Alfalfa Establishment: A Pathway to Increased Yield in Pure Stands

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M. SCOTT WELLS

UNIVERSITY OF MINNESOTA

AGRONOMY AND PLANT GENETICS

FORAGE AND CROPPING SPECIALIST

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Forage and variety selection

Varietal trials, forage identification and selection , alfalfa history

Establishment

Seeding rates and dates, stand establishment

Growth and development

Growth and stand evaluation, weather and crop damage

Utilization and management

Hay, silages, pastures and grazing, biomass, stand termination

Soil and water management

Soil properties, benefits to soil, cover crops, irrigation management

Nutrient management

Nutrient guidelines, legume N fixation and credits

Pest management

Diseases, weeds, insects

Organic production

→ Organic Risk Management website for organic and transitioning producers

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Minnesota Field Crop Trials – 2014

The most recent variety performance data for crops

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Forage Quarterly

A quarterly newsletter providing research-based information to Minnesota forage producers and their advisors.

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Current Issue

January 2015, Vol. 2 No. 1 (2.8 MB PDF)

- Double–cropping with a pea–barley forage mixture
- Alternative annual forages
- Sorghum-sudangrass and teff as summer forages for livestock systems
- Stand age affects alfalfa nitrogen credits to first–year corn
- Winter feeding tips for horse owners
- Pasture rental and lease

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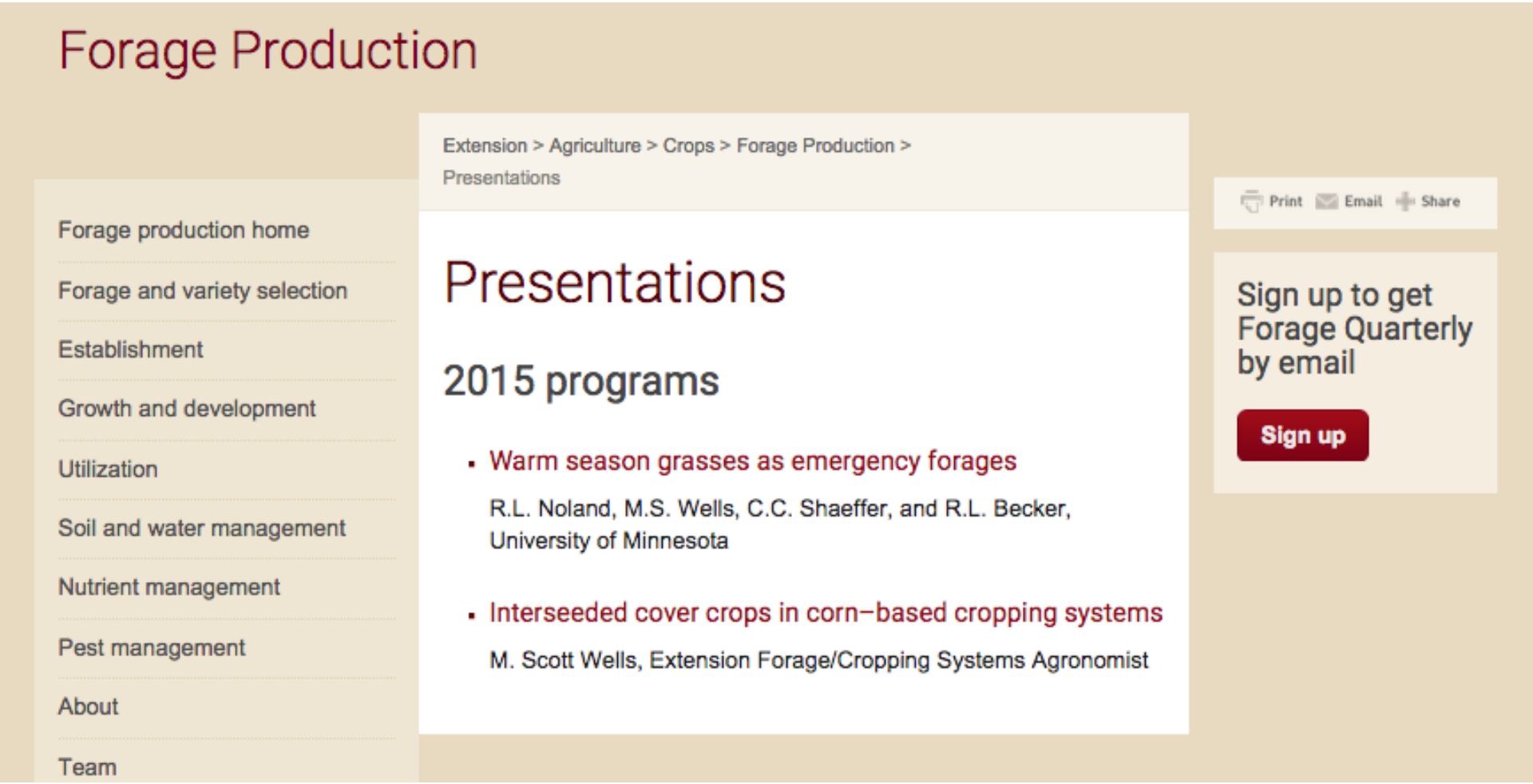

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2014 Field Crop Trials Results

Originally published in December 2014, the 2014 Field Crop Trials include results for: alfalfa, barley, canola, corn grain, corn silage, oat, soybean, spring wheat, and winter wheat.

All the data is presented in PDF format. If you are having difficulty opening the files download Adobe Reader.

Forage Crops:

- Alfalfa
- Corn Silage

Forages for "U" workshops

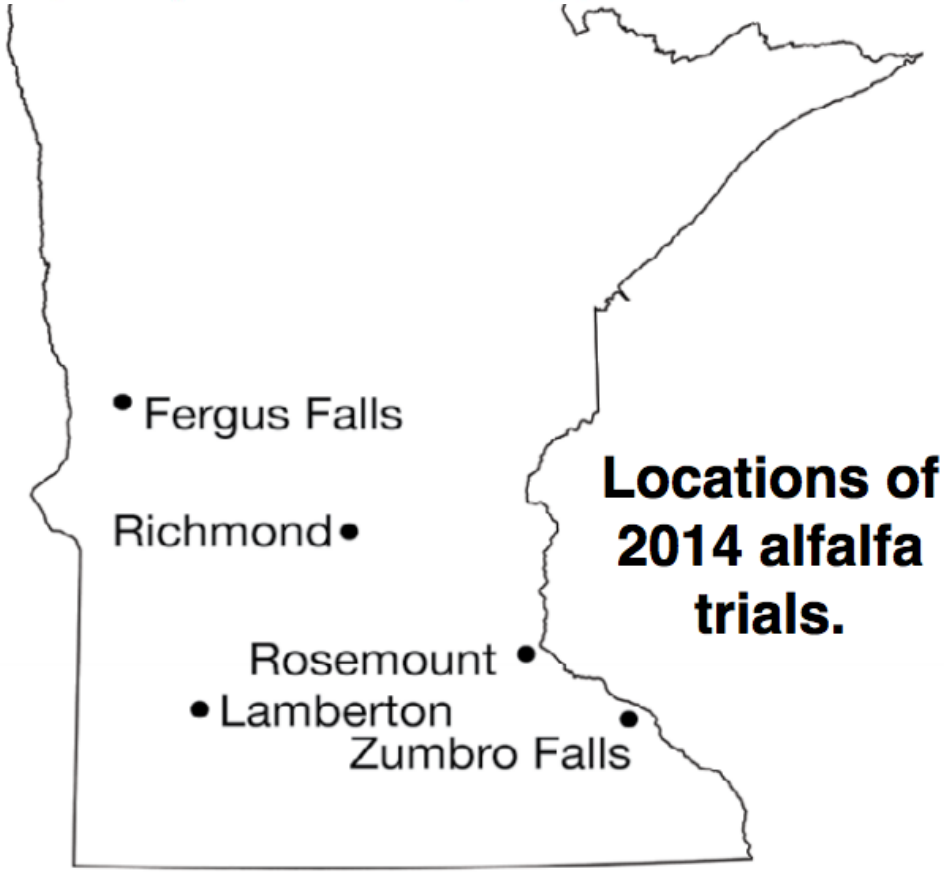
Forage production topics for today's producers

Minnesota Field Crop Trials – 2014

The most recent variety performance data for crops

2014 Alfalfa Field Crop Trials Results

Minnesota Agricultural Experiment Station and the College of Food, Agricultural and Natural Resource Sciences



Alfalfa
Planting Rate and Date

Bushel Weight, Pounds.....60

Seeds/Pound.....220,000

Planting Rate, Pounds/Acre
- Alone.....13
- With Grass.....5-10

Planting Rate, Seeds/Sq. Ft.
- Alone.....65
- With Grass.....25-50

Planting Date....Late April-Early May or Late July-Early August

Project Leaders

Craig Sheaffer, M. Scott Wells and Joshua Larson.

Test Plot Managers

Joshua Larson, Steve Quiring, Doug Holen and Tom Hoverstad.

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Table 1. Alfalfa entry yield as percentage of check entries at Rosemount (Dakota County) and Zumbro Falls (Wabasha County).

Entry[1]	Marketer	Rosemount				Zumbro Falls		
		2012 Seeding			2013 Seeding	2012 Seeding		
		2013	2014	2-Year Total	2014	2013	2014	2-Year Total
HYBRIFORCE-2400	**DairyLand**	**—**	**—**	**—**	**100**	**—**	**—**	**—**
MARINER IV	La Crosse	124	120	122	—	—	—	—
HYBRIFORCE-3400	**DairyLand**	**122**	**117**	**120**	**—**	**123**	**131**	**127**
SOLARGOLD	**Renk**	**113**	**116**	**114**	**—**	**108**	**127**	**118**
55V50	**Pioneer**	**118**	**119**	**118**	**107**	**109**	**123**	**116**
HYBRIFORCE-3400QR	**DairyLand**	**120**	**120**	**120**	**—**	**115**	**122**	**119**
DG 4210	**Crop Prod.**	**—**	**—**	**—**	**90**	**—**	**—**	**—**
55Q27	**Pioneer**	**120**	**124**	**122**	**94**	**108**	**124**	**116**
MAGNITUDE	La Crosse	110	116	113	—	—	—	—
FSG 403LR	La Crosse	—	—	—	107	—	—	—
LS 905	Legacy	—	—	—	101	—	—	—
FORAGEGOLD	**Renk**	**119**	**120**	**119**	**95**	**103**	**113**	**108**
55H94	Pioneer	107	109	[illegible]	—	106	106	106
L 455HD	Legacy	—	—	—	97	—	—	—
54QR04	Pioneer	—	—	—	94	—	—	—
54R02	Pioneer	—	—	—	98	—	—	—
9558 SBR	Cornell	—	—	—	99	—	—	—
FSG 424	La Crosse	—	—	—	91	—	—	—
MATRIX	Albert Lea	—	—	—	88	—	—	—
PGI 529	Producer	—	—	—	88	—	—	—
5312	Check	104	104	104	101	106	109	107
ONEIDA VR	Check	104	102	103	97	95	102	98
VERNAL	Check	92	94	93	101	99	90	94
Checks, tons/acre as hay		6.3	6.1	12.4	5.7	5.6	5.8	11.4
LSD 5%		11	8	8	8	15	21	14

[1]Entries are ranked according to their performance across all current trials. **Bold** varieties have been in Minnesota trials for more than 5 site-years.

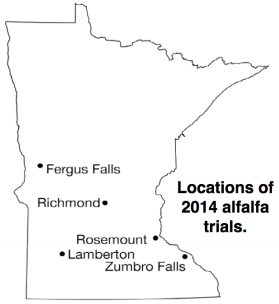

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Table 2. Alfalfa entry yield as percentage of check entries at Richmond (Stearns County) and Fergus Falls (Otter Tail County).

		Richmond					Fergus Falls		
		2011 Seeding				2013 Seeding	2012 Seeding		
Entry[1]	Marketer	2012	2013	2014	3-Year Total	2014	2013	2014	2-Year Total
CONTENDER	Beck's	125	127	127	126	—	—	—	—
402H	Byron Seed	—	—	—	—	125	—	—	—
AMERISTAND 407TQ	America's Alfalfa	123	122	128	124	—	—	—	—
HYBRIFORCE-2400	**DairyLand**	**121**	**113**	**122**	**119**	**120**	**—**	**—**	**—**
HYBRIFORCE-3400	**DairyLand**	**—**	**—**	**—**	**—**	**—**	**124**	**115**	**120**
L-449APH2	Legacy	121	119	122	120	—	—	—	
WL354HQ	**W-L**	**127**	**128**	**134**	**129**	**—**	**—**	**—**	**—**
401B	Byron Seed	—	—	—	—	120	—	—	—
SOLARGOLD	**Renk**	**126**	**129**	**132**	**128**	**—**	**106**	**107**	**106**
Magnum 7	DairyLand	—	—	—	—	117	—	—	—
55V50	**Pioneer**	**129**	**128**	**133**	**130**	**119**	**110**	**115**	**113**
REBOUND 6.0	**Croplan**	**123**	**116**	**128**	**122**	**—**	**—**	**—**	
HYBRIFORCE-3400QR	**DairyLand**	**—**	**—**	**—**	**—**	**—**	**110**	**106**	**108**
LEGENDAIRY XHD	CROPLAN	—	—	—	—	116	—	—	—
DG 4210	**Crop Prod.**	**122**	**119**	**126**	**122**	**124**	**—**	**—**	**—**
PGI 212	**Producer**	**121**	**119**	**120**	**120**	**—**	**—**	**—**	**—**
55Q27	**Pioneer**	**—**	**—**	**—**	**—**	**116**	**—**	**—**	**—**
LS 905	Legacy	—	—	—	—	120	—	—	—
YIELDMAX	Legend	—	—	—		111	—	—	—
FORAGEGOLD	**Renk**	**—**	**—**	**—**	**—**	**114**	**105**	**107**	**106**
L 455HD	Legacy	—	—	—	—	112	—	—	—
9558 SBR	Cornell	—	—	—	—	105	—	—	—
5312	Check	106	107	104	106	103	103	98	100
ONEIDA VR	Check	104	99	102	102	102	98	101	99
VERNAL	Check	90	94	94	92	95	100	101	100
Checks, tons/acre as hay		7.3	5.8	5.0	18.1	5.3	6.5	6.7	13.1
LSD 5%		10	12	10	8	9	11	15	10

[1]Entries are ranked according to their performance across all current trials. **Bold** varieties have been in Minnesota trials for more than 5 site-years.

