Corn Silage Yield Drivers and Profit Robbers

Joe Lauer
University of Wisconsin – Madison

World Dairy EXPO, Madison, WI
October 5, 2013

Overview

Some basic silage biology

Profit robbers

Yield drivers

Silage value

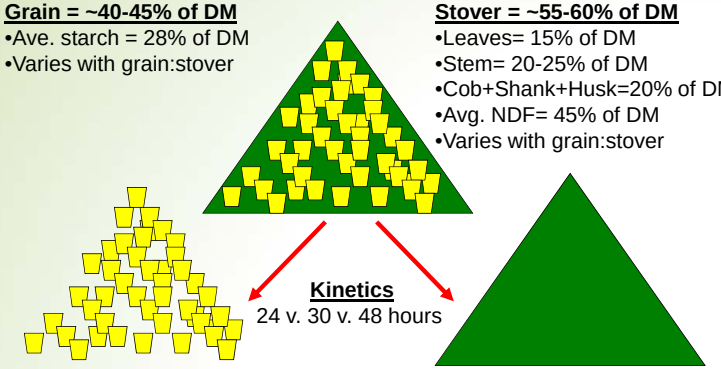
What typically ends up as corn silage?

- ✓ Un-adapted hybrid
- ✓ Late-planted
- ✓ Stress (hail, drought, flood, frost, N, pests, etc.)
- ✓ Worst fields on the farm

Corn Silage

Grain = ~40-45% of DM
- Ave. starch = 28% of DM
- Varies with grain:stover

Stover = ~55-60% of DM
- Leaves= 15% of DM
- Stem= 20-25% of DM
- Cob+Shank+Husk=20% of DM
- Avg. NDF= 45% of DM
- Varies with grain:stover

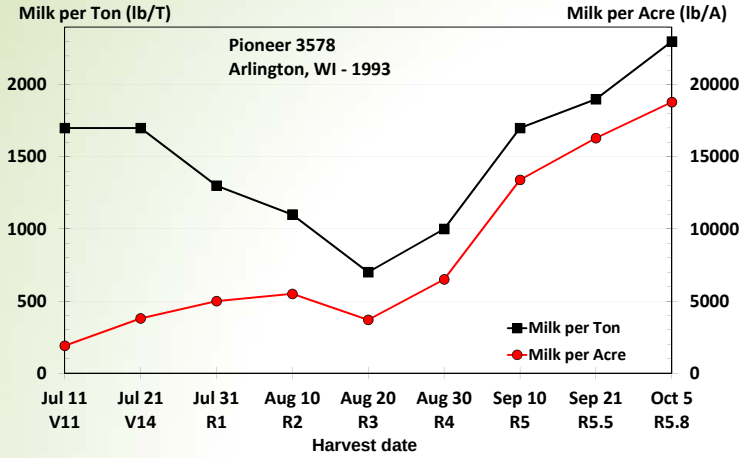


Kinetics
24 v. 30 v. 48 hours

80 to 98% starch digestibility
- Kernel maturity
- Kernel particle size
- Endosperm properties

40 to 70% NDFD
- Lignin/NDF
- Hybrid
- Maturity

Corn Silage Yield and Quality Changes During Development ("Double Quality Peak")



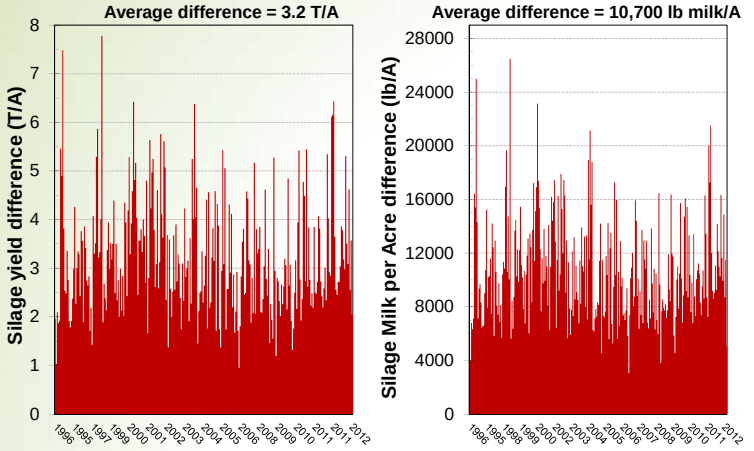
Lauer, 1994

Range and Relative Impact (%) of Management Decisions on Silage Yield and Quality

