

Safe and Effective Nutrient Rates in Spring Strip-till and at Planting



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Wheat Radicle Damage from Urea N applied at 100 pounds N/acre with Seed



Wheat Seed/Root Response to N Placement

Day 1

Day 4



Wheat Root Axis "Burn" when Close to Polycoated Urea Prills



Canola Root Damage from Nitrogen Bands 2" Below Seed

UAN

Urea



180 lbs/acre in 8" rows

Source: Madsen and Pan, Agron. J. 111, 2019

Canola Root Damage from Progressively More Nitrogen 2" Below Seed Depth



Just what causes the toxicity from fertilizers?

- 1. Ammonium (NH₄) ion concentration
- 2. Ammonia (NH₃) gas
- 3. Salt injury

RTK Guidance and Pre-plant UAN Application 2006-2008



Dr. Tony J. Vyn and Terry D. West Automatic Guidance Systems Add Efficiency To Fertilizer Management

Most precise GPS guidance available is the RTK system.

Recent developments in GPSguided automatic steering systems have opened up many new management options for corn producers. Automatic guidance devices have provided benefits in terms of improved timeliness of field operations, less operator fatigue, reductions in overlapping applications of pesticides and fertilizers, controlled traffic system opportunities, as well as reduction in capital expenses (such as the possible elimination of row markers on corn planters, or the use of strip tillage tools that are only half to two-thirds of the corn planter width). The economic merits of automatic steering devices



Planting within a day of UAN banding at: ---- 50, 100 and 200 pounds N/acre ----- 0", 5" and 10" away from UAN band



RTK and Pre-plant UAN at Wanatah, IN



200 N at 5" versus 200 N at 0"

200 N at 5" (background) vs. 200 N at 0" (foreground)



50 N at 0"versus 200 N at 0"

100 N at 0" versus 100 N at 10"

RTK Row Position Effects on Plant Population Response to Pre-Plant UAN Rates Wanatah, IN, 2006-2008



UAN Band Positions and Corn Yields #1



RTK Planting after Pre-plant UAN at West Lafayette, IN







100 N at 0" w & w/o starter

RTK after Pre-Plant UAN on silty clay at West Lafayette, IN



200 N @ O" w/o & w Starter



200 N @ 0"



200 N @ 10"

UAN Band Positions and Corn Yields #2 (with 10-34-0 Starter Fertilizer)

West Lafayette, IN, 2006-2008



UAN Band Positions and Corn Yields #3

Lafayette, IN, 2007-2008



Planting No-till Corn after Diagonal NH₃ Placement in Spring, 2010-2012





Individual Plant Growth and Development Uniformity



Consequences of Planter Banded Nitrogen Rate and Placement to Corn West Lafayette, IN, 2017-2018







Consequences of Planter Banded Nitrogen





Depth from Soil Surface

Consequences of Planter Banded Nitrogen Position and Rate on Final Populations (2017 and 2018, West Lafayette)

Planter UAN Placement by Rate Combinations				
Depth	Placement	AP	SD	Total
(inch)	(inch)		-(lbs/N/ac)	
2	2	30	150	180
2	2	90	90	180
2	2	180	0	180
4	2	30	150	180
4	2	90	90	180
4	2	180	0	180

Planter UAN Plant Populations	5
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	Population (plants per acre)		
Depth x Dist.	2017	2018	
2x2	33,300	30,800	
4x2	33,200	31,300	
At-plant N rate	2017	2018	
30	33,300	31,000	
90	33,100	30,900	
180	33,400	31,300	

Consequences of Planter Banded Nitrogen – Plant Heights 2017 and 2018 West Lafayette

I fanter Offit I fant freight and Stark Diameters				
	R1 Plant Heights (inch)		Stalk Diameters (inch)	
Depth x Dist.	2017	2018	2017	2018
2x2	92.6	99.6	0.93	0.82
4x2	94.9	98.9	0.92	0.82
At-plant N rate	2017	2018	2017	2018
30	92.6	95.6 b	0.95	0.81
90	93.7	103.0 a	0.87	0.84
180	94.9	99.1 ab	0.95	0.81







Consequences of Planter Banded Nitrogen Placement/Rate for Stem Volume in 2018 (West Lafayette)

N Placement

N Rate

Stem Volume at V10 and R1 in 2018

Stem Volume at V10 and R1 in 2018



Consequences of Planter Banded Nitrogen – Kernel # 2017 and 2018 West Lafayette

Kernel Number at 30, 90, and 180 lbs/N/ac Planter Applied



Kernel Number at 2x2 and 4x2 Placements

Consequences of Planter Banded Nitrogen – Kernel Weights 2017 and 2018 West Lafayette

350 350 Kernel Weight (mg/kernel) 300 300 Kernel Weight (mg/kernel) 250 250 200 200 150 150 100 100 50 50 NS NS AB NS B Α NS NS NS NS 0 2017 2018 0 2017 2018 316 270 $\Box 2x2$ 307 273 □90 306 286 ■4x2 319 275 ∎180 318 264