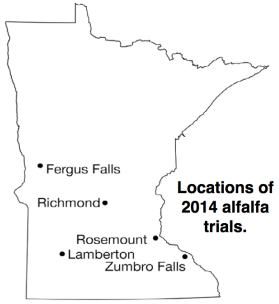

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Table 3. Alfalfa entry yield as percentage of check entries at Lamberton (Redwood County).

Entry[1]	Marketer	2011 Seeding 2012	2013	2014	3-Year Total	2013 Seeding 2014
MAGNUM 7-WET	DairyLand	144	124	117	126	—
SECURE-BR	DairyLand	139	119	114	122	—
HYBRIFORCE-2400	**DairyLand**	**146**	**137**	**119**	**131**	**123**
WL354HQ	**W-L**	**123**	**105**	**104**	**109**	**—**
620	MUSTANG	—	—	—	—	119
SOLARGOLD	**Renk**	**124**	**111**	**106**	**112**	**—**
55V50	**Pioneer**	**110**	**104**	**110**	**108**	**109**
REBOUND 6.0	**Croplan**	**107**	**112**	**111**	**110**	**—**
LEGENDAIRY XHD	CROPLAN	—	—	—	—	114
DG 4210	**Crop Prod.**	**120**	**109**	**110**	**112**	**111**
PGI 212	**Producer**	**108**	**108**	**111**	**110**	**—**
55Q27	**Pioneer**	**—**	**—**	**—**	**—**	**108**
SONIC	NuTech	116	114	108	112	—
FSG 403LR	La Crosse	—	—	—	—	115
FORAGEGOLD	**Renk**	**—**	**—**	**—**	**—**	**102**
520BR	MUSTANG	—	—	—	—	109
L 455HD	Legacy	—	—	—	—	110
54QR04	Pioneer	—	—	—	—	113
9558 SBR	Cornell	—	—	—	—	88
5312	Check	97	105	104	103	99
ONEIDA VR	Check	101	76	90	89	102
VERNAL	Check	102	119	105	109	99
Checks, tons/acre as hay		3.1	3.7	5.7	12.5	3.8
LSD 5%		28	19	18	17	20

[1]Entries are ranked according to their performance across all current trials. **Bold** varieties have been in Minnesota trials for more than 5 site-years.

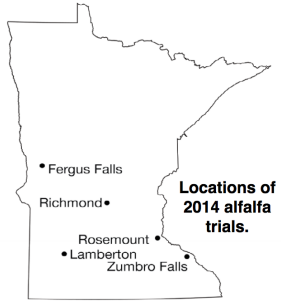

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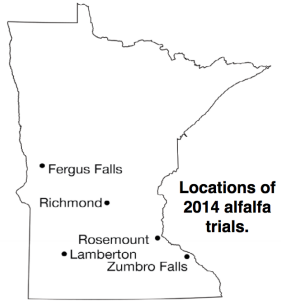
Table 4. Alfalfa Roundup Ready entry yield as percentage of all entries at Richmond (Stearns County).

Entry	Marketer	2011 Seeding 2012	2013	2014	3-Year Total	2013 Seeding 2014
WL 356HQ.RR	W-L	—	—	—	—	103
POWERHOUSE RR	Legend	—	—	—	—	102
54QR04	Pioneer	—	—	—	—	99
AMERISTAND 405T RR	America's Alfalfa	100	103	102	102	—
428RR	La Crosse	—	—	—	—	101
CONSISTENCY 4.10RR	CROPLAN	101	102	98	101	100
54R02	Pioneer	—	—	—	—	101
DKA44-16RR	Dekalb	—	—	—	—	100
YIELDMASTER RR	Jung	—	—	—	—	100
RR STRATICA	CROPLAN	—	—	—	—	99
DKA41-18RR	Dekalb	95	97	98	97	104
6497R	NEXGROW	—	—	—	—	97
MEGAMAXRR	Legend	—	—	—	—	97
AMERISTAND 455TQ RR	America's Alfalfa	—	—	—	—	97
WL 372HQ.RR	W-L	—	—	—	—	97
WL355.RR	W-L	96	94	99	96	—
54VR03	Pioneer	97	94	98	96	—
Average, tons/acre as hay		8.6	6.8	6.0	21.4	6.3
LSD 5%		9	11	ns	8	9



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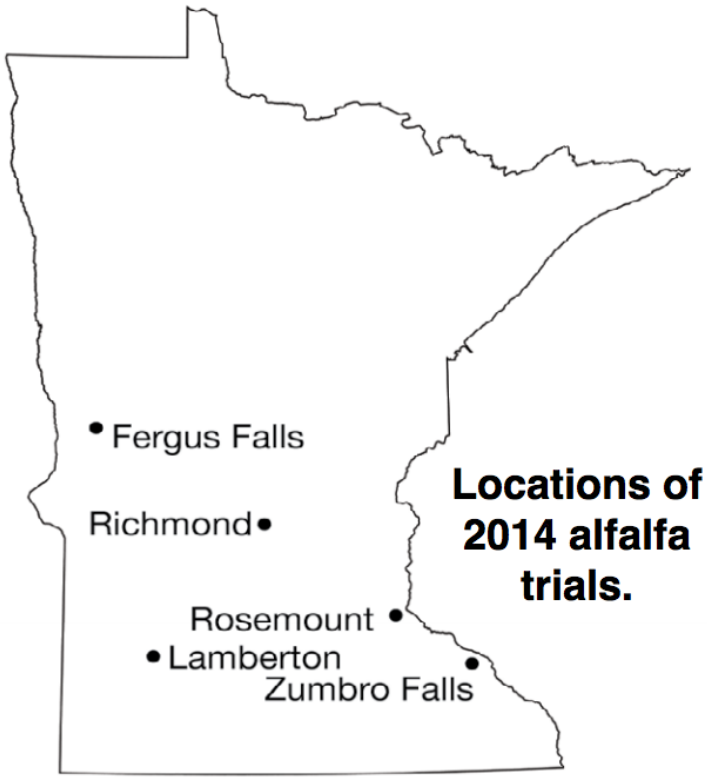

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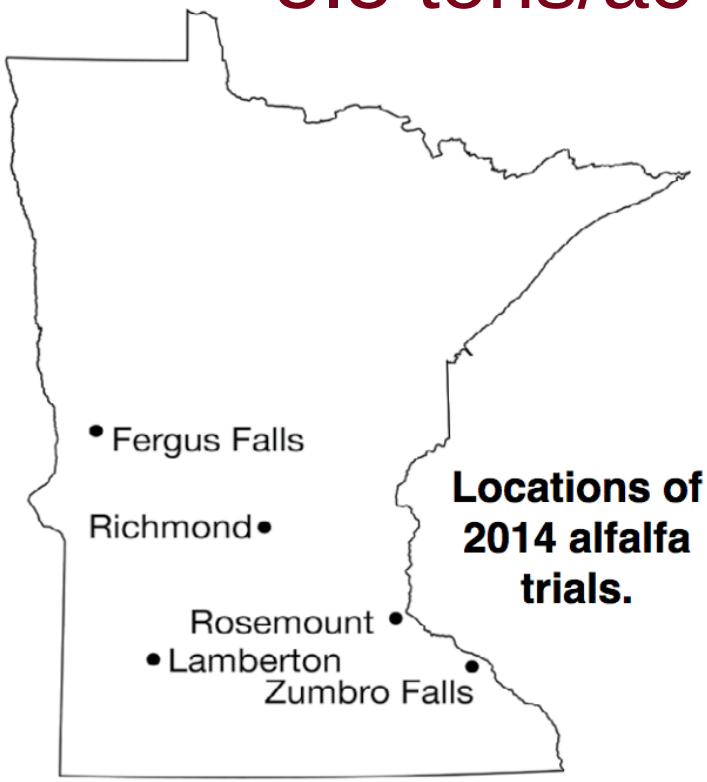
~5.5 tons/ac



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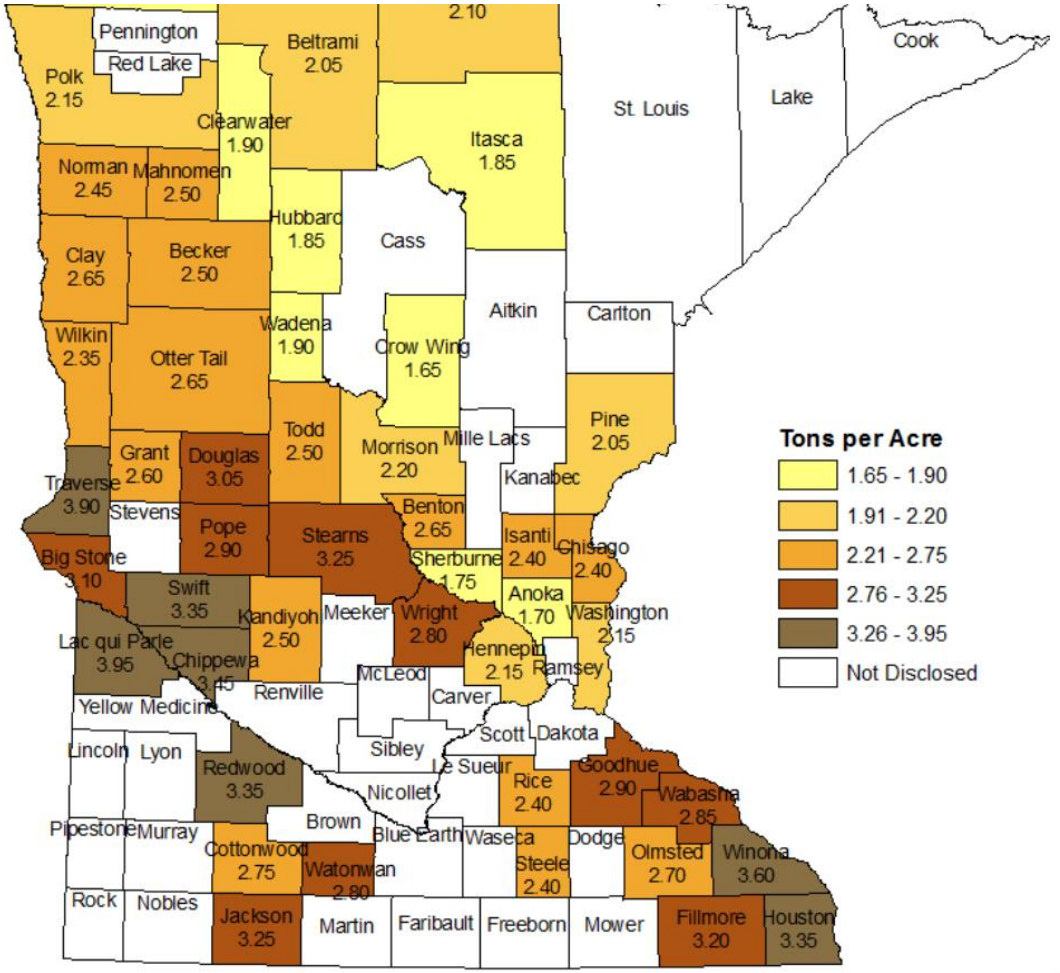
United States Department of Agriculture