Factor	N Trials	Yield T/A	Milk per Ton Lb milk/T	Milk per Acre Lb milk/A
Hybrid Top v. Bottom Entry	204	3.1 (39%)	477 (14%)	11,500 (43%)
Hybrid maturity Early- v. Late-Trials	232	0.1 (0%)	0(0%)	12 (0%)
Hybrid type BMR v. Leafy v. Average	126	-1.4 (18%)	200 (6%)	-4000 (16%)
Plant density 22K v. 40K	31	1.2 (14%)	-130 (4%)	2900 (10%)
Planting date April 24 v. June 16	28	→ 2.2 (27%)	110 (3%)	7800 (30%)
Row Spacing 30" v. 15"	13	0 (0%)	8 (0%)	70 (0%)
Rotation CC v. CS v. CSW	3	7.7 v. 8.3 (7%)	?	?
Soil Fertility 160 v. 0 lb N/A	Many	20 to 50% change		
Stress: Drought, Flooding, Hail, Early Frost	--	"Difficult to predict"		
Pest Control Poor v. Good	--	"Do for silage what you do for grain." Economic thresholds tend to be lower.		
Harvest timing Wet (R3) v. Dry (R5.5)	5	4.4 (40%)	490 (15%)	12,000 (38%)

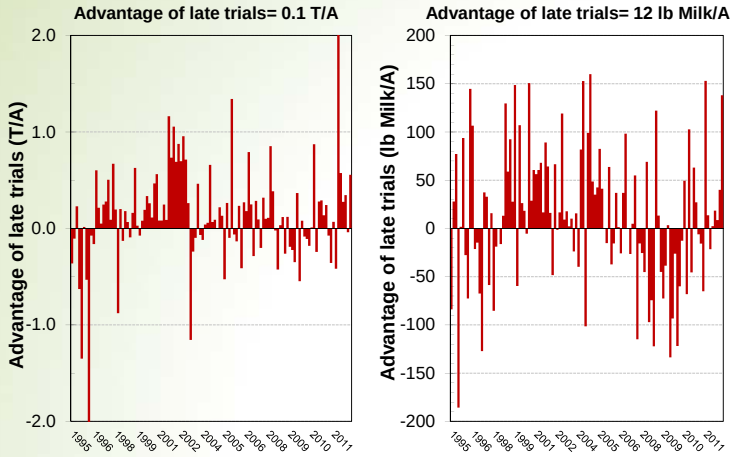
Lauer, 1995-2012

Silage yield and Milk per Acre difference between the highest and lowest corn hybrid in UW trials



