Why Plant Rye After Corn Silage?
Nutrient Management Implications and Opportunities

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Winter Rye Use and Management Trials: Arlington, Lancaster and Janesville, 2004-06

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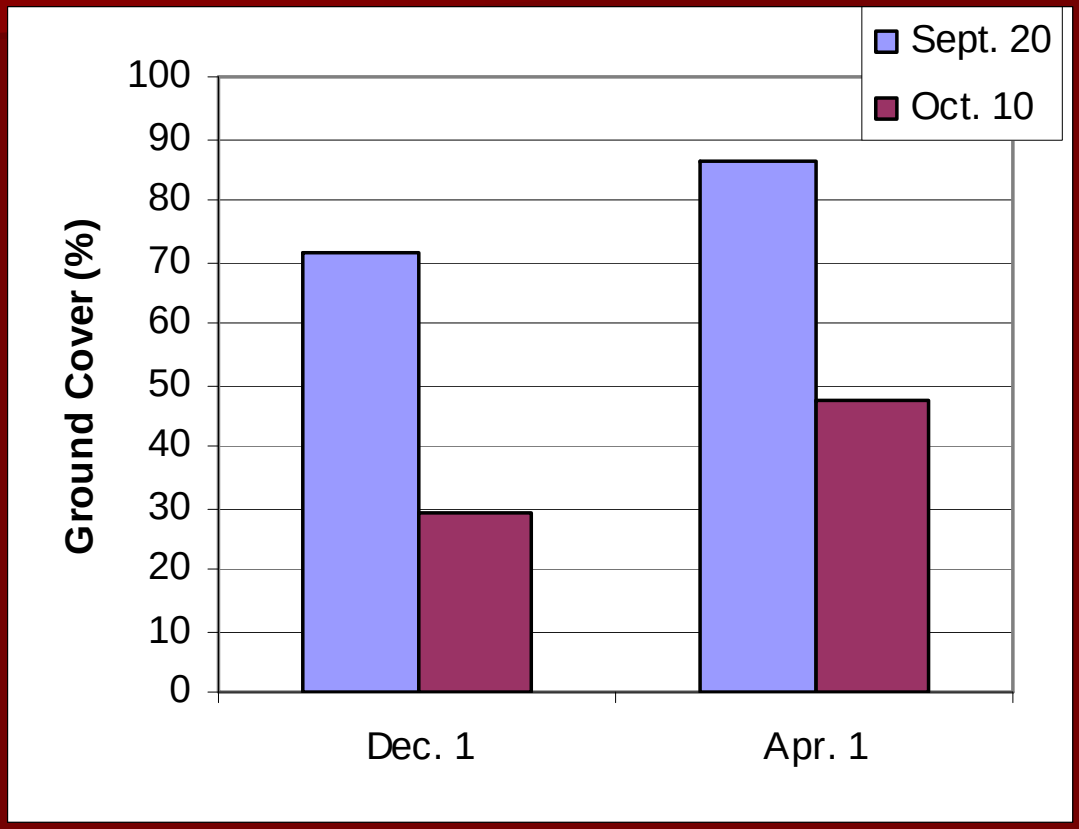
Why Plant Rye After Corn Silage?

- Cover crop for soil conservation and nutrient runoff prevention
- Forage production
  - Hedge against forage shortage
- Nutrient management

Effect of rye planting date on soil cover



Averages from replicated trials, Janesville, 2003-04. Seeding rate =112 lbs/acre.

RUSLE2 Soil loss prediction
Kidder silt loam 6-12% slope
Manure applied @ 40 T/A

Continuous	RUSLE2	
Corn silage system	T/Ac	SCI
Fall chsl, Spr FC, No rye	8.7	-.54
Fall chsl, Spr FC, With rye	4.6	-.27
No-till, No rye	5.5	-.45
No-till, With rye	2.4	.29

Rye planted Sept 20, rye killed April 19

Rye as an early-season forage?