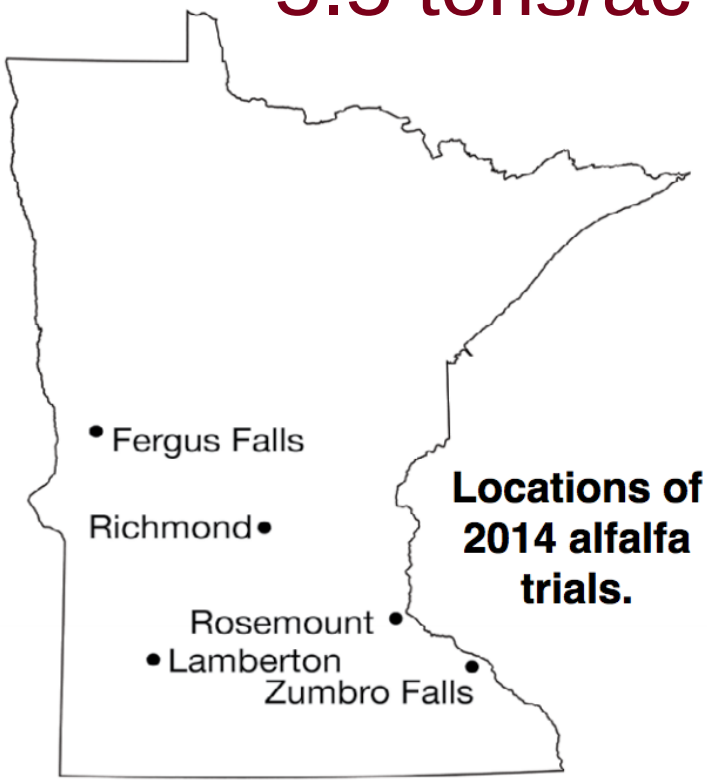
Minnesota Ag News – 2013 Hay County Estimates

Upper Midwest Region - Minnesota Field Office · P.O. Box 7068 · St. Paul, MN 55107 (651) 728-3113
fax (855) 271-9802 · www.nass.usda.gov
Cooperating with the Minnesota Department of Agriculture

April 10, 2014 *Media Contact: Dan Lofthus*



~5.5 tons/ac



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The Alfalfa Yield Gap: A Review of the Evidence

Michael P. Russelle

Published in Forage and Grazinglands
DOI 10.1094/FG-2013-0002-RV

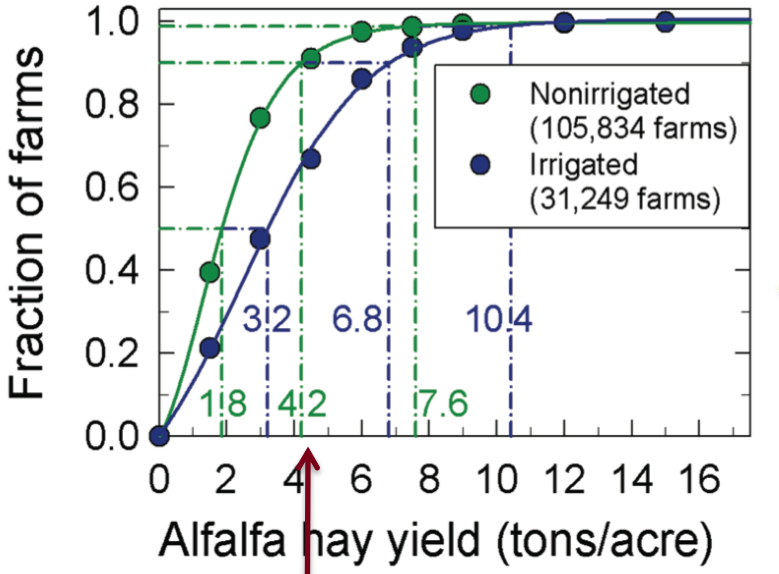
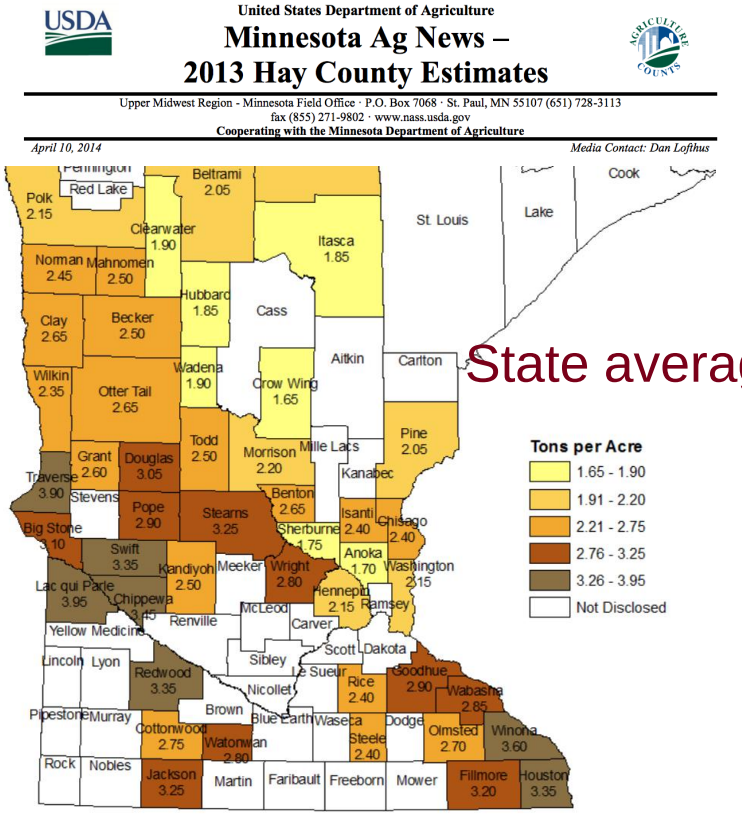


Fig. 3. Cumulative yield distribution of dry alfalfa hay (13% moisture) for irrigated (mostly western US) and nonirrigated (mostly eastern US), based on a subset of the 2007 Census of Agriculture. Data were fit to sigmoidal equations for interpolation of yield at the 50th, 90th, and 99th percentiles (dash-dot lines).

90% Farms at or below 4 tons/ac

~5.5 tons/ac



State average ~2.9 tons/ac

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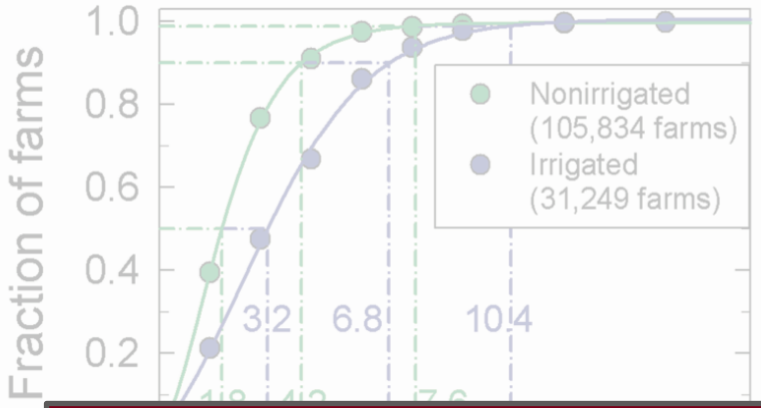
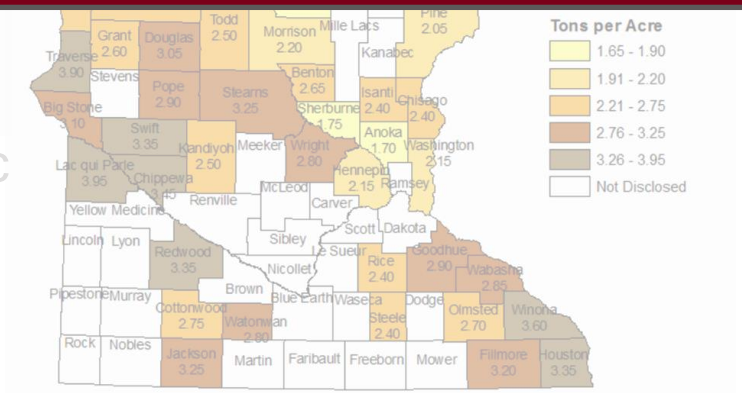
~5.5 tons/ac



QUESTION: How do we increase our yield (26 % to 60%)?

Fig. … /ac
mois…
(mostly eastern US), based on a subset of the 2007 Census of Agriculture. Data were fit to sigmoidal equations for interpolation of yield at the 50th, 90th, and 99th percentiles (dash-dot lines).

90% Farms at or below 4 tons/ac



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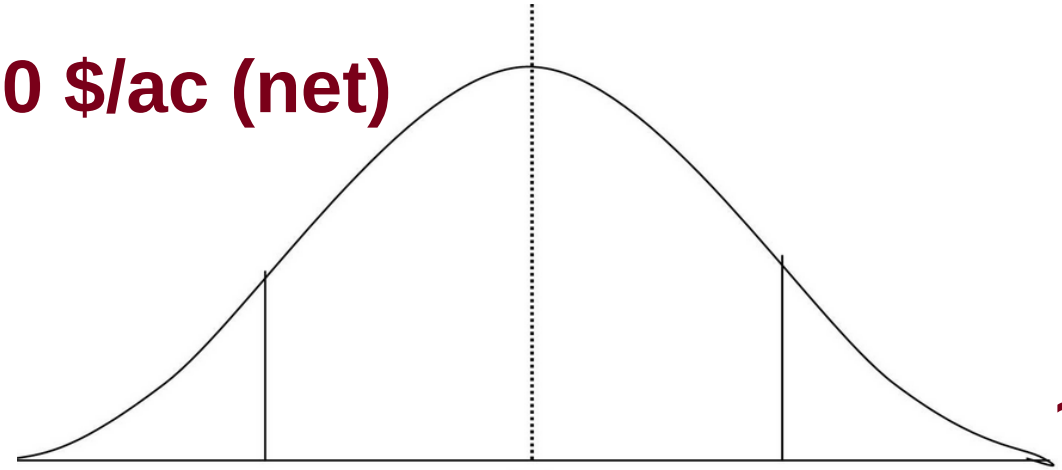
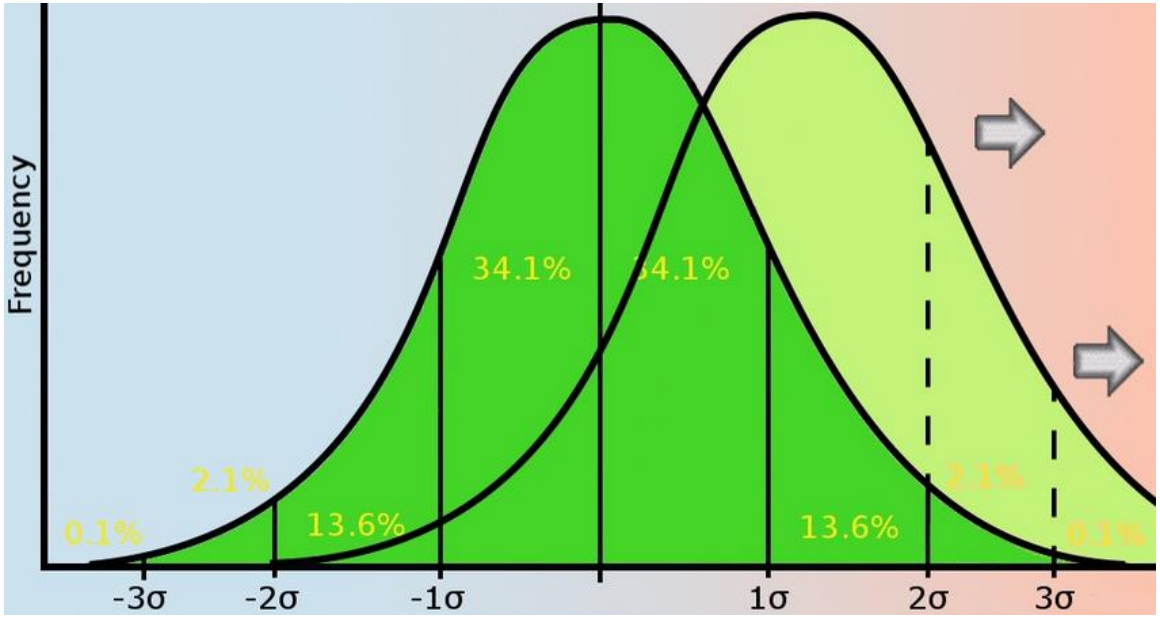
ESTABLISHMENT

~ 630 $/ac (net)



~ 1150 $/ac (net)



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ESTABLISHMENT STRATEGIES FOR OPTIMUM YIELD

- Fertility Management (i.e. know your soil!)
- Field Preparations
- Seeding rates
- Planting dates and planters
- Seeding depth
- Limit traffic

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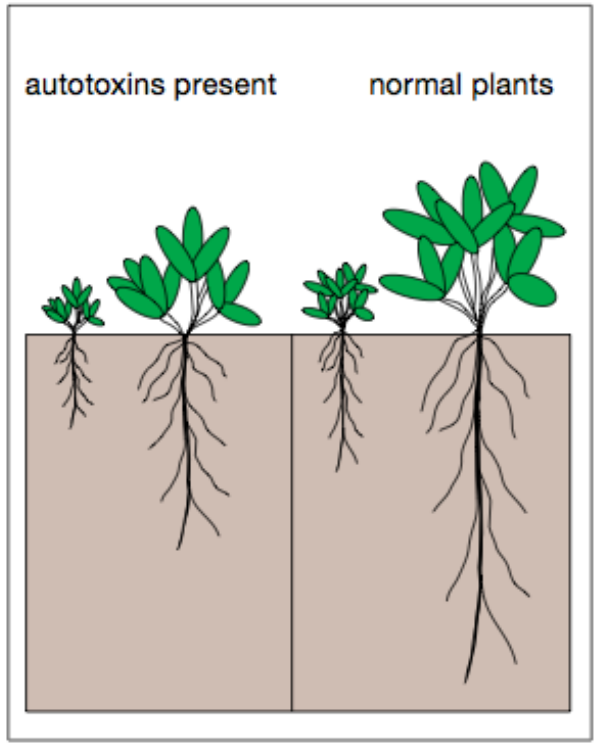
KNOW YOUR FIELD AND THE SOIL

- Select well drained soils
  - Wet soils benefit diseases
  - Reduces $O_{2(g)}$ diffusion
- Soil should be deep enough to accommodate alfalfa tap roots
- Autotoxicity

Figure 1. Effect of autotoxicity on root development of alfalfa.