Kernel Weight at 2x2 and 4x2 Placements

Kernel Weight at 30, 90, and 180 lbs/N/ac Planter Applied

Consequences of Planter Banded Nitrogen – Grain Yield 2017 and 2018 West Lafayette



Consequences of Planter-banded UAN Placement/Rate for Yield 2017 and 2018 West Lafayette



Grain Yield For Placement by Rate Combinations

2017

2018

Consequences of Planter Banded Nitrogen – 2019 LaCrosse after Broadcast AS

Sidedress N Timing and Placement				
Combinations with 2x2 Banded N At-Planting				
	AP V5 V12 Total			
ID	(lbs/N/ac)			
Zero	0	0	0	0
AP140	140	0	0	140
V5 Y-Drop	70	70	0	140
V12 Y-Drop	70	0	70	140



2019 Optimum Sidedress



Consequences of Planter Banded Nitrogen to emergence where starter fertilizer not properly aligned (2019 LaCrosse)



Consequences of Planter Banded Nitrogen on Plant Populations (2019, LaCrosse, IN)

35,000 Population (plants/acre) 30,000 25,000 20,000 15,000 10,000 5,000 AB В AB А ns ns ns ns 0 Rainfed Irrigated □Zero 31,200 31,400 □ AP140 27,700 28,800 ■V5 Y-Drop 30,000 30,200 ■V12 Y-Drop 31,100 30,500

Population at V1

35,000 30,000 25,000 20,000 15,000 10,000 5,000 NS NS NS NS ns ns ns ns 0 Rainfed Irrigated □Zero 30,500 31,400 □ AP140 29,300 29,800 □ V5 Y-30,700 31,000 Drop ■V12 Y-31,600 31,400 Drop

Population at V6

Consequences of Planter Banded Nitrogen on Plant Heights at V6, V9, V12 and R2 (2019, LaCrosse, IN)



□Zero □AP140 □V5 Y-Drop □V12 Y-Drop

Consequences of Planter Banded Nitrogen on Grain Yields in Rainfed vs. Irrigated (2019, LaCrosse, IN)

Grain Yield



Strip-Till Corn Yield Response to K Banding (2016-2019; First-year Corn after Soybean)



Year 1 with 3 sites



Year 2 with 2 sites



Soil-test K with zero K= 205 (2016), 110 (2017) and 107 (2019)

Fall or Spring Strip-till Banding of Aspire® (0-0-58 + 0.5 B) at 100 or 200 lb/acre: Effects on In-Row Exchangeable K



Strip-Till Corn Earleaf K Response to K Banding (2016-2019; First-year Corn after Soybean)

Year 1

Year 2



Safe and Effective Rates at Planting or Short Pre-plant May Mean More In-Season Applications.....

Other Practical Influencing Factors:

- 1. Hybrid
- 2. Uniformity of nutrient delivery
- 3. Time from Strip-till banding to planting
- 4. Nutrient Depth and Consistency
- 5. Seed size
- 6. Nutrients other than N and K (e.g. B)
- 7. Other seasonal stresses



Some Conclusions

- Corn seedling injury risk increases with N rates, but the actual risk depends on N source, proximity, soil texture and rainfall amount/timing after N banding.
- Actual plant population losses are rare with UAN rates up to 100 pounds/N applied in a 2" x 2" band but can occur if there are fertilizer coulter alignment problems or very dry conditions.
- Plant growth stunting is another side effect from too close placement
- A N band displacement of 4"-5" from row at planting is recommended when UAN N rates exceed 100 pounds of actual N.
- Applying 100% of N at planting doesn't usually give the best yields. Nitrogen banding up to 50% of the intended rate can be safe (with proper displacement).
 - Potash fertilizer banding is also harmful at high rates.

Acknowledgments

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Equipment: John Deere Cropping System











Indiana Corn Yield Responses to K₂O Placement and Timing

Tillage System	K2O timing	Aspire K product rate (lb/acre)	3-year Mean 2016-2018 (bu/acre)
No-till	NA	0	230 d
NIA 4911	Comina	200	240 100
Fall Strip-till	NA	0	236 cd
Fall Strip-till	Fall	100	245 ab
Fall Strin_till	Fall	200	250.9
Spring Strip-till	NA	U	232 a
Spring Strip-till	Spring	100	245 ab
Spring Strip-till	Spring	200	249 a
raii Chisei	NA	U	241 DC
Fall Chisel	Fall	200	249 a







Mosaic

Soil-Test K mean: 151 ppm in 2016; 106 ppm in 2017, and 127 in 2018.

Average Yield Gain with 200 rate: 8 bu/ac in 2016; 15 bu/ac in 2017, 14 bu/ac in 2018

Source: Vyn and Schwarck, 2018, Unpublished