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The Value of a Better Variety
How much is an extra ton of alfalfa worth?

Over the past 10 years, the **BEST** has **YIELDED MORE** than Vernal:

- ~1.0-2.0 tons/yr - Southern MI and Thumb
- ~0.5 tons/yr - Northern MI and UP

Current alfalfa hay price ~ \$ 150/ton in Michigan

- **+ 1 ton/acre/yr X 3 yrs = +\$450 (S. MI) / \$225 (N)**
- **3 tons of hay is +\$ 113/acre/yr (S. MI) / \$57 (N)** over four years (3 production years plus seeding year)

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Disease Resistance Ratings, Winterhardness, & Fall Dormancy



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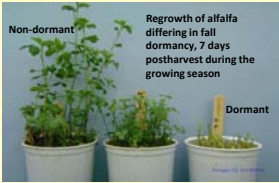
FALL DORMANCY (FD) RATING = tendency to stop growing as daylength and temperature decrease

- Rated as 1= extremely dormant to 11= extremely non-dormant
- Michigan – FD rating 2 to 6 recommended (2 to 4 for UP)
- Lower FD score also reduces spring and summer regrowth rate
- Trade-off: faster regrowth (higher FD score) allows more cuttings per year and greater total yield for early stand years, but often reduces stand life

WINTER SURVIVAL INDEX (WSI)

- Winter hardiness is not as tightly linked to fall dormancy trait as previously thought
- WSI rates varieties from 1 (superior survival) to 6 (no survival)

“Annual alfalfa” is simply non-dormant plus poor winter survival



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Yellow-Flower Alfalfa Update



Released in 2015 as ‘Sholty’ (SDSU, NRCS, and MSU) Foundation seed fields planted in 2015 in South Dakota

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What’s the Scoop on Reduced Lignin Alfalfa?



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Why do we care how much lignin is in forage?

Lignin has negative nutritional value


- Greater lignin decreases forage digestibility through physical interference with fermentation
- Cell wall, including lignin, increases as forage plants mature
- Proportion of lignin increases faster than digestible cell wall components
- Alfalfa typically contains 5-14% lignin

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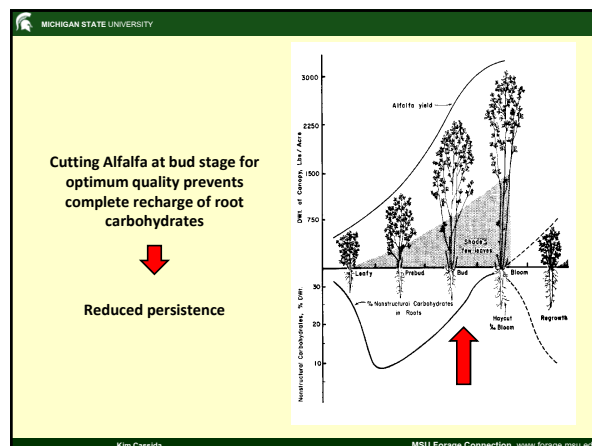
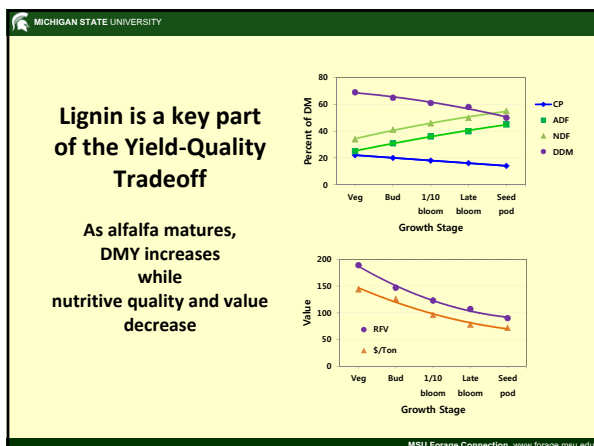
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What is lignin?