Source: Jennings, Nelson, and Coutts, Universities of Arkansas and Missouri, 1998

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KNOW YOUR FIELD AND THE SOIL

- SOIL TEST BEFORE PLANTING!!

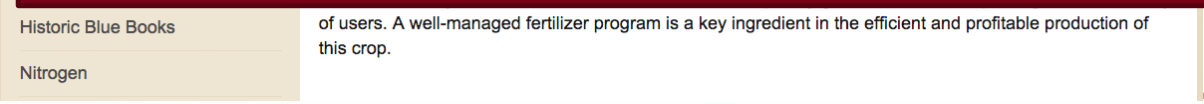
Soil Water and Climate:

Dr. Daniel Kaiser: dekaiser@umn.edu

Dr. John Lamb: johnlamb@umn.edu

Dr. Fabien Fernandez: fabiangf@umn.edu

http://www.extension.umn.edu/agriculture/nutrient-management/



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KNOW YOUR FIELD AND THE SOIL

- SOIL TEST BEFORE PLANTING!!
  - Fertility Management
    - Ensures good stands through vigorous and early growth
    - Increase yield, quality and persistence

http://www.extension.umn.edu/agriculture/nutrient-management/

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NUTRIENT MANAGEMENT

- Soil sample – Lime and pH (6.7 to 6.9)

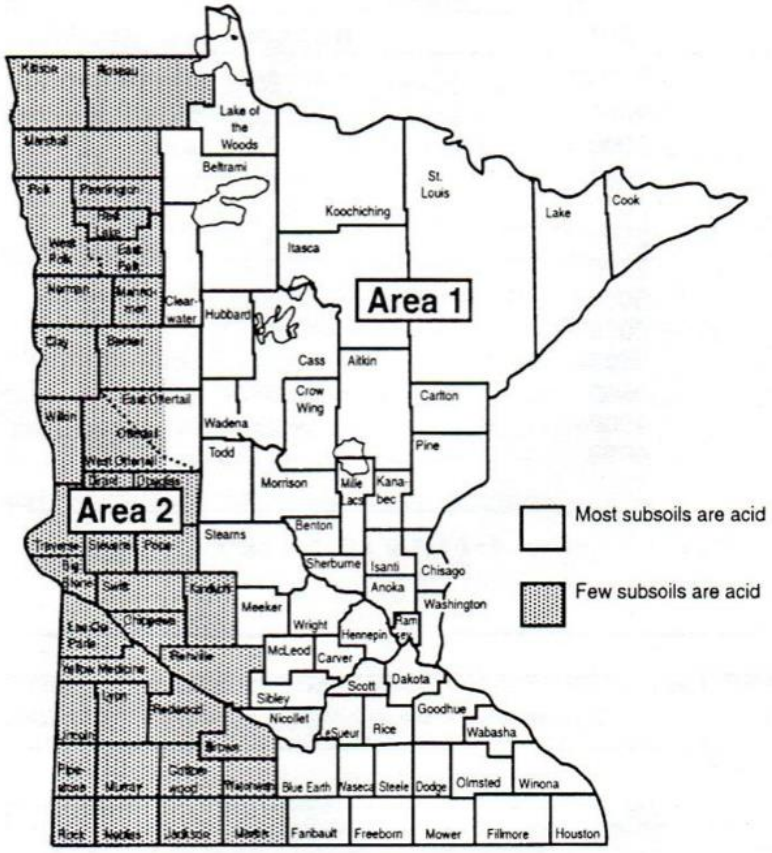
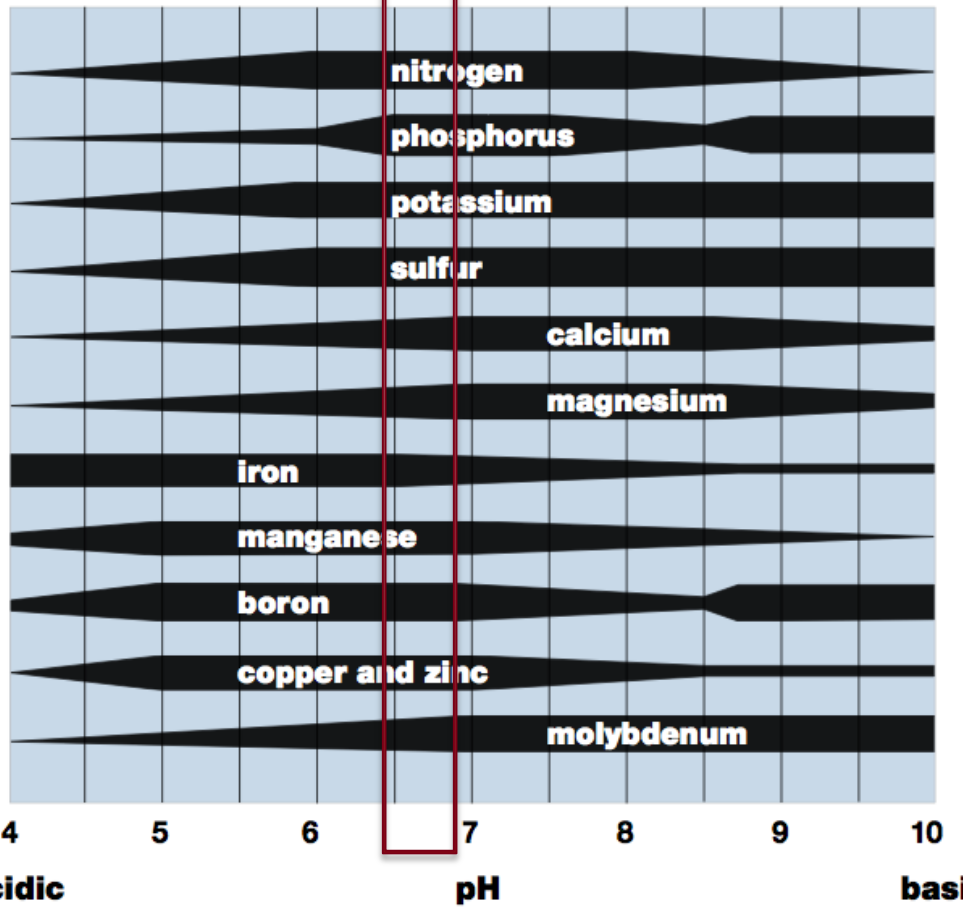


Figure 1. Reference map for lime suggestions.

Figure 3. Available nutrients in relation to pH.



NUTRIENT MANAGEMENT

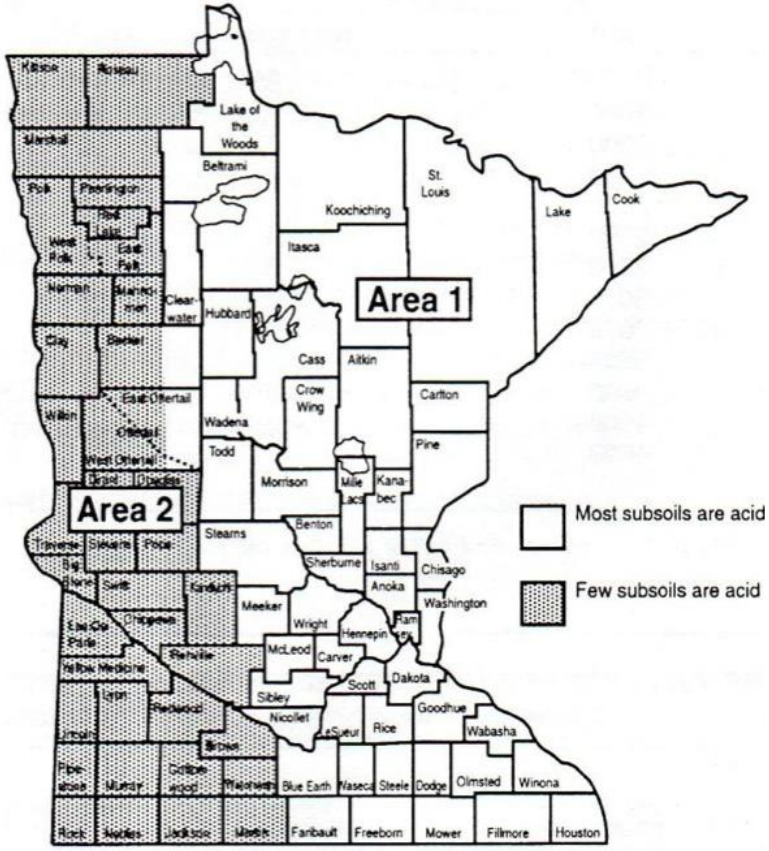


Figure 1. Reference map for lime suggestions.

Apply 12-months before alfalfa seeding

Table 2. Lime suggestions for mineral soils when the SIKORA BUFFER TEST IS NOT USED (soil pH is 6.0 or higher). The rates suggested should raise the pH to 6.5.

SOIL-WATER PH	AREA 1		AREA 2	
	ENP	AG LIME*	ENP	AG LIME*
	lb/ac	ton/ac	lb/ac	ton/ac
6.5	0	0	0	0
6.4	2000	2.0	0	0
6.3	2000	2.0	0	0
6.2	3000	3.0	0	0
6.1	3000	3.0	0	0
6.0	3000	3.0	2000	2.0

*These are approximate suggestions based on the average ENP value of Ag lime. An ENP of 1,000 lb. per ton is an average value for Ag lime (crushed limestone) in Minnesota.

NUTRIENT MANAGEMENT

Figure 3. Available nutrients in relation to pH.

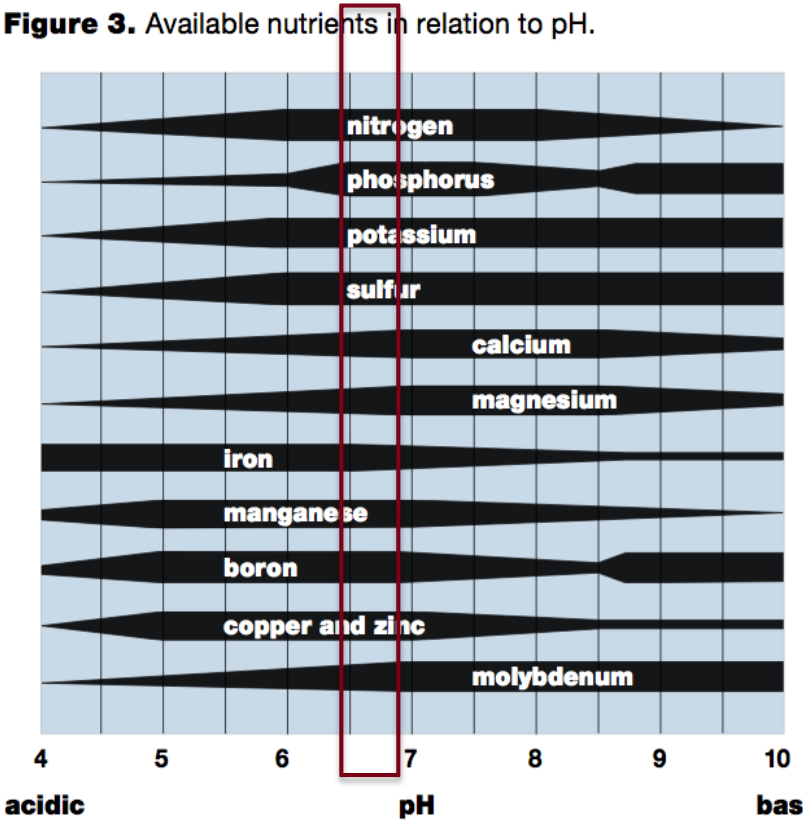
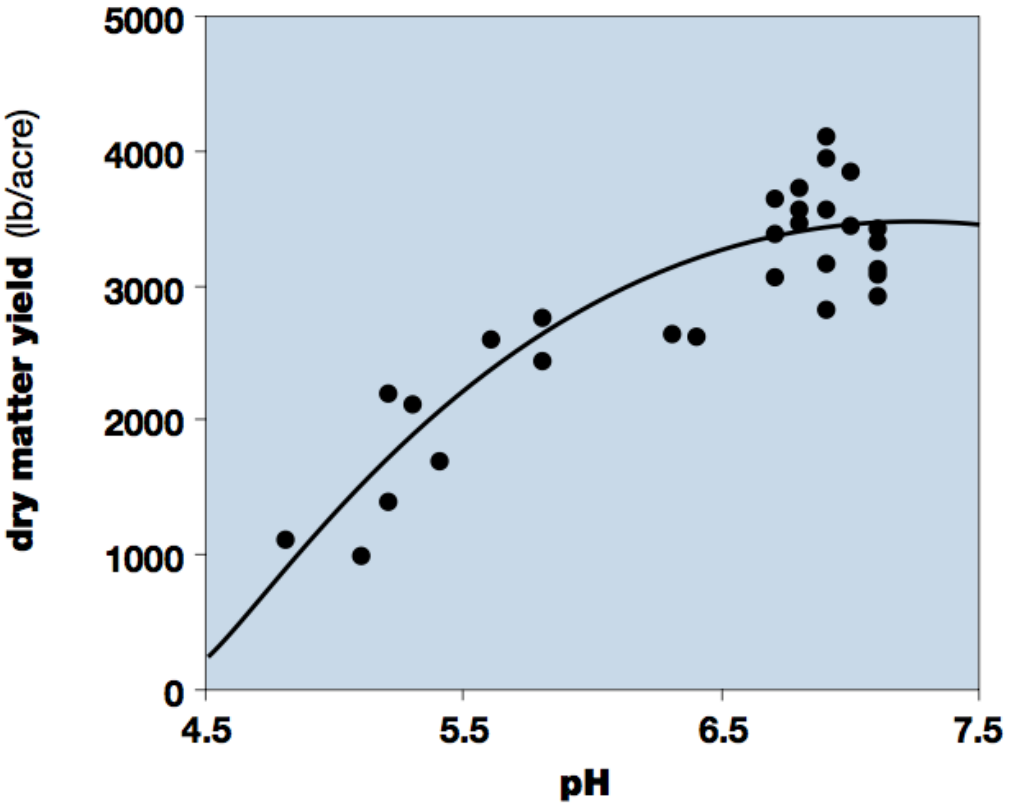


Figure 4. First-cutting alfalfa yield relative to soil pH.



