa breeders have made exciting progress improving persistence in alfalfa across all dormancy groups.
LESS DORMANT ALFALFA

✓ Increased plant vigor
✓ Earlier maturity
✓ Faster rates of recovery following harvest
✓ Increased yield potential
  - Lower levels of tolerance to freezing winter temperatures
MORE DORMANT ALFALFA

- Better winter hardiness
- Better persistence
  - Less vigor
  - Less late summer and fall growth
  - Lower forage yield potential
Fall Dormancy and Winterhardiness in Alfalfa

FD/WH closely related in older alfalfa varieties
Breeding progress has greatly changed this relationship
FD4 and FD5 types now persist well in areas not previously adapted offering growers higher forage yield potential without compromising persistence
FACTORS TO CONSIDER IN CHOOSING AN ALFALFA VARIETY

- Forage Yield
- Persistence has a huge impact on forage yield in years 2-4 of the stand.
  - Fall dormancy
  - Winterhardiness
  - Pest Resistance
- Forage Quality
## BALANCING THE YIELD/QUALITY TRADEOFF

<table>
<thead>
<tr>
<th>Harvest Maturity</th>
<th>Days at Harvest</th>
<th>TDN %</th>
<th>Yield (DM T/A)</th>
<th>Stand %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Bud</td>
<td>1</td>
<td>56.3</td>
<td>7.5</td>
<td>29</td>
</tr>
<tr>
<td>Mid-Bud</td>
<td>25</td>
<td>54.2</td>
<td>8.8</td>
<td>38</td>
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<tr>
<td>10% Bloom</td>
<td>29</td>
<td>52.4</td>
<td>9.9</td>
<td>45</td>
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<tr>
<td>50% Bloom</td>
<td>33</td>
<td>52.0</td>
<td>11.4</td>
<td>56</td>
</tr>
<tr>
<td>100% Bloom</td>
<td>37</td>
<td>50.1</td>
<td>11.6</td>
<td>50</td>
</tr>
</tbody>
</table>

RELATIVE FORAGE YIELD AND QUALITY AT DIFFERENT ALFALFA GROWTH STAGES.

Source: Balancing Yield, Quality and Persistence. Steve Orloff and Dan Putnam 2004 Proceedings CA Alfalfa Symposium
APPROACHES TO BALANCING YIELD AND QUALITY

1. Agronomic Approach
   1. Timing of Harvest
   2. Fall dormancy

2. Plant Breeding Approach – select for:
   1. Multifoliolate Leaf Expression
   2. NIRS
   3. Gene Silencing (Lignin Pathway)
Reduced Lignin Alfalfa