Roundup-ready, Low Lignin and Other New Traits Alfalfa's Future

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Value of Roundup Ready Alfalfa in Seeding Year

- Less herbicide damage
- Herbicide cost is less
- Ease of herbicide use
- Control winter annuals weeds and other special problems
## Performance of Roundup Ready Alfalfa Varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Marshfield 2006</th>
<th>Lancaster 2006</th>
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<tbody>
<tr>
<td></td>
<td>Roundup</td>
<td>Conventional</td>
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<tr>
<td>425RR</td>
<td>1.91</td>
<td>1.68</td>
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<tr>
<td>4G418RR</td>
<td>2.00</td>
<td>1.76</td>
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<tr>
<td>6443RR</td>
<td>2.04</td>
<td>1.61</td>
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<tr>
<td>DKA41-18RR</td>
<td>1.82</td>
<td>1.71</td>
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<td>Liberator RR</td>
<td>1.95</td>
<td>1.72</td>
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<td>WL 355 RR</td>
<td>2.02</td>
<td>1.74</td>
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<tr>
<td><strong>Trial mean</strong></td>
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<td>1.68</td>
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</tbody>
</table>
Seeding year yield advantage of Roundup Ready Alfalfa

The average yield advantage has been 0.20 t/a.
New Potential – establish alfalfa with oats or ryegrass

Procedure:
- Seed alfalfa with oats or ryegrass
- Spray nurse crop with 4 to 6”

Benefits:
- Erosion control benefits of nurse crop
  - weed control
  - soil dry down
- Yield and quality of solo alfalfa
Value of Roundup Ready Alfalfa in Seeding Year

- Less herbicide damage
  - Up to 0.6 t/a yield advantage of RR alfalfa over same varieties treated with Pursuit or Raptor

- Herbicide cost is less

- Ease of herbicide use
  - Using same herbicide as for other crops
  - Broader window of application

- Control winter annuals and other special problems
Concerns about RR Alfalfa and RR resistant weeds

- Glyphosate resistance has been reported in approximately a dozen weeds
- Including RR alfalfa in rotation with row crops will generally enhance weed control because some weeds cannot tolerate the frequent defoliation of a forage crop
- The key to minimizing development of resistant weed populations and weed shifts will be the recommended stewardship:
  - multiple herbicides in rotational systems
  - combined multiple mechanical controls such as preplant tillage and frequent mowing of alfalfa.
Value of Low Lignin

- Provides strength to plants
- Allows the plant vascular system to transport water in the plant without leakage.
- Increases with advanced maturity in alfalfa
- Is indigestible and reduces fiber digestibility
Planted at 5 locations to determine response in harvest system
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Yield and Quality Curve of Alfalfa

- **Percent of Maximum Yield or Quality**
- **Days of Regrowth**

- **Low Lignin Quality**
- **Forage Quality**
- **Yield**

Graph showing the relationship between days of regrowth and percent of maximum yield or quality for alfalfa, highlighting different quality metrics.
# 3 vs 4 cutting by Sept 1 - effect on alfalfa yield, Arlington, Wisconsin

<table>
<thead>
<tr>
<th>Year</th>
<th>1st cutting</th>
<th>2nd cutting</th>
<th>3rd cutting</th>
<th>4th cutting</th>
<th>Season Total</th>
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<tbody>
<tr>
<td>2nd year</td>
<td>3 cut</td>
<td>2.97</td>
<td>2.43</td>
<td>2.15</td>
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<td>4 cut</td>
<td>1.66</td>
<td>1.48</td>
<td>1.71</td>
<td>1.68</td>
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<tr>
<td>3rd year</td>
<td>3 cut</td>
<td>2.32</td>
<td>1.53</td>
<td>1.24</td>
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<td>4 cut</td>
<td>1.31</td>
<td>1.18</td>
<td>0.75</td>
<td>0.83</td>
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</tbody>
</table>

17% 25%

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Summary of Low Lignin GMOs

- Low lignin lines had lower lignin and higher fiber digestibility.
- The CCOMT line stood (lack of lodging) as well in space plantings at the commercial alfalfa line.
- Low lignin lines could be harvested later to get the same quality as standard lines but at higher yields.
Other biotech traits for alfalfa

- Elevated bypass protein
  - Tannins
  - Polyphenyl Oxidase
- Drought tolerance
- Leaf retention
- Delayed flowering
- Improved disease resistance