Source: Wollenhaupt and Undersander, University of Wisconsin, 1991.

NUTRIENT MANAGEMENT

- Potassium: most limiting nutrient for alfalfa production in central, east-central, and southeastern Minnesota.

- Potassium
  - Improved Stand Est.
  - Improved yield and stand survival

Table 4. Pounds of nutrient removed per ton of alfalfa produced, dry matter basis.

nutrient	dry matter removed (lb/ton)
phosphorus (P)	6
phosphate (P_2O_5)	14
potassium (K)	48
potash (K_2O)	58

NUTRIENT MANAGEMENT

Table 4. Potash suggestions for alfalfa production in Minnesota*

YIELD GOAL	Potassium (K) Soil Test (ppm)				
	0-40	41-80	81-120	121-160	161+
--ton/ac--	----------lb. K_2O / acre to apply*----------				
3 or less	145	100	55	10	0
4	190	130	70	10	0
5	240	165	90	15	0
6	290	195	105	15	0
7	335	230	125	20	0
More than 7	380	265	145	20	0

*Use the following equation to calculate potash fertilizer suggestions for specific yield goals and specific soil test values for K:

$K_2O_{Suggested} = [55.7 – (0.38)(\text{Soil Test K, ppm})](\text{Yield Goal})$

- P and K
  - Applied PRE plant
  - Collect soil samples in the fall of the 1st production yr.
  - Fert. additions can be applied in the spring

NUTRIENT MANAGEMENT

- Phosphorus
  - Root growth
  - Persistence
  - Winter injury
  - Very immobile

Table 3. Phosphate suggestions for alfalfa production in Minnesota*.

	Phosphorus (P) Soil Test (ppm)				
YIELD BRAY:	0-5	6-10	11-15	16-20	21+
GOAL OLSEN:	0-3	4-7	8-11	12-15	16+
----ton/ac----	----------lb. P_2O_5 / acre to apply*----------				
3 or less	40	35	20	5	0
4	65	45	25	10	0
5	80	55	30	15	0
6	95	65	40	15	0
7	110	80	45	20	0
More than 7	125	90	55	25	0

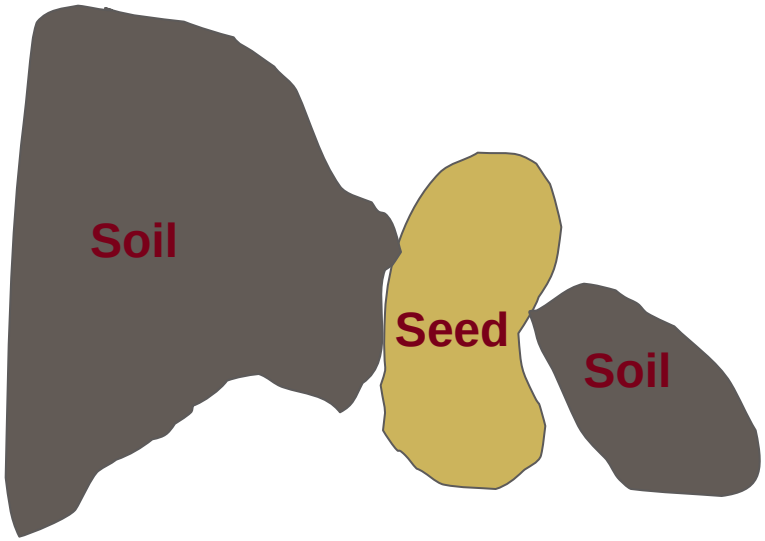
NUTRIENT MANAGEMENT

http://www.extension.umn.edu/agriculture/nutrient-management/

FIELD PREPARATIONS

Seed-to-Soil Contact (#2 cause of failure)

Most forage seeds must absorb more than their own weight in water from the soil before germination begins.



PLANTING DEPTH

Seed-to-Soil Contact (#2 cause of failure)

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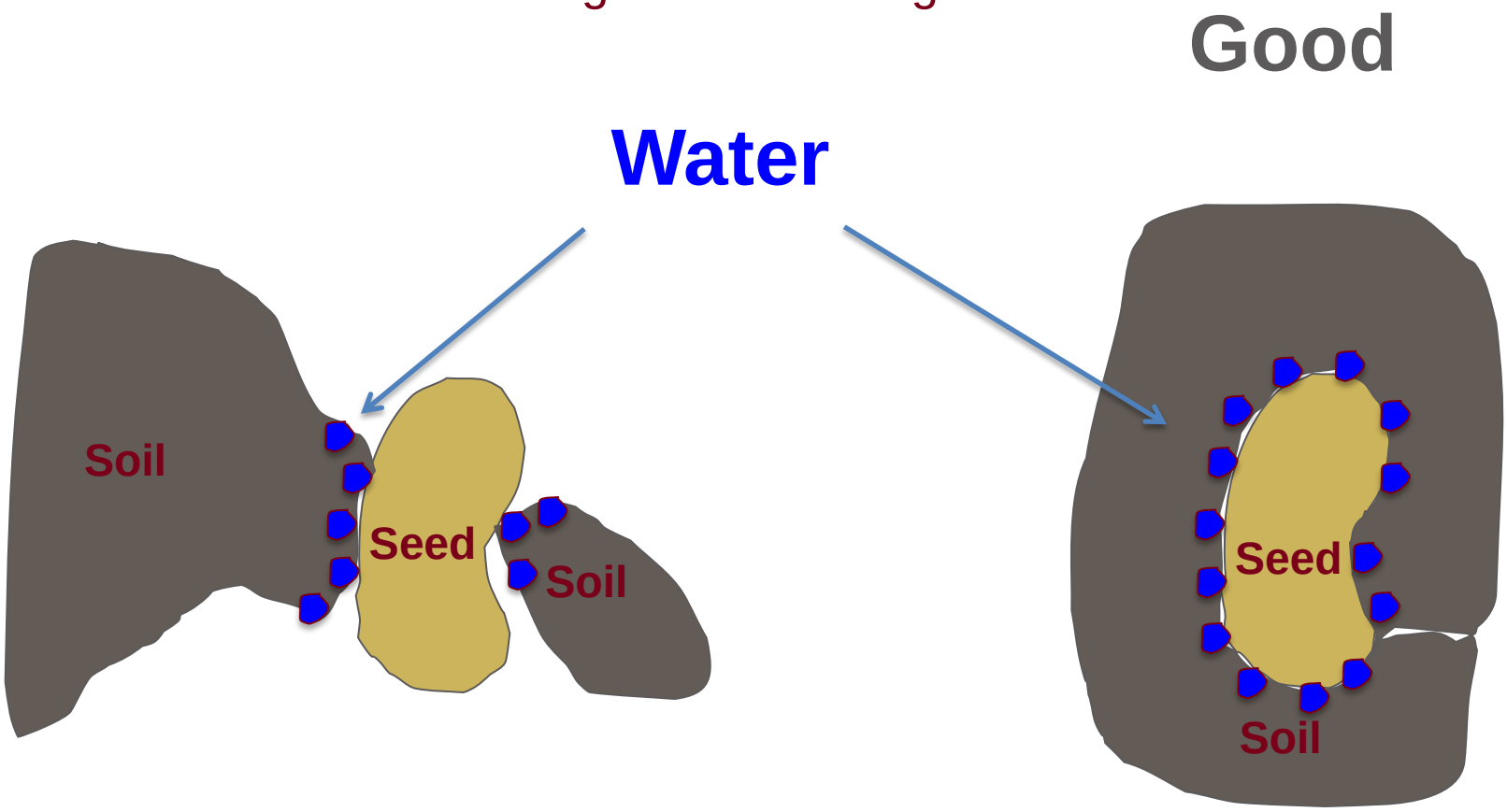
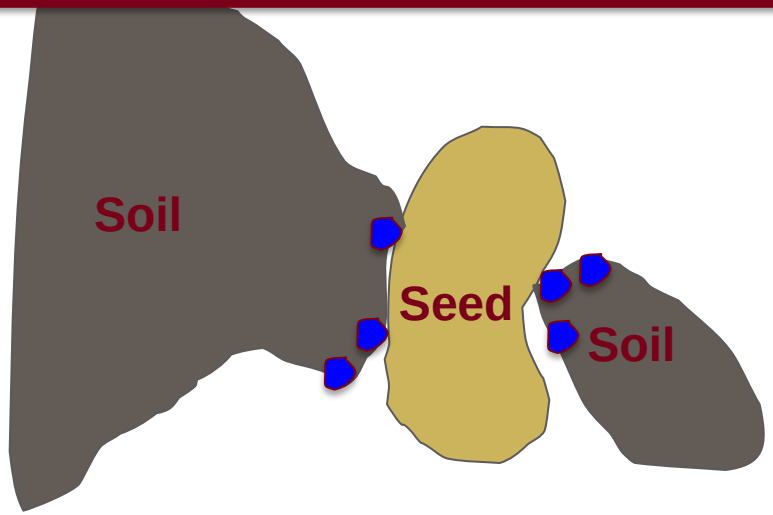


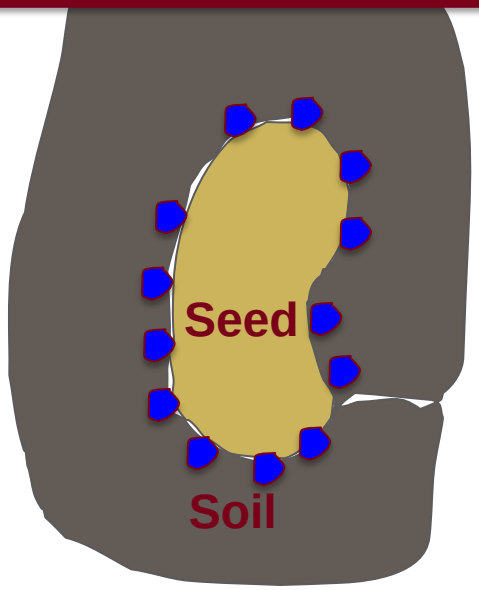
PLANTING DEPTH

Seed-to-Soil Contact (#2 cause of failure)

Most forage seeds must absorb more than their own weight in water from the soil before germination begins.

