

Table 1. 2013 and 2014 yields (Mg ha<sup>-1</sup>, dry matter) are presented for the injection manure (IM) versus broadcast manure (BM) treatments in the MANURE ROTATION.

Crop	Year	IM	BM	SE	P-value
		(Mg ha <sup>-1</sup> )			
Alf+Grass - Yr. 1	2013	5.78	5.00	0.42	0.11
	2014	12.25	12.28	0.77	0.45
Alf+Grass - Yr. 2 <sup>^</sup>	2013	6.65	6.66	0.42	0.97
	2014	17.87	18.55	0.77	0.45
Spring Canola	2013	1.07	1.53	0.14	0.10
Rye Silage <sup>#</sup>	2014	<b>6.29</b>	<b>6.89</b>	0.24	<b>0.02</b>
SS Grass <sup>#</sup>	2014	<b>4.54</b>	<b>5.53</b>	0.35	<b>0.05</b>
Corn Silage (after RC/HV)	2013	13.63	13.42	0.67	0.14
Corn Silage (after RC/CC)	2014	18.09	16.48	0.80	0.25
Corn Silage (wheat) <sup>§</sup>	2013	17.96	16.05	0.67	0.14
Corn Silage (interseeded cc) <sup>§</sup>	2014	15.50	15.96	0.80	0.25
Corn Grain	2013	9.97	10.57	0.20	0.13
	2014	10.02	10.34	0.46	0.80

Manure Management Comparison		2013	2014
Sources of Variation	df	p-value	
Crop <sup>&amp;</sup>	3	<b>&lt;0.001</b>	<b>&lt;0.001</b>
Manure Management	1	0.42	0.6383
MainMgt*Crop	3	<b>0.05</b>	0.1341

<sup>^</sup> Due to a failed alfalfa+grass stand in 2012, timothy grass + red clover was planted in 2013, resulting in lower yields.

<sup>#</sup> Spring canola was replaced with rye silage followed by sorghum sudangrass and fall-planted crimson clover or rye silage underseeded by red clover.

<sup>§</sup> In 2014-2015, corn silage that was after wheat in 2013 will follow interseeded clovers and annual ryegrass mix.

<sup>&</sup> When crop entry plots received manure treatments, they were included in the manure management comparison analysis. These included canola, both corn silage, and corn grain plots in 2013 and corn grain and both corn silage plots in 2014 due to canola winterkill.

Table 2. 2013 yields (Mg ha<sup>-1</sup>, dry matter) are presented for the reduced herbicide (RH) versus standard herbicide (SH) treatments in the PEST ROTATION.

Crop	Year	RH	SH	SE	P-value
		(Mg ha <sup>-1</sup> )			
Alf+Grass+Trit (RH) - Yr. 1 Alfalfa (SH) - Yr. 1	2013	3.46	4.95	0.42	<b>0.02</b>
	2014	10.57	12.66	0.77	0.22
Alf+Grass (RH) - Yr. 2 Alfalfa (SH) - Yr. 2	2013	12.83	13.22	0.42	0.44
	2014	17.76	17.99	0.77	0.22
Alf+Grass (RH) - Yr. 3 Alfalfa (SH) - Yr. 3	2013	10.43	11.32	0.42	0.11
	2014	15.39	15.03	0.77	0.22
Canola (winter) <sup>#</sup>	2013	1.83	1.77	0.04	0.41
SS grass <sup>#</sup>	2014	10.41	10.67	0.29	0.36
Corn Silage <sup>§</sup>	2013	13.36	15.28	1.28	0.37
	2014	16.27	15.47	0.37	0.23
Soybean <sup>^</sup>	2013	3.08	3.31	0.24	0.11
	2014	3.35	3.41	0.11	0.31

Pest Management Comparison		2013	2014
Sources of Variation	df	p-value	
Crop <sup>&amp;</sup>	3	<b>&lt;0.001</b>	<b>&lt;0.001</b>
Manure Management	1	<b>0.04</b>	0.351
MainMgt*Crop	3	<b>0.004</b>	<b>0.014</b>

<sup>#</sup> Canola yields were examined in a nested split-split plot model that included canola from the Pest Rotation in 2013, while in 2014, sorghum sudangrass was planted as a rescue crop when canola winterkilled.

<sup>§</sup> Corn silage yields were compared for RH-high residue cultivation and for SH.

<sup>^</sup> Soybean yields were compared for RH with high residue cultivation and for SH in 37.5 cm rows and were examined in a nested split-split plot model that included soybeans from the Control Rotation.

<sup>&</sup> When crop entry plots received manure treatments, they were included in the manure management comparison analysis. These included canola, both corn silage, and corn grain plots.