- Lignin is a phenolic secondary compound found in plant cell walls
- Cell walls consist of a framework of cellulose and hemicellulose strands in a matrix of lignin
- Lignin is required for plant function & survival
 - Gives rigidity and strength to cell wall
 - Contributes to normal growth patterns
 - Enhances water transport in plant by reinforcing xylem vessels
 - May help reduce water content of cell walls
 - Provides resistance to attack by pests & diseases



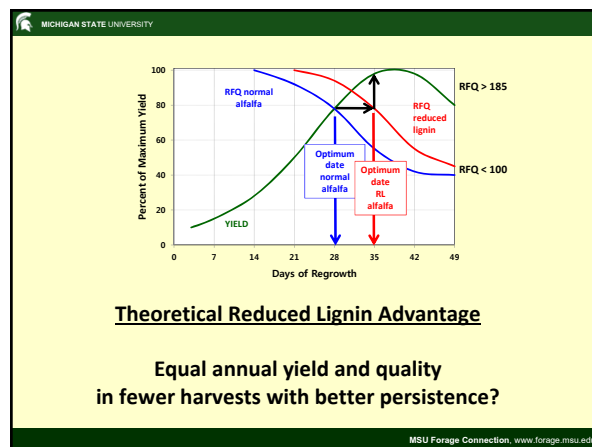
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Development of Reduced Lignin Alfalfa

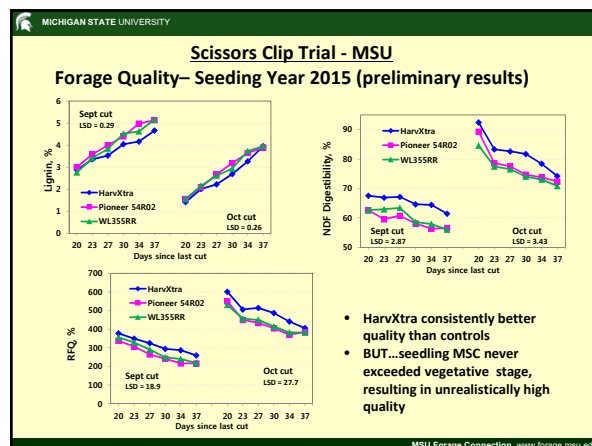
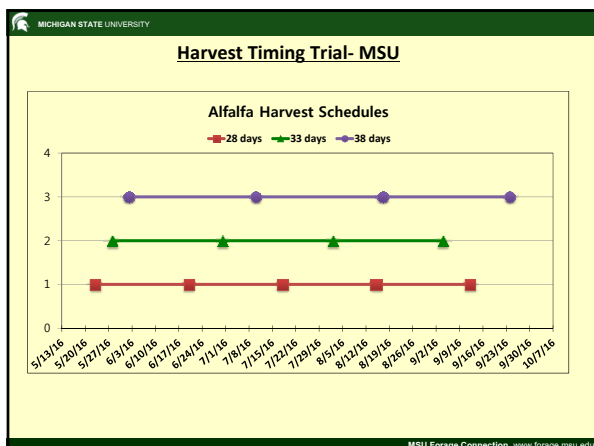
Variety name	Hi-Gest	HarvXtra
Development and Marketing Team	Alforex Seeds (Dow Agrosciences)	Forage Genetics Int'l Monsanto Noble Foundation ARS Dairy Forage Lab
Origin	Conventional breeding	GMO (turn OFF existing gene)
Stacked traits	None	Roundup Ready
Seed Availability	2015 (Limited supply)	2016 (Limited supply)
Marketing Claims	7-10% less lignin 7 day longer cut interval	20% less lignin ≥ 7 day longer cut interval ≥ 12 points more RFQ
Technology fee	No	Yes

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- ### Unanswered Questions
- ???
- How will it yield? Is there a yield drag? *Limited plot data*
 - What is the ideal harvest schedule? *7-10 days longer?*
 - Will it lodge? *Small plot data promising*
 - Will there be pest/disease problems? *Limited data*
 - Will lignin reduction be consistent? *Limited data*
 - How will it feed? Will there be enough effective fiber? Are ration adjustments needed? *Limited animal feeding data*
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- ### Reduced-lignin Alfalfa Research at MSU
- Sponsored by FGI
- 5 states participating – CA, KS, MI, PA, WI
 - HarvXtra and two RR-ready controls
 - Planted May 22, 2015
 - Seeding year data collected in 2015 (2 regrowth cuts)
- Trial 1 – Harvest Timing
- Harvest at 28, 33, or 38-d intervals
 - Yield and quality measured
- Trial 2 – Scissors Clip Trial
- Harvested six times from 20 to 37 d of growth
 - Forage quality measured
-
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Harvest Timing Trial- MSU