Lauer et al., 1995-2012
N= 274 trials; 25,794 plots

Silage yield and Milk per Acre difference between early- and late-trials

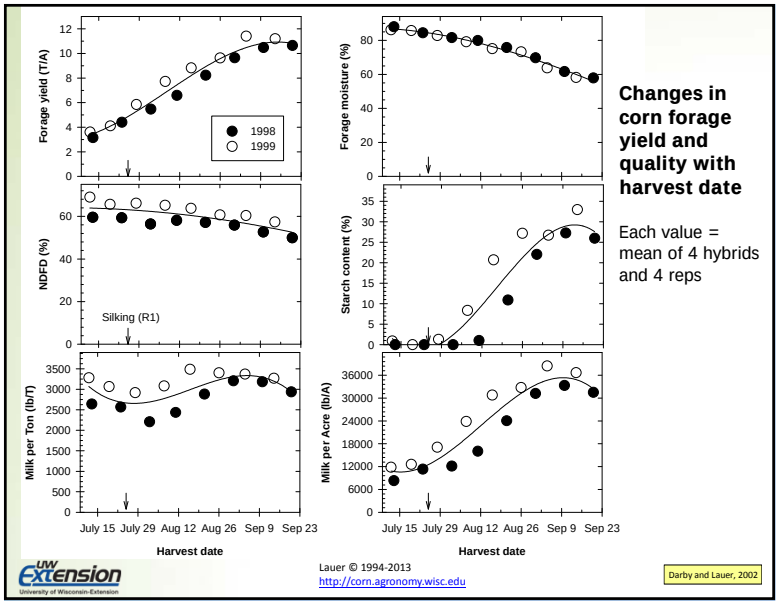


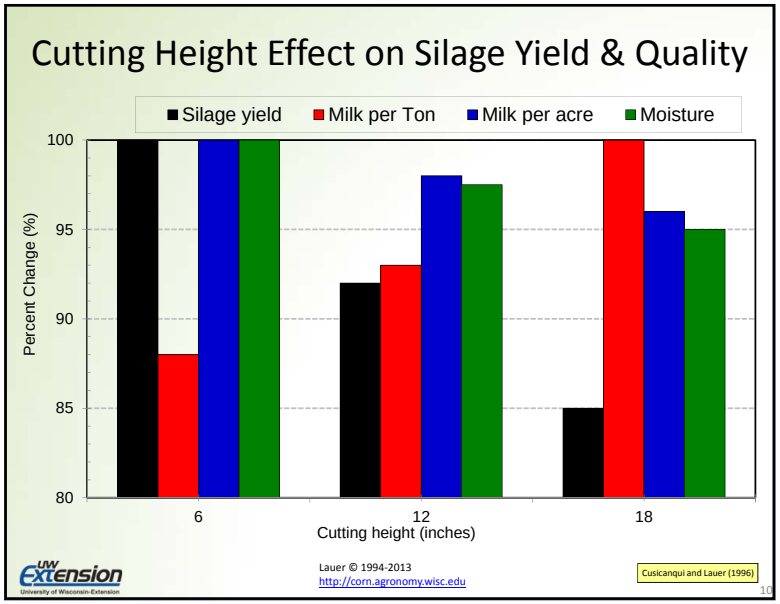
Lauer et al., 1995-2012
N= 232 trials

What is an Average Corn Silage Hybrid?

Trait(s)	GxE	Forage yield	NDF	NDFD	Starch	Milk2006	
	N	T DM/A	%	%	%	Lbs/T	Lbs/A
Normal →	3398	7.8	47	59	30	3100	25000
Bmr	126	6.4	48	67	26	3300	21000
Leafy	240	8.1	48	59	27	3100	25000
CB	736	8.1	46	59	31	3100	26000
RR	339	7.8	47	58	30	3100	24000
CB,LL	331	8.2	47	59	30	3100	26000
CB,RR	395	8.0	46	59	32	3100	25000
CB,RW,RR	891	7.9	46	58	32	3100	25000
LSD(0.05)		0.6	2	1	4	100	2000
Average	7403	8.0	47	58	30	3100	25000

Lauer, 1990-2010; UW ST trials= 266; n= 21,420





Reducing Shrink in Corn Silage Piles

Shrink can never be eliminated:

- ✓ Fermentation loss = 2-5%
- ✓ Leaching loss = 1-3%
- ✓ Feed-out loss = 5-11%

Harvest at the optimum maturity and moisture (60-70%).

Pack with the correct weight to exceed density requirements of >17 lbs/ft^3.

Seal with two layers of black plastic and plenty of weight to secure it.

Pitch any spoilage to protect ration integrity.

Feed off with the correct method and rates (12" per day).

What is corn silage worth?