Table 3. 2014 forage yields (Mg ha<sup>-1</sup>, dry matter) at each cutting are presented for the injection manure (IM) versus broadcast manure (BM) treatments in the MANURE ROTATION and for the reduced herbicide (RH) versus standard herbicide (RH) treatments in the PEST ROTATION.

Crop Entry	Harvest Date	Dry Matter Yield (Mg ha <sup>-1</sup> )		
		IM	BM	(SE)
Alf + Grass Yr. 1 (cut #1)	6/24	2.76	2.85	0.24
Alf + Grass Yr. 1 (cut #2)	8/1	5.33	5.18	0.24
Alf + Grass Yr. 1 (cut #3)	9/4	4.15	4.54	0.24
Alf + Grass Yr. 2 (cut #1)	6/2	6.62	6.36	0.23
Alf + Grass Yr. 2 (cut #2)	7/1	3.90	4.51	0.23
Alf + Grass Yr. 2 (cut #3)	8/1	3.62	3.72	0.23
Alf + Grass Yr. 2 (cut #4)	9/4	3.77	3.68	0.23

B) PEST ROTATION

Crop Entry	Harvest Date	Dry Matter Yield (Mg ha <sup>-1</sup> )		
		RH	SH	(SE)
Forage Yr. 1 (cut #1) <sup>§</sup>	7/3	2.86 b	5.03 a	0.16
Forage Yr. 1 (cut #2)	8/1	3.20 b	3.85 a	0.16
Forage Yr. 1 (cut #3)	9/16	4.00	3.75	0.16
Forage Yr. 2 (cut #1)	6/2	6.72	6.55	0.32
Forage Yr. 2 (cut #2)	7/1	4.08	4.59	0.32
Forage Yr. 2 (cut #3)	8/1	3.50	4.06	0.32
Forage Yr. 2 (cut #4)	9/4	3.41	3.33	0.32
Forage Yr. 3 (cut #1)	6/2	7.51 a	6.33 b	0.26
Forage Yr. 3 (cut #2)	7/1	4.04	4.32	0.26
Forage Yr. 3 (cut #3)	8/1	3.51	3.60	0.26

<sup>§</sup> RH treatment has alfalfa, orchard grass, and triticale in cut #1, while SH has alfalfa only.

Table 4. Cover crop biomass, weed biomass, and crop yields in soybean: PEST Rotation 2010-2013. “SH” refers to standard herbicide weed management strategy and “RH” refers to reduced herbicide weed management strategy. Two sub-management strategies were added to the “RH” strategy in 2013, including a post-herbicide spray or a post high residue cultivation.

Year/Management	Row Spacing	Cover Crop Biomass <sup>£</sup> Mg/ha	SE	Crop Population plants/ha	SE	Weed Biomass <sup>€</sup> g/m <sup>2</sup>	SE	Yield <sup>€</sup> Mg/ha (DM)	SE
<b>2010</b>									
SH	19 cm	2.0 ^	----	295,163	16377	0.0	3.8	4.2	0.3
RH	76 cm	1.5 ^	----	343,239	16377	8.0	3.8	4.3	0.3
<b>2011</b>									
SH	19 cm	3.5 b	0.3	-----	-----	0.4 b	11.4	3.3 a	0.3
RH	76 cm	4.4 a	0.3	-----	-----	89.0 a	11.4	2.8 b	0.3
<b>2012</b>									
SH	19 cm	4.9	1.3	289,209 a	26459	0.0	0.5	3.5 a	0.3
	76 cm	4.5	0.9 <sup>§</sup>	151,947 b	39219 <sup>§</sup>	0.1	0.1 <sup>§</sup>	3.1 ab	0.3
RH	76 cm	7.9	1.3	111,278 b	26459	1.2	0.5	2.4 b	0.3
<b>2013</b>									
SH	38 cm	5.3	1.3	264,160	22195	0.1	1.0	3.3	0.2
	76 cm	5.5	1.3	250,049	22195	0.9	1.0	3.3	0.2
RH (High Res. Cult.)	76 cm	5.8	1.3	303,671	22195	2.1	1.0	3.1	0.2
RH (Post Herbicide)	76 cm	4.5	1.3	296,333	22195	0.5	1.0	3.0	0.2
<b>2014</b>									
SH	38 cm	2.8	0.7	344,045	29598	0.0	3.1	3.5	0.1
	76 cm	3.2	0.7	314,475	29598	0.0	3.1	3.3	0.1
RH (High Res. Cult)	76 cm	2.1	0.7	378,318	29598	10.9 a	3.1	3.3	0.1
RH (Post Herbicide)	76 cm	2.3	0.8	395,932	29598	0.4	3.1	3.4	0.1

a,b- Indicate values that were statistically significant by SH or RH management.