Forage yield and quality optimized at boot stage

Rapid quality decline thereafter

Rye forage yield and quality

	Average	Range
Yield (ton DM/acre)	2.37	1.34–3.88
RFQ	180	149–205
CP (%)	16.2	13.3–19.0
ADF (%)	27.6	24.6–31.4
NDF (%)	52.2	47.2–56.7
P (%)	0.39	0.29–0.48
K (%)	3.05	2.10–4.37

* Results from 11 trials (site years) at Arlington, Lancaster and Janesville, 2004-06.

Managing rye for optimum forage = maximum conservation & nutrient management benefits

- Seeding rate
- Planting date
- Fertilization: nitrogen/manure application
- Harvest management
- Subsequent crop options

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Planting Winter Rye after Corn Silage:

Managing for Forage

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Dwight Mueller, UW Arlington Agricultural Research Station
Tim Wood, UW Lancaster Agricultural Research Station

Rye field cut and windrowed on a Rock county farm.

Why Plant Rye?

Winter rye (*Secale cereale*) can be used as a cover crop after corn silage to protect against soil erosion, and in parts of Wisconsin is recommended by conservation planners. Properly managed, it has multiple uses and benefits beyond conservation, including forage production, nutrient management and weed suppression. It can also provide a hedge against weather related forage shortage caused by alfalfa winterkill or drought.

This publication focuses on using rye as an early-season forage crop. However, when rye is managed for optimum forage production, conservation and nutrient management benefits will also be achieved. Except where otherwise noted, the information presented is based on trials conducted at research stations at Arlington, Lancaster and Janesville, WI from 2004 to 2006.

Forage Production

Rye, planted in the fall, can produce substantial dry matter (DM) yield the following spring, often without undue planting delay for the following crop. Rye harvested at boot stage typically produces DM yield in the 2 to 3 ton per acre range at quality levels acceptable for many animal production groups (Table 1).

Table 1: Rye forage yield, quality and nutrients removed by harvest.

	Average	Range
Yield (ton/acre)	2.37	1.34–3.88
RFQ	180	149–205
CP (%)	16.2	13.3–19.0
ADF (%)	27.6	24.6–31.4
NDF (%)	52.2	47.2–56.7
P (%)	0.39	0.29–0.48
K (%)	3.05	2.10–4.37
Nutrient removal (lb/acre) dry matter basis, harvested at boot stage		
N	121	69–178
P_2O_5	42	29–71
K_2O	178	110–344

Factors Affecting Rye Forage Yield and Quality

Planting: Rye should be planted as soon after corn silage harvest as possible. In southern Wisconsin, rye planted in mid-to-late September produces higher forage yield, and tends to mature slightly earlier the next spring. However, yield potential does not significantly decline until about October 10 (Figure 1). Later planting results in less soil cover going into winter, thus reducing soil protection (Figure 2). However, rye grows rapidly in spring and acceptable forage yield can usually be achieved with later October planting.

Rye planted at different planting dates, Oct. 10 (left) and Sept. 20 (right). Photo taken the following April.

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Rye nutrient management opportunities

Nutrient removal, lb/ton dry matter of rye harvested at boot stage:

	WI research	NRC
N	52	52
P2O5	18	19
K2O	80	81
number of samples	212	1155

Nutrients removed by rye forage

	WI research *	UWEX A2809/ SNAP+**
Yield (tons dm/ac)	2.37	2 - 3.5
P2O5 (lbs/ac)	42	30
K2O (lbs/ac)	178	120