MOST ABSORB 125% ITS MASS IN WATER



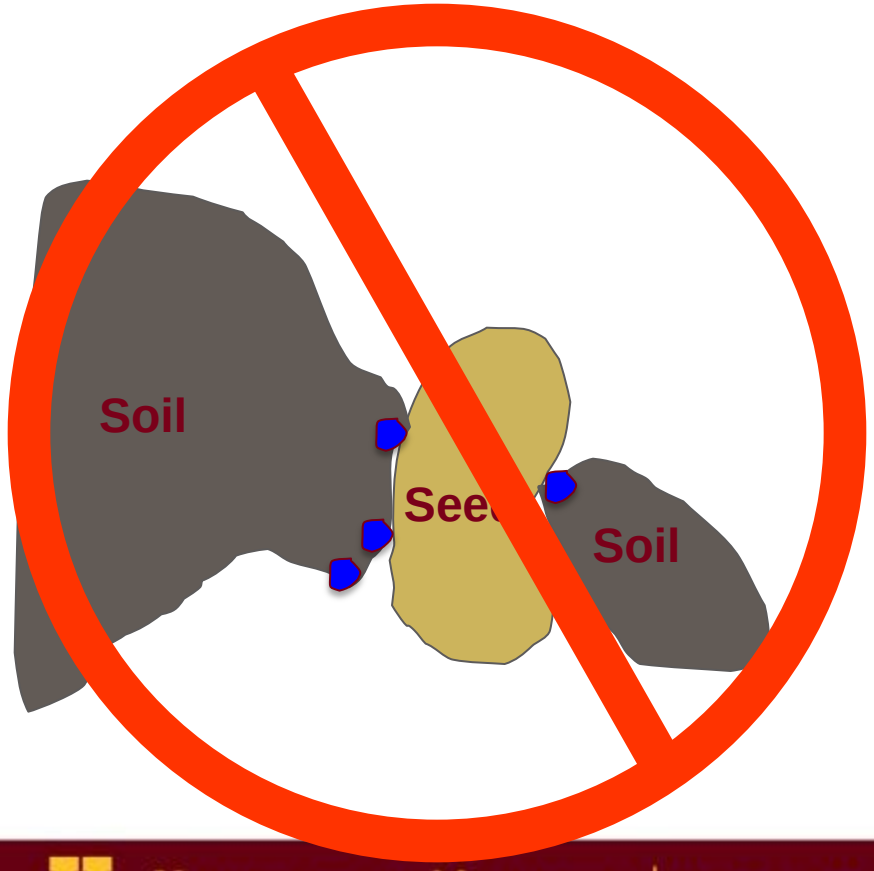


PLANTING DEPTH

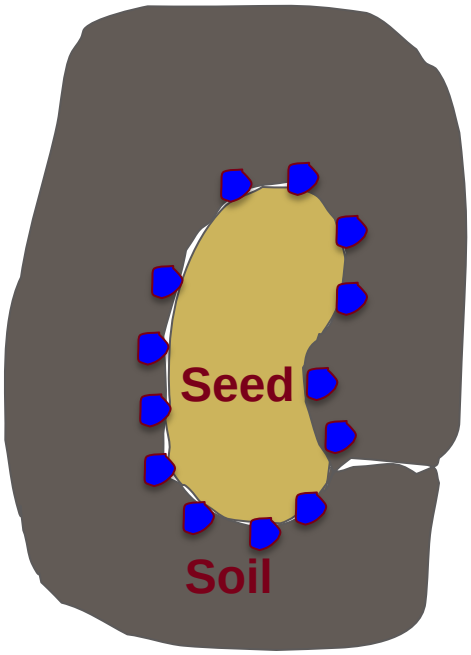
Seed-to-Soil Contact (#2 cause of failure)

Most forage seeds must absorb more than their own weight in water from the soil before germination begins.

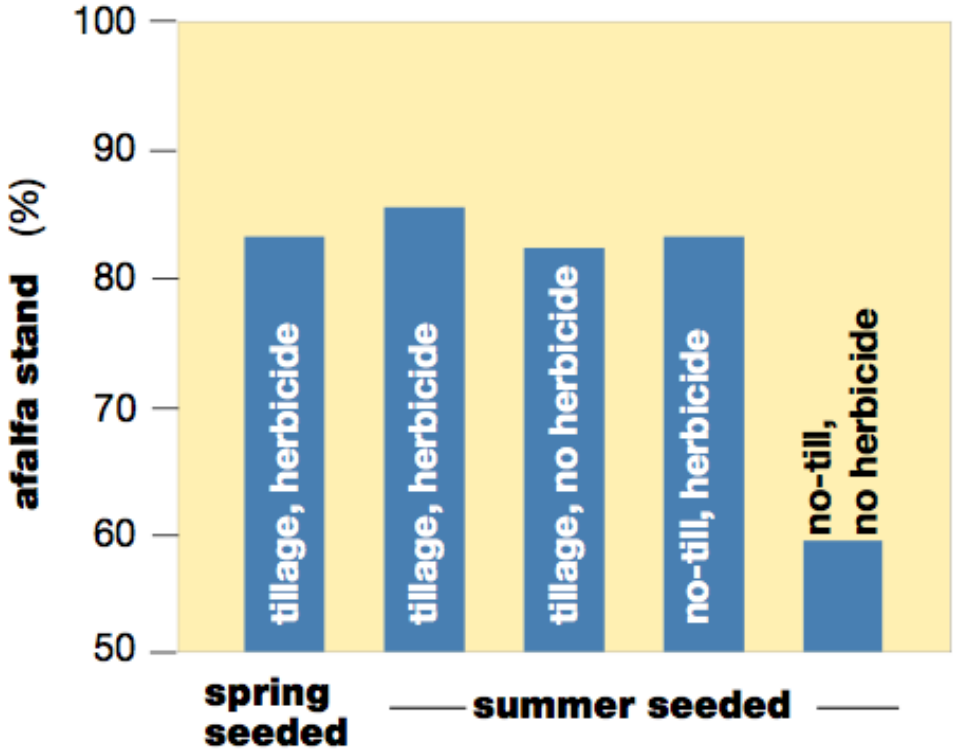
Bad



Good



FIELD PREPARATION



Primary and Secondary tillage typically needed for spring seeding.

Soil should be firm enough at planting for a footprint to sink no deeper than 3/8 inch.

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FIELD PREPARATION

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FIELD PREPARATION

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PLANTING DEPTH

(#1 cause of failure)

The percent seedling emergence of several forage crops when seeded at 5 depths.

Crop	Seedling Depth in Inches				
	1/3	1/2	1	1 1/2	2
Alfalfa	78	64	53	45	19
Clover, Alsike	84	53	49	9	4
Clover, Ladino	91	47	28	2	0
Clover, Red	89	56	62	22	14
Bluegrass, Kentucky	70	43	27	4	0
Bromegrass	94	78	69	51	24
Timothy	98	89	81	39	12
Redtop	88	64	33	2	0

Rules of Thumb:

Heal of shoe shouldn't sink in more than ½ inch.

About 10% of seeds should be on soil surface after planting!

PLANTING DEPTH

(#1 cause of failure)

SEEDING DEPTH

Emergence

The percent see emergence of several forage crops when seeded depths.

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Clover, Red	89	56	62	22	14
Bluegrass, Ken	70	43	27	4	0
Bromegrass	94	78	69	51	24
Timothy	98	89	81	39	12
Redtop	88	64	33	2	0

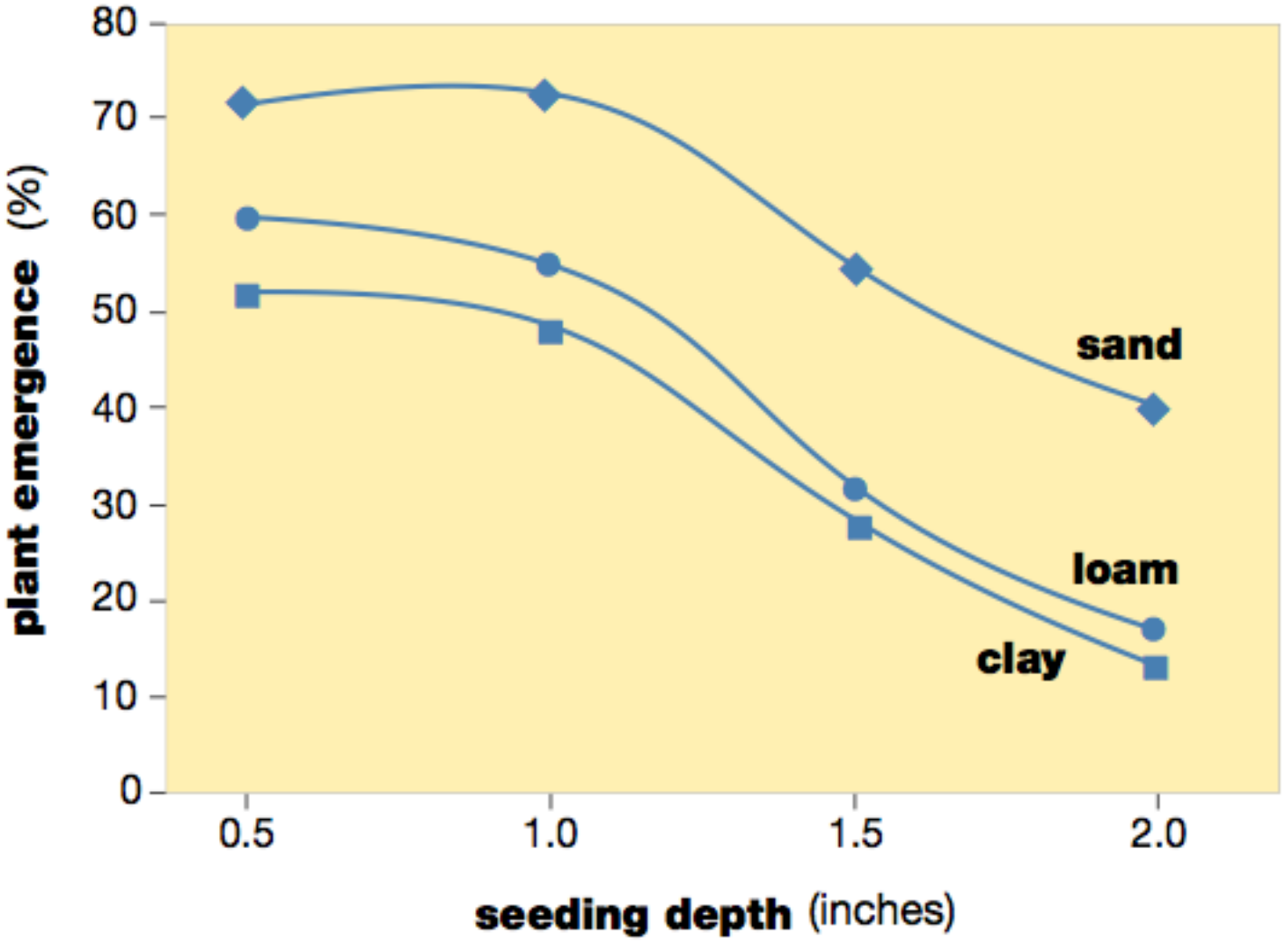
Rules of Thumb:

Heal of shoe shouldn't sink in more than ½ inch.

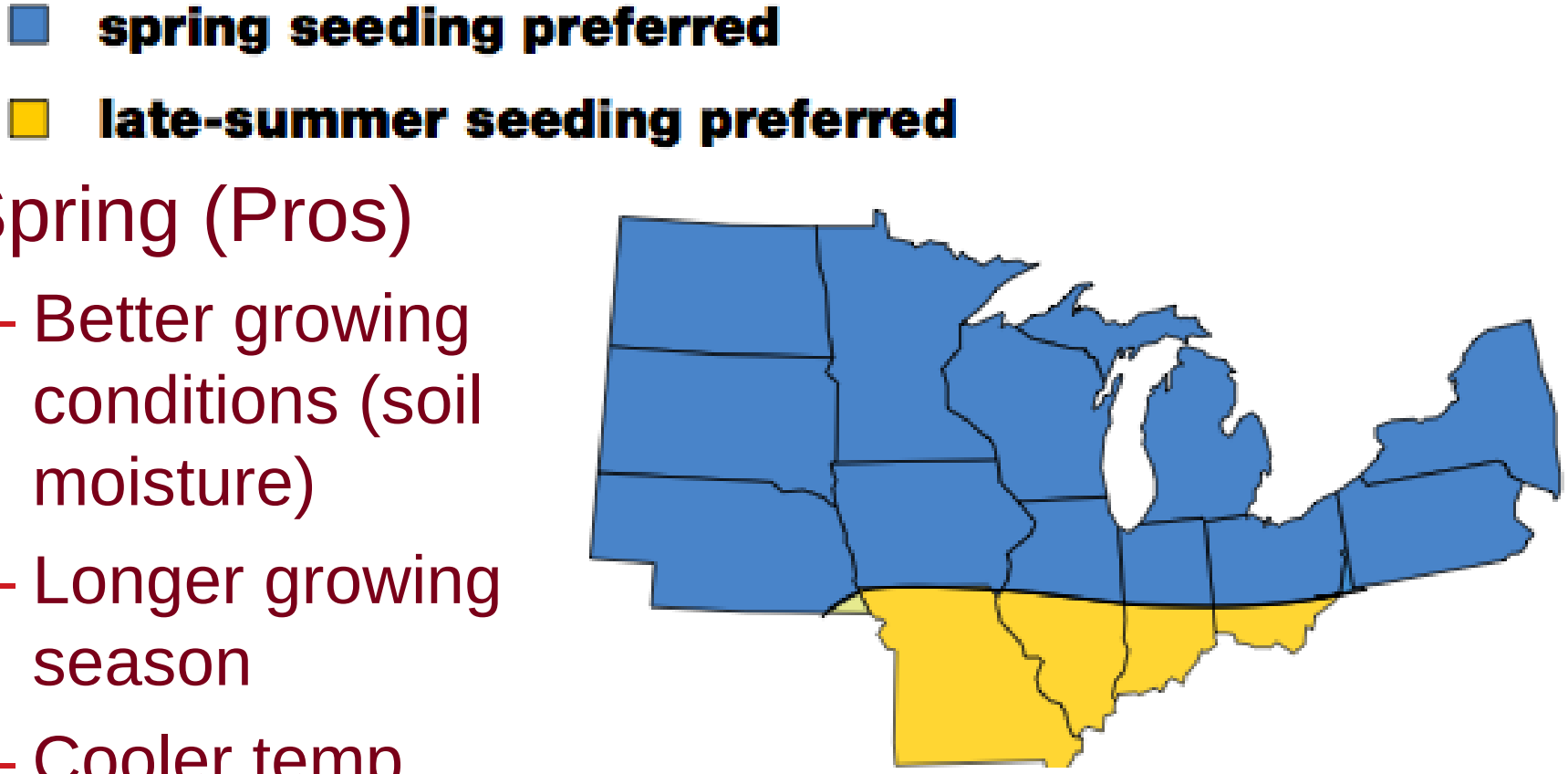
About 10% of seeds should be on soil surface after planting!

