Evaluating the Efficacy of 590 Fall Manure Management Practices to Improve Corn N Utilization

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40 lb N/a + Sidedress N	Fall Dairy Slurry 7,000 gal/a	Instinct	Spring Wheat Cover
-	Yes	-	-
-	Yes	Yes	-
-	Yes	-	Yes
-	Yes	Yes	Yes
0 to 240 lb N/a	-	-	-

Slurry broadcast and incorporated within 1 hr
Spring wheat planted 2 days after slurry application
Arl PD = 9/23/15, 9/30/16, 9/18/17
March PD = 9/21/15, 10/4/16, 10/28/17

Manure Analysis	A16	A17	A18	M16	M17	M18
Total N, lb N/a	127	116	145	58	69	53
NH_4-N, lb N/a	63	59	66	26	31	22
NH_4-N/TN, %	50	51	46	45	45	42
Dry Matter, %	4.1	5.5	6.5	1.8	2.6	3.6
Est. 1st yr avail., lb N/a	64	58	73	29	35	27

Research funded by Pioneer

More growing degree days = more N uptake by cover crop

	Arlington			Marshfield		
Treatment	2016	2017	2018	2016 †	2017	2018
	---------- lb/a ----------					
Cover Crop Biomass yield						
No Instinct®	1,664 a	498	1099 a	-	350	141
Instinct®	1,407 b	528	921 b	-	320	135
Cover Crop Biomass N uptake						
No Instinct®	70 a	18 b	40 a	-	10	7
Instinct®	64 b	20 a	35 b	-	9	7

† Grazed by wildlife

- At Arlington, Instinct reduced biomass N uptake in 2016 and 2018, but increased it in 2017
- Instinct had no effect a Marshfield; but very little biomass

Cover crop reduced fall soil nitrate

	Crop Year 2016		Crop Year 2017		Crop Year 2018	
	Post fall slurry		Post fall slurry		Post fall slurry	
Treatments	4 weeks	8 weeks	4 weeks	8 weeks	4 weeks	8 weeks
	---------- Soil Nitrate Concentrations, lb N/a ----------					
Arlington						
No N Control	61 c †	24 b	43	35 a	39	35 c
Slurry	128 a	58 a	39	33 a	57	64 a
Slurry + Instinct®	124 a	57 a	38	38 a	46	55 b
Slurry + Cover	91 b	23 b	35	20 b	42	17 d
Slurry + Instinct® + Cover	87 b	22 b	38	17 b	44	17 d
Marshfield						
No N Control	42 bc	33 b	17	19 a	25 b	29 c
Slurry	59 a	45 a	15	19 a	38 a	40 b
Slurry + Instinct®	51 ab	51 a	15	19 a	39 a	47 a
Slurry + Cover	35 c	17 c	16	15 b	21 b	26 c
Slurry + Instinct® + Cover	37 c	15 c	15	15 b	25 b	29 c

- Instinct largely had no effect on soil nitrate concentrations

At Arlington cover crop reduced PPNT at 2-3', but not at Marshfield

	Crop Year 2016		Crop Year 2017		Crop Year 2018	
	Spring		Spring		Spring	
Treatments	2-3' PPNT	0-1' PSNT	2-3' PPNT	0-1' PSNT	2-3' PPNT	0-1' PSNT
	---------- Soil Nitrate Concentrations, lb N/a ----------					
Arlington						
No N Control	30 b	70 b	24 a	51	17 a	83
Slurry	44 a	74 b	23 a	49	19 a	73
Slurry + Instinct®	49 a	79 b	25 a	55	18 a	63
Slurry + Cover	28 b	97 a	16 b	51	13 b ★	68
Slurry + Instinct® + Cover	27 b	95 a	14 b	46	12 b	68
Marshfield						
No N Control	20	66 ab	9	14	18	37
Slurry	18	82 a	9	17	17	56
Slurry + Instinct®	16	85 a	10	13	17	45
Slurry + Cover	15 ★	60 b	9	13	21	74
Slurry + Instinct® + Cover	12	56 b	8	15	14	39

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★ Sites had ~30 lb N/a less in top 2' at PPNT where cover was grown; 2nd & 3rd largest biomass

- Instinct had no effect on soil nitrate concentrations

Effect of fall manure BMPs on corn yield

	Arlington			Marshfield		
Treatment	2016	2017	2018	2016	2017	2018
	---------- bu/a ----------					
No N Control	265	186 a	185 b	160 bc	74	103 b
Slurry	259	185 a	211 a	192 a	78	118 a
Slurry + Instinct®	267	191 a	213 a	184 ab	77	120 a
Slurry + Cover	261	180 a	180 b	154 c	75	120 a
Slurry + Instinct® + Cover	260	153 b	187 b	164 bc	72	114 a
Yield at $EONR_{0.10}$	271	232	227	229	176	187
$EONR_{0.10}$, lb N/a	10	192	135	118	157	183

- Cover significantly reduced yield by 29 bu/a at M16 and A18 compared to no cover
- Instinct + Cover reduced yield by 38 bu/a compared to Instinct at A17
- All fall manure was lost in 2017 at both locations because of greater than normal precip.

Effect of fall manure BMPs silage

	Arlington			Marshfield		
Treatment	2016	2017	2018	2016	2017	2018
Silage yield, T DM/a						
No N Control	11.8	8.7	8.2	6.3 b	3.5	5.4
Slurry	12.7	8.7	9.0	7.9 a	3.3	6.3
Slurry + Instinct®	12.7	8.8	9.3	7.9 a	3.3	6.1
Slurry + Cover	13.0	8.3	8.5	6.2 b	3.3	6.1
Slurry + Instinct® + Cover	12.6	7.5	8.9	7.1 ab	3.1	6.0
Silage N uptake, lb N/a						
No N Control	247 b	159	144	111	71	68
Slurry	295 a	146	161	146	66	77
Slurry + Instinct®	291 a	147	166	141	66	76
Slurry + Cover	313 a	140	145	104	68	83
Slurry + Instinct® + Cover	279 ab	128	153	132	63	78

- Blue boxes show where cover crop reduced grain yield
- Similar trends for silage yield and N uptake, *BUT* only significant at M16 where wildlife grazed cover

Conclusions

- Spring wheat cover crop reduced 1’ soil nitrate in the fall at all sites
- At 2 sites where cover sig. reduced grain yield, cover reduced PPNT in top 2’ by 30 lb N/a
  - A18 - 2nd largest cover crop biomass, N uptake by cover was 40 lb N/a
  - M16 - 3rd largest cover crop biomass, wildlife grazed cover N uptake unknown
- Cover crop reduced soil nitrate at 2-3’ at PPNT at Arlington, not Marshfield
- PSNT picked up reduced N availability where cover crop was grown at 1 of 3 sites where cover reduced yield
- A forage double crop may be useful to remove N from the system and make sure it becomes protein
- Use of Instinct with dairy manure continues to have variable results
- Instinct + spring wheat cover didn’t provide added benefits for conserving N
- Low manure N applied at Marshfield may have influenced results
- Cover crop clearly influenced N cycle
- Cover and N cycle influenced by weather

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