Need to recover production costs

Opportunity cost of marketing grain

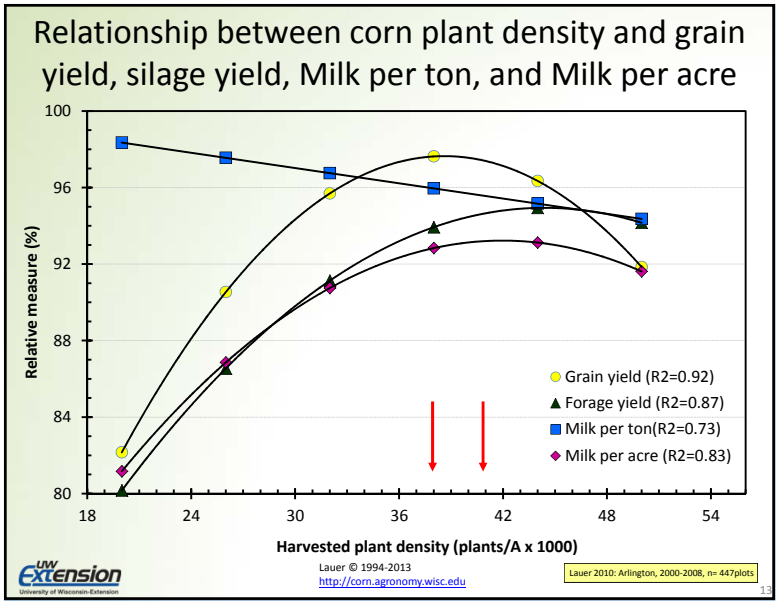
Value of stover

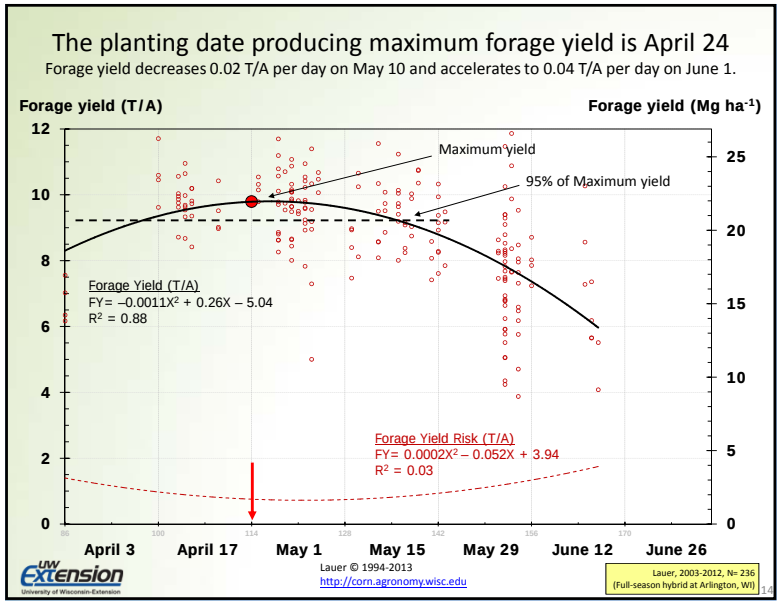
- ✓ Fertilizer
- ✓ Quality for milk production

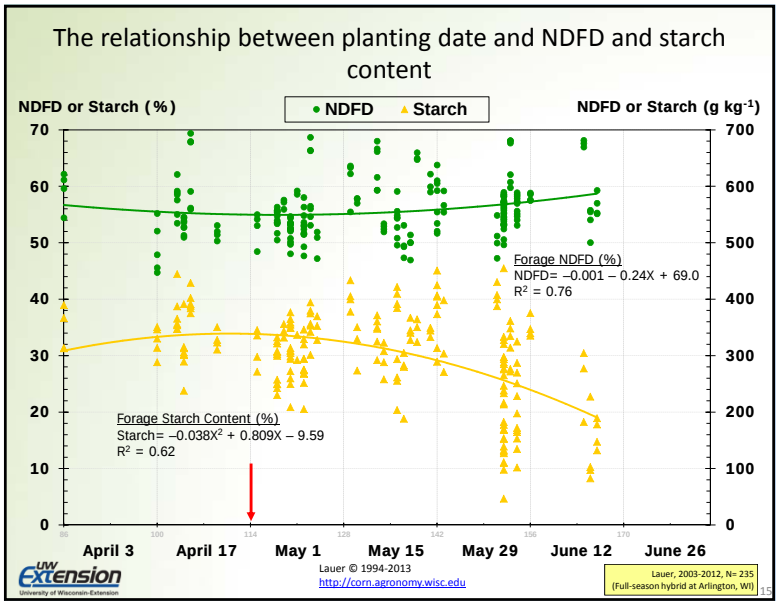
Harvesting cost differences between grain and silage