£-Rye terminated in RH soybeans earlier than in SH soybeans in every year, and is rolled down with a roller-crimper

€- Dry matter reported.

^ - Statistical analysis not performed on cover crop biomass in 2010 as biomass was only collected from half of the plots.

§- SE reported determined by within Main Management comparison between SH-19 cm row and SH-76 cm row.

Table 5: Cover crop biomass, weed biomass, and crop yields in corn: PEST Rotation 2010-2012 (corn grain) and 2013 (corn silage). “SH” refers to standard herbicide weed management strategy and “RH” refers to reduced herbicide weed management strategy. Two sub-management strategies were added to the “RH” strategy in 2013, including a post-herbicide spray or post-high residue cultivation.

Year/Management	Row Spacing	Cover Crop Biomass <sup>£</sup> Mg/ha	SE	Weed Biomass <sup>€</sup> g/m <sup>2</sup>	SE	Yield <sup>€</sup> Mg/ha (DM)	SE
<b>2010 – corn grain</b>							
SH	76 cm	2.2 <sup>^</sup>	----	1.0	1.3	10.6	0.3
RH	76 cm	2.3 <sup>^</sup>	----	3.3	1.3	10.9	0.3
<b>2011 – corn grain</b>							
SH	76 cm	0.3	0.1	0.2 b	3.5	8.4	0.3
RH	76 cm	0.5	0.1	20.6 a	3.5	9.0	0.3
<b>2012 – corn grain</b>							
SH	76 cm	1.6 a	0.1	0.3	6.7	8.6	0.3
RH	76 cm	1.0 b	0.1	15.7	6.7	8.3	0.3
<b>2013 – corn silage</b>							
SH	76 cm	0.22	0.03	0.7	5.9	15.3 a	1.3
RH (High Res. Cult.)	76 cm	0.33	0.03	18.9	7.7	13.4 ab	1.3
RH (Post Herbicide)	76 cm	0.25	0.02 <sup>§</sup>	6.8	2.6 <sup>§</sup>	12.3 b	0.3 <sup>§</sup>
<b>2014 – corn silage</b>							
SH	76 cm	1.02	0.17	0.003 a	.23	15.5	0.4
RH (High Res. Cult.)	76 cm	1.53	0.17	1.6 b	0.003	16.3	0.4
RH (Post Herbicide)	76 cm	0.98	0.18 <sup>§</sup>	0.0 a	0.002	12.3	0.3 <sup>§</sup>

a,b- Indicate values that were statistically significant by weed management. In 2013, this comes from pairwise comparisons among treatments.

€- Dry matter reported.

<sup>^</sup>- Statistical analysis not performed on cover crop biomass in 2010 as biomass was only collected from half of the plots.

<sup>§</sup>- SE reported determined by within Main Management comparison between SH and RH-Post herbicide treatments.

Table 6. 2013 crop yields ( $\text{Mg ha}^{-1}$ , dry matter) for common crops across rotations are presented for A) canola, B) soybean, and C) corn grain for the injection manure (IM) versus broadcast manure (BM) treatments in the MANURE and C-S ROTATION and for the reduced herbicide (RH) versus standard herbicide (RH) treatments in the PEST ROTATION.

A) Canola								
Year	PEST (P)			MANURE (M)			(M)	P vs. M
	RH	SH	SE	IM	BM	SE	p-value	
	$(\text{Mg ha}^{-1})$			$(\text{Mg ha}^{-1})$				
2013	1.83	1.77	0.10	1.07	1.53	0.10	<b>0.02</b>	<b>0.01</b>
B) Soybean								
Year	PEST (P)			CORN-SOY (C-S)			(C-S)	P vs. C-S
	RH	SH	SE	IM	BM	SE	p-value	
	$(\text{Mg ha}^{-1})$			$(\text{Mg ha}^{-1})$				
2013	3.08	3.31	0.25	3.25	3.04	0.25	0.16	0.75
2014	3.35	3.41	0.11	3.32	3.54	0.11	0.31	0.61
C) Corngrain								
Year	MANURE (M)			CORN-SOY (C-S)			(C-S)	M vs. C-S
	IM	BM	SE	IM	BM	SE	p-value	
	$(\text{Mg ha}^{-1})$			$(\text{Mg ha}^{-1})$				
2013	9.97	10.56	0.50	7.72	8.29	0.50	0.39	<b>0.03</b>
2014	10.02	10.34	0.46	8.19	8.18	0.46	0.8	<b>0.01</b>