SEEDING DEPTH

Figure 11. Alfalfa emergence from various seeding depths.



PLANTING DATE AND PLANTERS



- Spring (Pros)
  - Better growing conditions (soil moisture)
  - Longer growing season
  - Cooler temp.
  - Enhanced germination

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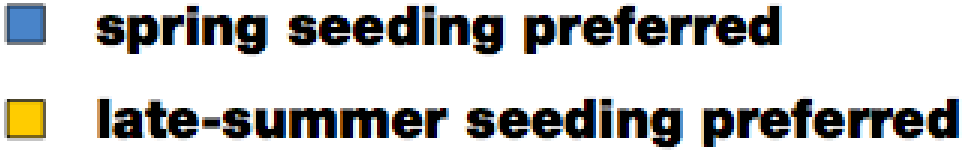
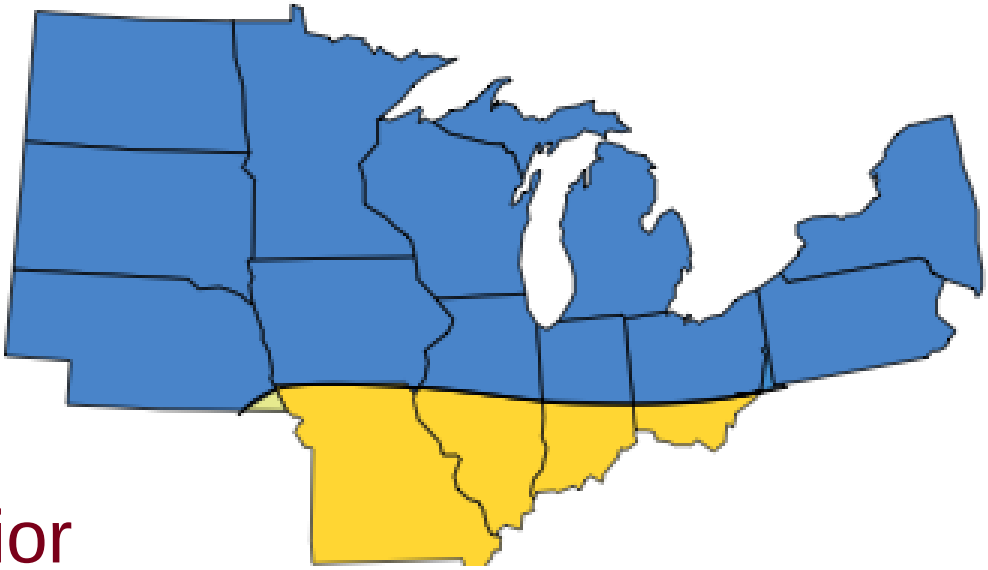
PLANTING DATE AND PLANTERS



- Summer (Pros):
  - Herbicides typically not needed
  - (Cons): Available soil moisture
  - Insufficient growth prior to killing frost
  - Sclerotinia crown rot may be prevalent in late-summer seeding



  - Need 6 to 7 weeks of growth for winter survival

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PLANTING DATE AND PLANTERS

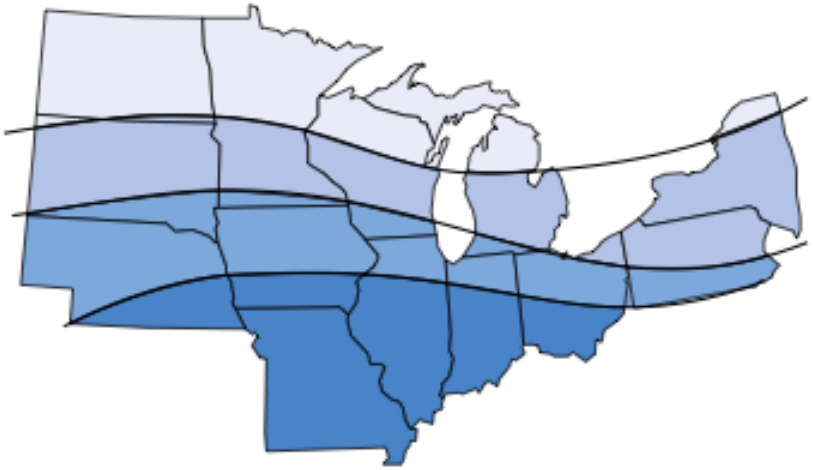
spring seeding dates

May 1–30

April 15–May 15

April 1–30

March 15–April 15



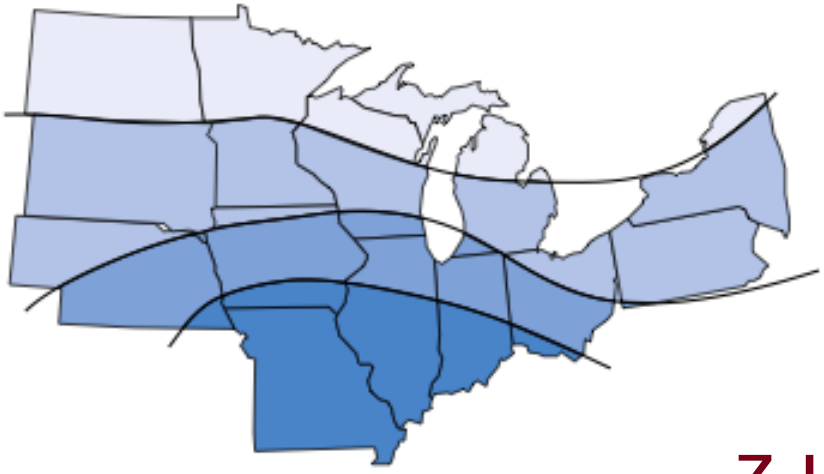
late-summer seeding dates

July 20–Aug. 1

Aug. 1–15

Aug. 15–Sept. 1

Sept. 1–15



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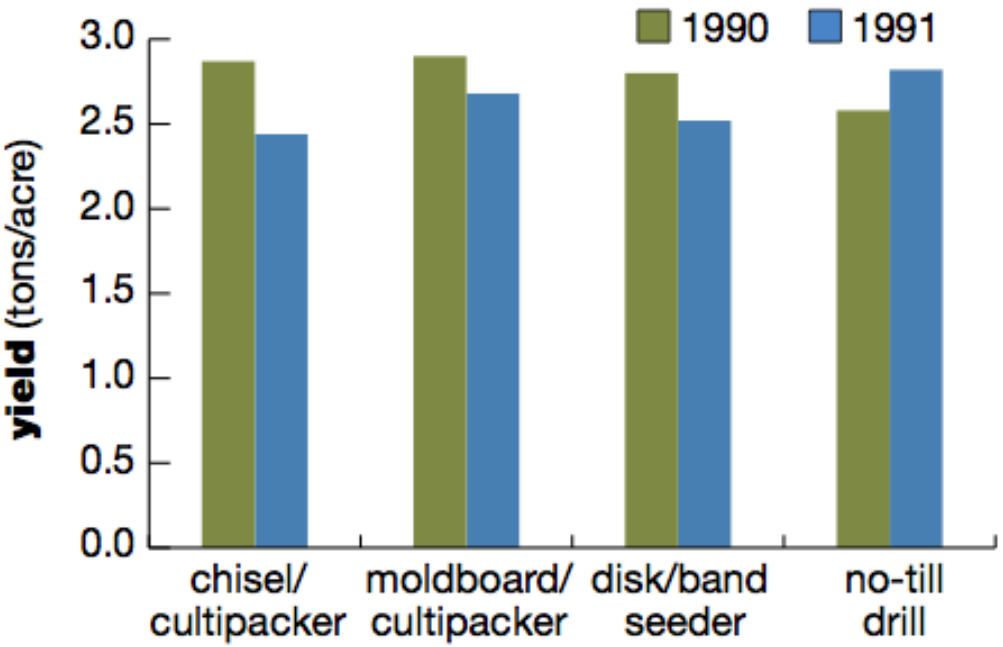
PLANTING DATE AND PLANTERS

Figure 15. Effect of seeding equipment on yield and stand in seedling year.



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SEEDING RATES

The approximate seeds per pound of several forage crop species together with the theoretical number of seeds per square foot at various rates of seeding.

Crop	Approximate Seeds/Pound	Seeds/Square Foot at Seeding rate per acre of 1 lb.	2 lb.	5 lb.	10 lb.
Alfalfa	221,000	5	10	26	51
Bluegrass, Kentucky	2,000,000	46	92	230	460
Brome, Smooth	136,000	3	6	16	31
Clover, Ladino	754,000	17	35	87	173
Clover, Red	293,000	7	13	34	67
Crownvetch	120,000	3	6	14	27
Fescue, Tall	246,000	6	11	28	56
Orchardgrass	468,000	11	21	54	107
Redtop	5,605,000	129	257	644	1287
Reed Canarygrass	660,000	15	30	61	152
Ryegrass	280,000	6	13	32	64
Sudangrass	55,000	1	3	7	13
Timothy	1,260,000	29	58	145	289
Trefoil, Birdsfoot	414,000	10	19	48	95

Most seeding rates are designed to provide 3 to 8 times as much seed as would be needed under ideal conditions.

SEEDING RATES

ALFALFA

Effect of Seeding Rate on Alfalfa Stand Longevity

M. H. Hall,* C. J. Nelson, J. H. Coutts, and R. C. Stout

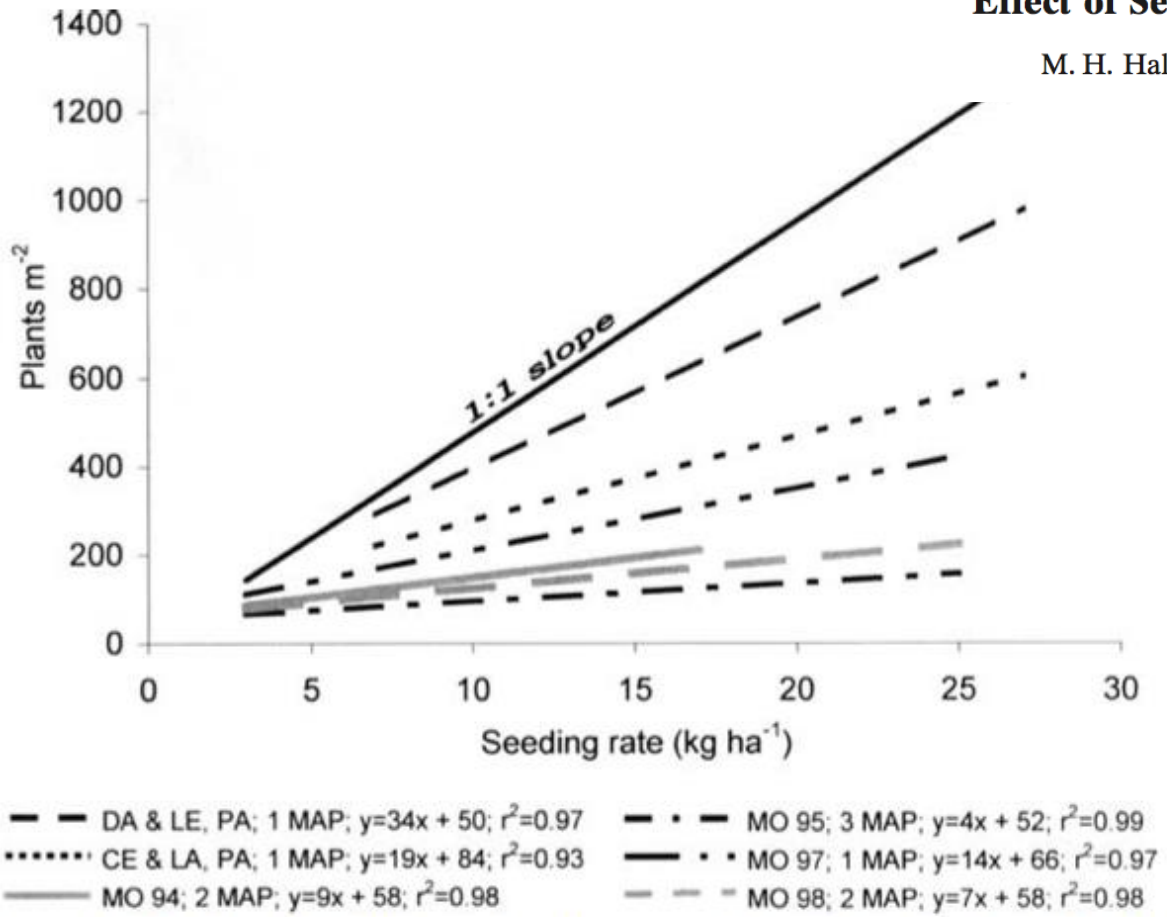


Fig. 1. Density of alfalfa one to three months after planting (MAP) at various rates in eight location-years. Values are the average of three cultivars at the Missouri location-years and two cultivars at the Pennsylvania sites.