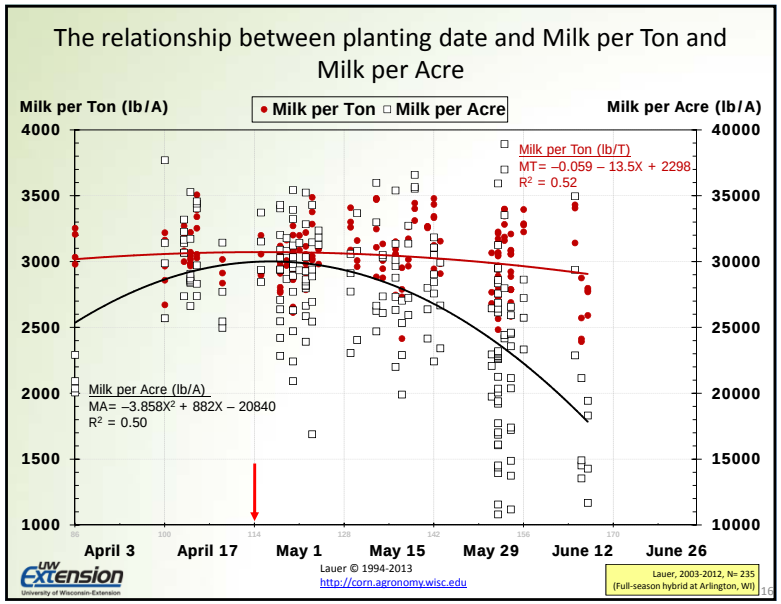
Storage losses of silage

See http://corn.agronomy.wisc.edu/Season/DSS.aspx


Relationship between corn plant density and grain yield, silage yield, Milk per ton, and Milk per acre
Relative measure (%)
Harvested plant density (plants/A x 1000)
Grain yield (R2=0.92)
Forage yield (R2=0.87)
Milk per ton(R2=0.73)
Milk per acre (R2=0.83)
Lauer © 1994-2013
http://corn.agronomy.wisc.edu
Lauer 2010: Arlington, 2000-2008, n= 447plots


The planting date producing maximum forage yield is April 24
Forage yield decreases 0.02 T/A per day on May 10 and accelerates to 0.04 T/A per day on June 1.
Forage yield (T/A)
Forage yield (Mg ha-1)
Maximum yield
95% of Maximum yield
Forage Yield (T/A)
FY= –0.0011X² + 0.26X – 5.04
R² = 0.88
Forage Yield Risk (T/A)
FY= 0.0002X² – 0.052X + 3.94
R² = 0.03
April 3
April 17
May 1
May 15
May 29
June 12
June 26
Lauer © 1994-2013
http://corn.agronomy.wisc.edu
Lauer, 2003-2012, N= 236
(Full-season hybrid at Arlington, WI)


The relationship between planting date and NDFD and starch content
NDFD or Starch (%)
NDFD
Starch
NDFD or Starch (g kg-1)
Forage NDFD (%)
NDFD= –0.001 – 0.24X + 69.0
R² = 0.76
Forage Starch Content (%)
Starch= –0.038X² + 0.809X – 9.59
R² = 0.62
April 3
April 17
May 1
May 15
May 29
June 12
June 26
Lauer © 1994-2013
http://corn.agronomy.wisc.edu
Lauer, 2003-2012, N= 235
(Full-season hybrid at Arlington, WI)


The relationship between planting date and Milk per Ton and Milk per Acre
Milk per Ton (lb/A)
Milk per Ton
Milk per Acre
Milk per Acre (lb/A)
Milk per Ton (lb/T)
MT= –0.059 – 13.5X + 2298
R² = 0.52
Milk per Acre (lb/A)
MA= –3.858X² + 882X – 20840
R² = 0.50
April 3
April 17
May 1
May 15
May 29
June 12
June 26
Lauer © 1994-2013
http://corn.agronomy.wisc.edu
Lauer, 2003-2012, N= 235
(Full-season hybrid at Arlington, WI)

Soil Fertility

It's not the place to cut costs.