*Mean values from 11 trials, 2004-06, Arlington, Janesville and Lancaster

**SNAP+ = “winter rye forage”; UWEX A2809 = “small grain silage”

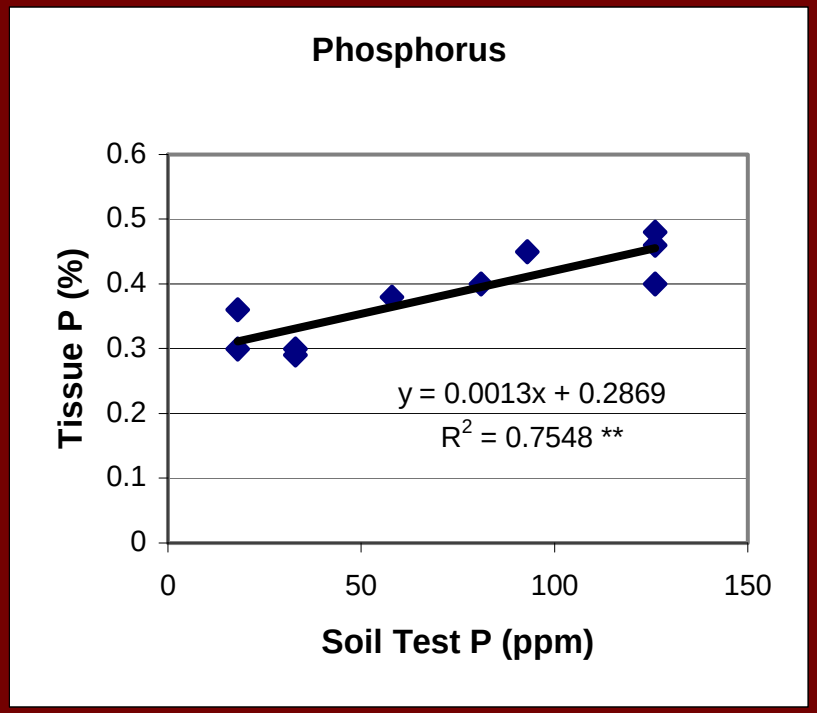
Rye nutrient management opportunities

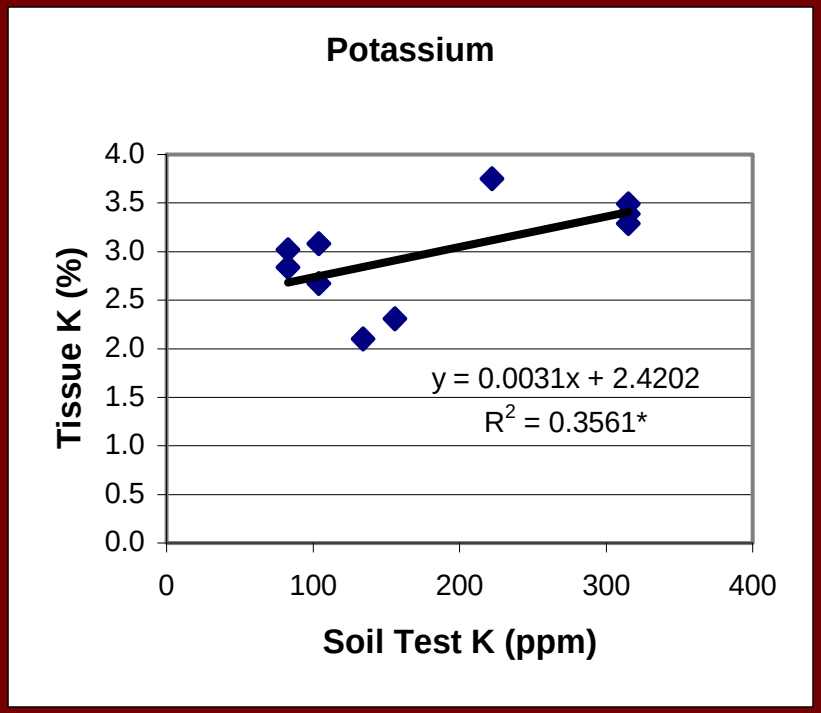
Nutrient removal (lb/acre) dry matter basis, harvested at boot stage:

	Average	Range
N	121	69–178
P2O5	42	29–71
K2O	178	110–344

Results from 11 trials (site years) at Arlington, Lancaster and Janesville, 2004-06.