SEEDING RATES

ALFALFA

Effect of Seeding Rate on Alfalfa Stand Longevity

M. H. Hall,* C. J. Nelson, J. H. Coutts, and R. C. Stout

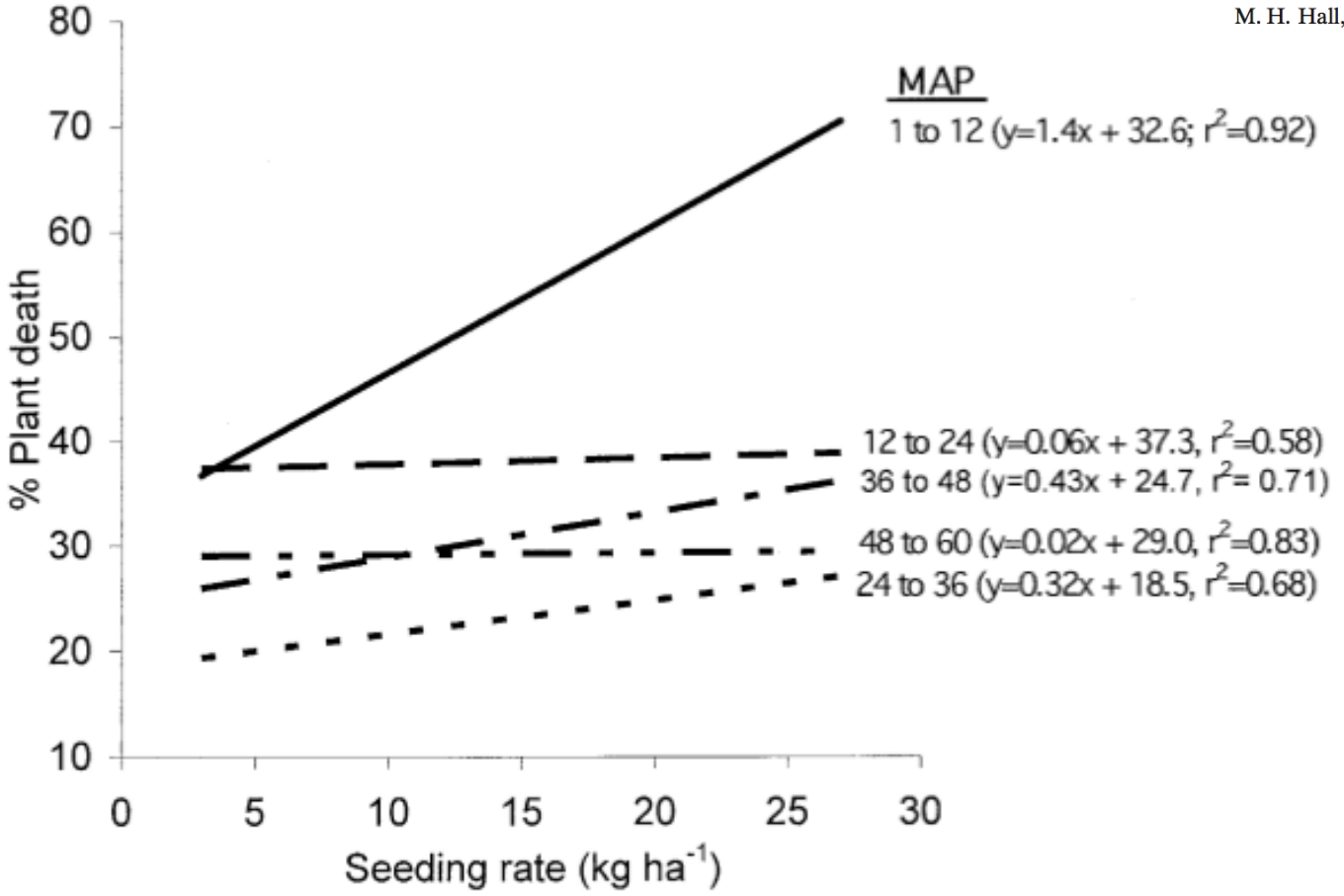
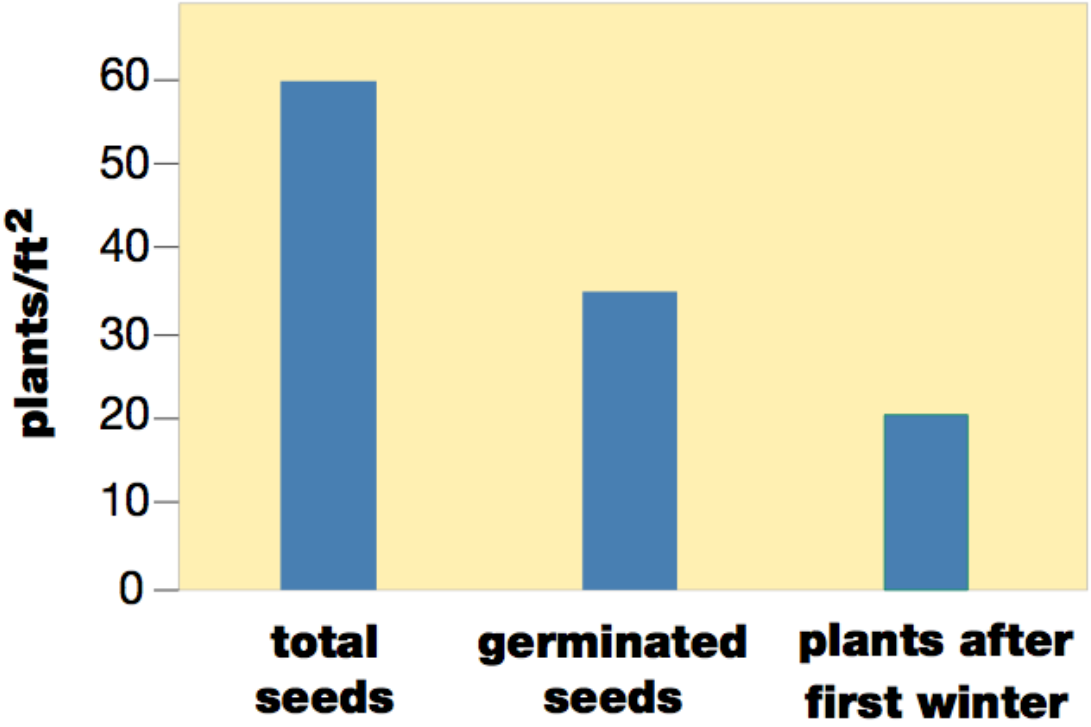


Fig. 2. Mortality rates during yearly time periods (months after planting, MAP) for alfalfa seeded at various rates. Values are the average of eight location-years and multiple cultivars.

SEEDING RATES

Figure 12. Stand density during first 12 months (seeded at 12 lb/acre).



Source: Undersander, University of Wisconsin, 1995.

Table 3. Effect of seeding rate on first-year alfalfa dry matter yields.

seeding rate (lb/acre)	dry matter yield (tons/acre)
12	3.4
15	3.6
18	3.6

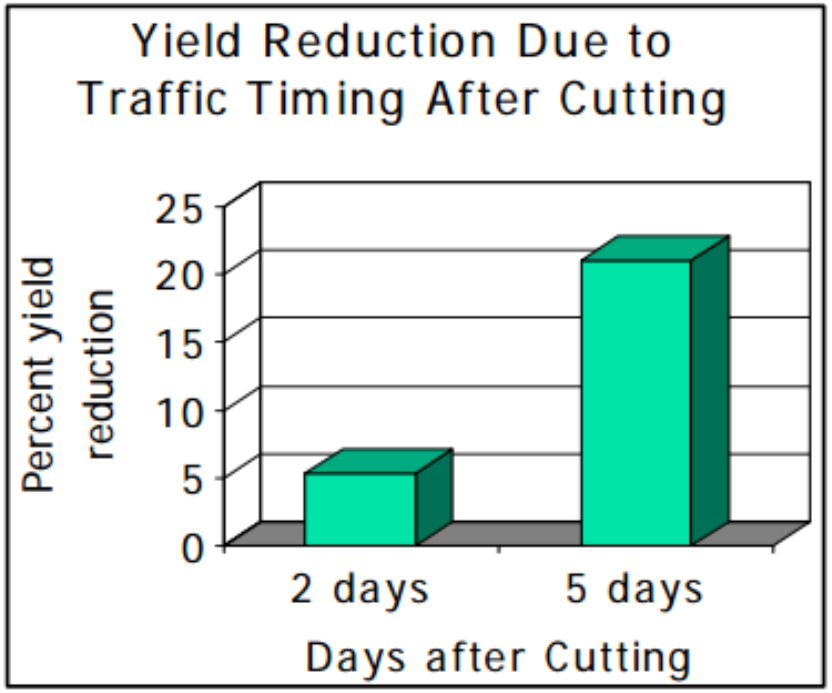
Source: Buhler, Proost, and Mueller, University of Wisconsin, 1988.

5 lb/ac = 25 seeds/ft^2

10 lb/ac = 51 seeds/ft^2

TRAFFIC

- Restrict traffic
- Perform all traffic based task as close to the cutting date as possible.



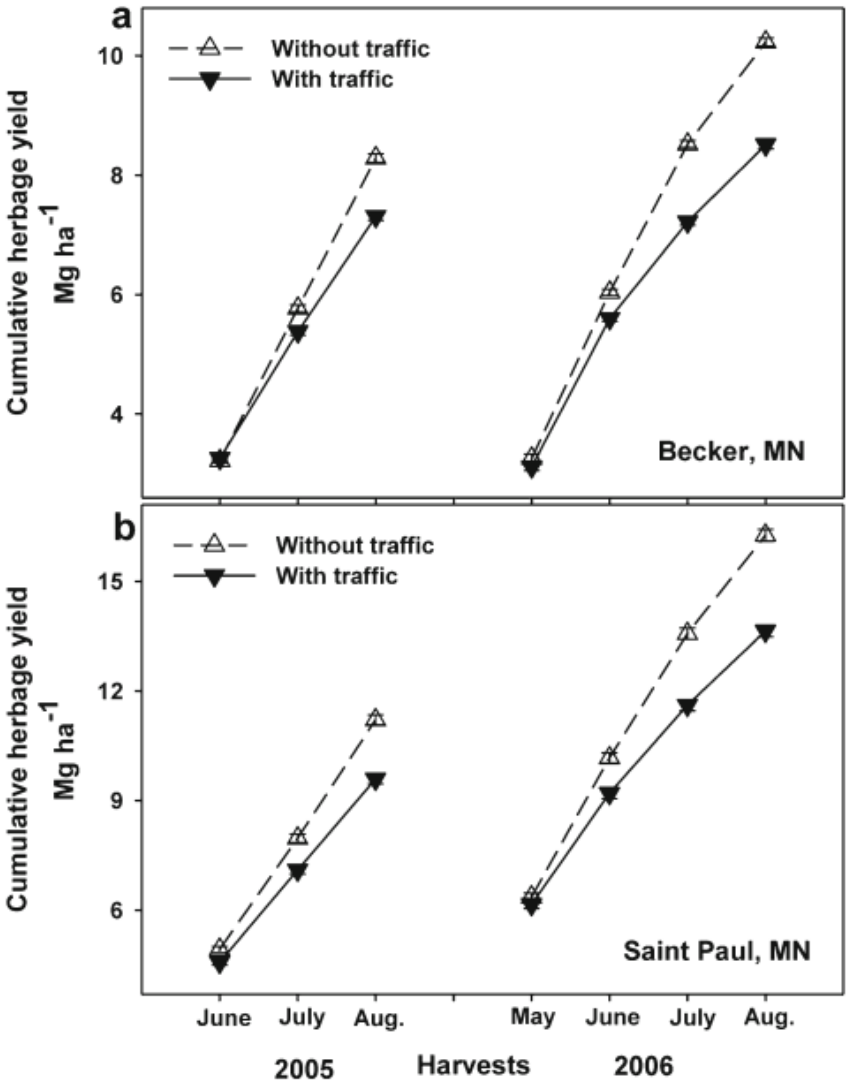
Wheel traffic No Wheel traffic
Growth 10 days after cutting

http://fyi.uwex.edu/forage/files/2014/01/FOF-WheelTrafficAlfalfa.pdf

TRAFFIC KILLS!

Plant Soil (2013) 372:349–359

Fig. 3 Cumulative forage yield in plots with tractor wheel traffic and the no traffic control. **a** Becker location. **b** St. Paul location



Effect of wheel traffic and green manure treatments on forage yield and crown rot in alfalfa (*Medicago sativa*)

Deborah A. Samac · JoAnn F. S. Lamb · Linda L. Kinkel · Lindsey Hanson

SUMMARY

- Field Selection
  - Well drained, deep soils
- Nutritive Management
  - Soil Sample and balance soil fertility to non-limiting
  - Soil test after each production year
- Field Preparation
  - Heal of shoe shouldn't sink in more than ½ inch.
- Planting Dates
  - Spring planting preferred for MN.
- Seeding Rates
  - 10 to 12 lb seed/ac sufficient (need 25 plant ft^2 following year)
- Traffic kills
  - Try minimizing traffic and plant driving events close to harvest date

FIG. 116. SEEDING ALFALFA, ADIRONDACK FARMS, GLENS FALLS, N. Y.

Questions?

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Agronomy/Plant Genetics
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