Follow extension recommendations

Soil test and only apply needed nutrients:

- ✓ Use cheapest form of fertilizer per unit of N, P, or K and apply efficiently
- ✓ Use manure and legume credits to reduce purchased fertilizer costs
- ✓ Don't cut back on overall N supplied unless over applying
- ✓ Don't use micronutrients unless soil test recommends

17

Nutrients Removed by Corn at Harvest

Corn	P_2O_5 (lbs)	K_2O (lbs)
Per Yield Unit		
Grain, per bushel	0.38	0.29
Silage, per ton (65% moisture)	3.6	8.3
Per Area		
Grain, 175 bushels per acre	67	51
Silage, 24 tons per acre (65% moisture)	86	199

derived from UW NPM Fast Facts

18

Available Nutrient Content in Dairy Manure

The manure produced by a 1400 lb dairy cow =

Solid: 148 Lb/day 27 ton/yr

Liquid: 17.7 gal/day 6500 gal/yr

Dairy manure type	N	P_2O_5	K_2O
First year			
Solid (lb per ton)	3-4	3	7
Liquid (lb per 1000 gal)	7-10	5	16
Second year			
Solid (lb per ton)	1	1	1
Liquid (lb per 1000 gal)	2-3	1	2

derived from UW NPM Fast Facts

19

University of Wisconsin Nitrogen Guidelines for Corn

N:Corn Price Ratio (see table on other side)

Soil[1]	Previous Crop	0.05	0.10	0.15	0.20
		lbs N/acre (total to apply)[2]			
high/very high yield potential soils	Corn, Forage legumes, Legume vegetables, Green manures[5]	170[3] 155–185[4]	150 135–160	130 120–145	115 105–125
	Soybean, Small grains[6]	140 125–160	120 105–135	105 95–115	95 80–105
medium/low yield potential soils	Corn, Forage legumes, Legume vegetables, Green manures[5]	125 110–140	110 100–115	100 95–110	95 85–100
	Soybean, Small grains[6]	110 90–125	85 70–95	70 60–80	60 50–70
sands/ loamy sands	Irrigated—All crops[5]	215 205–225	205 195–215	195 180–205	180 170–195
	Non-irrigated—All crops[5]	140 130–150	130 120–140	120 110–130	110 100–120

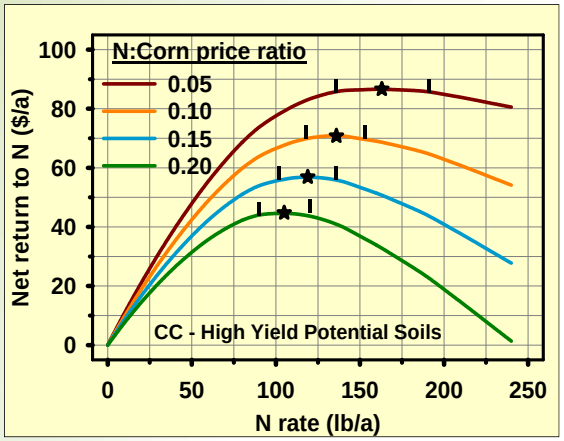
N:Corn Price Ratio Table*

Price of N (¢/lb N)	Price of Corn ($/bu corn) 2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50
0.25	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05
0.30	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05
0.35	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06
0.40	0.16	0.15	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07
0.45	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08
0.50	0.20	0.18	0.17	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10	0.09
0.55	0.22	0.20	0.18	0.17	0.16	0.15	0.13	0.13	0.12	0.12	0.11	0.11	0.10
0.60	0.24	0.22	0.20	0.18	0.17	0.16	0.14	0.14	0.13	0.13	0.12	0.11	0.11
0.65	0.26	0.24	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12
0.70	0.28	0.25	0.23	0.22	0.20	0.19	0.18	0.16	0.16	0.15	0.14	0.13	0.13
0.75	0.30	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.14
0.80	0.32	0.29	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15

*to use an online calculator go to http://www.soils.wisc.edu/extension/

Laboski, 2010

Profitable N Rates

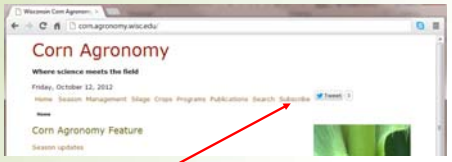


A range of N rates can produce profitable yields

Economics clearly drives the profitable N rate

Laboski and Bundy, 2006

Thanks for your attention! Questions?



Website: http://corn.agronomy.wisc.edu
To subscribe (unsubscribe) to season updates

Wisconsin Corn Conferences

WiscCorn.blogspot.com

@WiscCorn

WiscCorn

http://corn.agronomy.wisc.edu/HT/

22