Relationship between soil test level and rye tissue nutrient concentration. Data points represent trial means, n=184.





Estimated nutrient removal based on rye tissue nutrient level and dry matter yield

Forage Yield (tons/acre)				
Tissue concentration	1	2	3	4
P(%)	P2O5 (lb/ac)			
.25	11	23	34	44
.35	16	32	48	64
.45	20	41	61	80*
K(%)	K2O (lb/ac)			
2.00	48	96	144	192
3.00	72	144	216	288
4.00	96	192	288	384*

* Values beyond observation in Wisconsin research

Impact of rye on nutrient removal and manure rates for crop rotations – according to ***SNAP Plus***

Year 1	Year 2	P2O5 balance	K2O balance	Impact of rye P2O5	Impact of rye K2O	Addl. manure application = P Balance
Corn silage	Corn silage	-160	-370			**3,000 gals/ac** or **8 tons/ac** Incorporated dairy manure
	Rye-Corn silage	-210	-590	-30	-120	
Corn silage	Soybean	-120	-255			
	Rye-Soybean	-170	-475	-30	-120	
Corn silage	Alfalfa seeding	-105	-290			
	Rye-Alfalfa seeding	-155	-510	-30	-120	

Impact of rye on nutrient removal and manure rates for crop rotations – according to ***plant tissue analysis***

Year 1	Year 2	P2O5 balance	K2O balance	Impact of rye P2O5	Impact of rye K2O	Addl. manure application = P balance
Corn silage	Corn silage Rye-Corn silage	-160 -210	-370 -590	-50	-220	**5,000 gals/ac** or **13 tons/ac** Incorporated dairy manure
Corn silage	Soybean Rye-Soybean	-120 -170	-255 -475	-50	-220	
Corn silage	Alfalfa seeding Rye-Alfalfa seeding	-105 -155	-290 -510	-50	-220	

Crop yields following winter rye cover and forage crops

Arlington Research Station

Mueller and Doll, 2004

Crop	Rye treated as cover crop	Rye treated as forage crop
Soybeans (2004)	46 bu/acre	47 bu/acre
Corn (2004)	145 bu/acre	110 bu/acre