Forage Yield – Seeding Year 2015 (preliminary results)

Harvest schedule timing did not affect DMY in the seeding year

- all DMY relatively low

Reduced lignin variety yielded ~15% less than controls in both cuttings

Variety	Cut 2 (Sept)	Cut 3 (Oct)	Total
	----- tons/acre -----		
Pioneer 55R02	1.12a	0.58a	1.67a
WL355RR	1.07a	0.53a	1.59a
HarvXtra008	0.94b	0.42b	1.40b
LSD	0.217	0.029	0.230

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Harvest Timing Trial- MSU

Forage Quality – Seeding Year 2015 (preliminary results)

Reduced lignin variety had consistently better NDFd and greater RFQ than controls in both cuttings. Lignin was reduced only in the Sept cutting.

Vegetative maturity stage resulted in exceptionally high forage quality.

Variety	Cut 2 (Sept)			Cut 3 (Oct)		
	Lignin %	NDFD %	RFQ	Lignin %	NDFD %	RFQ
Pioneer 55R02	4.8a	55.8b	224c	3.26	73.6b	414b
WL355RR	4.5b	57.2b	245b	3.18	74.6b	427b
HarvXtra008	4.0c	63.4a	295a	3.25	76.2a	464a
LSD	0.68	1.86	25	ns	3.66	24

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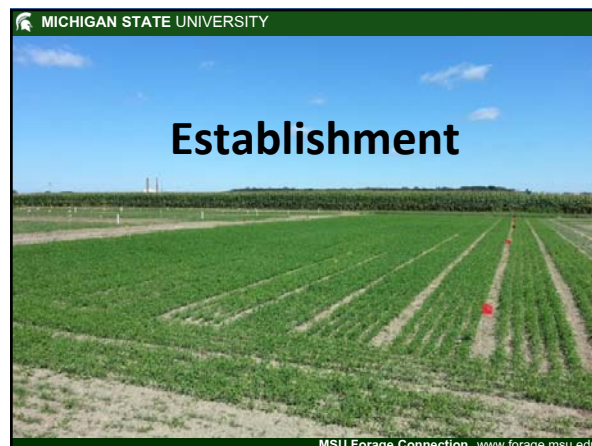
Harvest Timing Trial- MSU

Forage Quality – Seeding Year 2015 (preliminary results)

Lengthening the harvest interval increased lignin while decreasing NDFD and RFQ

Harvest Timing	Cut 2 (Sept)			Cut 3 (Oct)		
	Lignin %	NDFD %	RFQ	Lignin %	NDFD %	RFQ
28 days	3.5c	64.1a	303a	2.8c	76.2a	437ab
33 days	4.7b	56.7b	238b	3.2b	74.9ab	453a
38 days	5.1a	55.5b	222c	3.7a	73.2b	416b
LSD	0.17	1.84	12.4	0.38	3.65	2.2

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Good field sites for Alfalfa are:

1. Well-drained



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Good field sites for Alfalfa are:

1. Well-drained
2. Soil pH > 6.8
3. Deep soil
4. Good fertility (K, P, S, B)
5. No autotoxicity

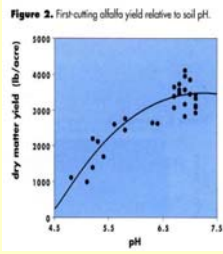


Figure 2. First-cutting alfalfa yield relative to soil pH.

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Autotoxicity

Alfalfa is toxic to its own seedlings

- a. Specific toxic compound unknown (probably a combination of things)
- b. Toxin concentrated in above ground tissue
- c. Toxin is water-soluble, leaches out of soil over time
- d. Soil type affects duration of effect (sandy soil clears faster than heavy soil)
- e. Negative effect persists 2 wk to 3 yr after an alfalfa stand is killed

f. Effects of autotoxicity

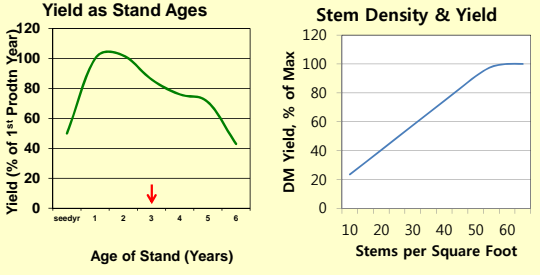
1. Reduced seedling germination within 8-in diameter of a mature (has flowered) alfalfa plant
2. Permanent damage to structure of seedling roots
3. AUTOSUPPRESSION – even if stand looks ok, damaged roots lead to reduced lifetime stand productivity

g. Avoiding problems

1. Don't overseed alfalfa into existing alfalfa stands
2. Safest plan- Rotate out of alfalfa for at least one year before replanting
3. Use tillage to speed toxin breakdown

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Good Establishment is Vital to Stand Productivity



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Alfalfa Seeding Rate

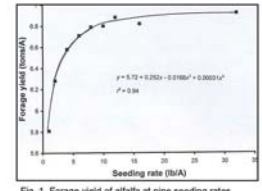


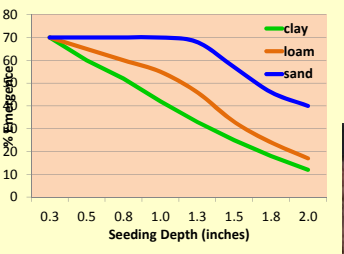
Fig. 1. Forage yield of alfalfa at nine seeding rates averaged over seven best years.

D.W. Meyer. 2008. Seeding Rate Effects in Alfalfa. North Dakota State University


- Plant 12-16 lb/acre
 - ~75 - 120 seeds per square foot
 - Ideal at least 75 seedlings emerged
- No data support economic value (yield, quality, or persistence) for seeding rates > 16 lb/acre
- Plant RR alfalfa at the same seeding rate as conventional alfalfa (Hall et al., 2010; 2012)

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Effect of Seeding Depth on Alfalfa Emergence




Planting too deep is the single most common reason for alfalfa establishment failure



Firm, level seedbed is optimum

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Controlling Null Plants in RR Alfalfa




- A “null” plant does not have the RR trait (up to 10% of seeds)
- In a new seeding, there will be 75-100 plants/ft² and about 8-10 nulls/ft²
- Stand will continually self thin down to 5 plants/ft² at the end of its economic life – you do not want these survivors to be nulls
- Apply glyphosate at or before 4th trifoliate leaf to remove the nulls before they can win the competition with neighbors

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Terminating RR Alfalfa

- Failure to kill RR alfalfa plants is problematic if succeeding crop in rotation is also RR
- Best results in the Forage Program: fall-applied 2,4-D and dicamba combination PLUS tillage



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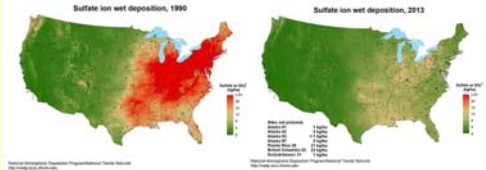
Fertility



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Sulfur

- More than half of Michigan alfalfa stands surveyed by MSUE in 2015 were deficient or low normal in plant tissue sulfur
- Sulfur fertilizer may pay on sandy or low organic matter soils



Maps: National Atmospheric Deposition Program (from www.hayandforage.com, 2015)

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Nutrient Removal by Alfalfa Hay Crop

Nutrient	1 ton alfalfa hay (82% DM)	1 ton alfalfa DM	MI State avg 3.5 ton DM/yr	MSU Variety Test 7 ton DM/yr
K ₂ O	50	61	214	427
P ₂ O ₅	13	16	56	112
S	7	6	21	42

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Does RR Alfalfa need extra TLC?

RRA High Yield Management Trial
Sponsor: Monsanto

Popular criticisms of glyphosate use include:

1. glyphosate-induced tie-up of soil micronutrients
2. increased pathogen pressure on crop

So what happens if we apply extra micronutrients and pesticides?

RESULTS: On fertile soil, apply extra PKS+B, foliar micronutrients, insecticide, fungicide, and Bioforge:

- Nothing improved DMY unless alfalfa was stressed by hot, dry weather in midsummer cuttings
- Did not improve lifetime stand DMY
- Unlikely to be cost effective

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