Alfalfa w/Rye Establishment Trials

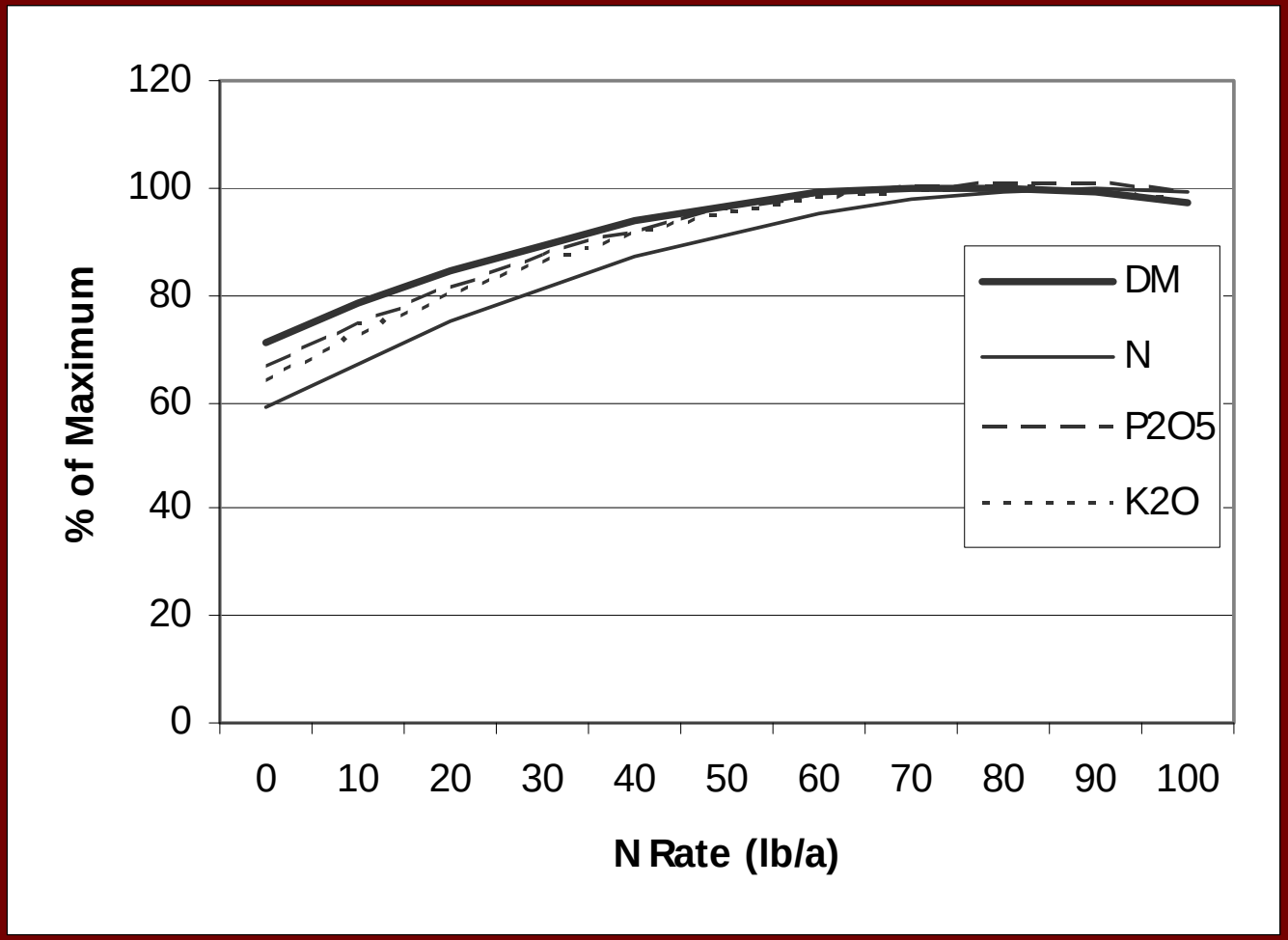
Arlington Research Station

Mueller and Doll, 2004

Tons Dry Matter/acre

Alfalfa was seeded:	Alfalfa yield – 2 cuttings	Rye yield	Total forage yield
Into rye as nurse crop	1.98	1.53	3.51
Following rye forage harvest	1.79	1.83	3.62
Into rye as cover crop	2.13	--	2.13
Conventional/no rye	2.32	--	2.32

Response to N Fertilizer
DM yield and nutrient removal (% of maximum)



Summary

- Winter rye planted following corn silage harvest can provide conservation and nutrient management benefits in addition to a likely economical source of forage:
  - Costs: seed, planting, extra tillage, harvest, impact on yield of subsequent crop;
    - Consider risk of un-timely harvest delay
  - Returns: value of forage, conservation and nutrient management benefits.

Summary

- P and K content of rye forage is variable and should be determined with plant tissue or forage analysis;
- P and K concentrations in rye forage are often higher than UWEX book values;
- Documenting yield and nutrient content often increases nutrient removal estimates allowing greater flexibility in manure application in nutrient management planning;
- K concentrations should be monitored for dairy herd health concerns.

Summary

- UWEX A2809 and SNAP Plus require updating with newly collected data;
- Additional trials are planned to further understanding of manure-supplied N in relation to time and amount needed;
- Much interest in further understanding of rye's role in livestock feeding and storage.

Thank you!

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