Strategies for Split N Applications for Corn

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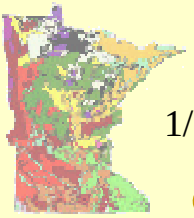
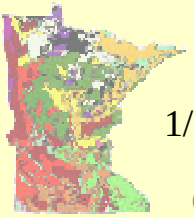


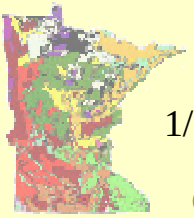
Purpose

- To present information and recommendations on split N application strategies
  - Primarily on medium and fine-textured soils
- To “crystal ball” the future of split-N applications



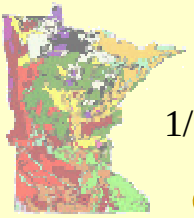
Preplant vs. Split Application 1989–1992

- Conditions
  - 32 sites including coarse-textured outwash, medium-textured loess, and fine-textured glacial till soils
  - Growing season rainfall ranged from 36% below normal to 59% above normal
  - Previous crop = soybean, corn, oat, and rye



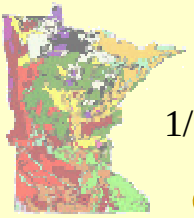
Preplant vs. Split Application 1989–1992

- Procedures
  - Preplant N rates = 0, 30, 60, 90, 120, 150, and 180 lb N/A as broadcast incorporated urea
  - Split rates = 60 and 30 lb N/A as PP urea in 1989–90 and 1991–92, respectively, PLUS 30, 60, and 90 lb N/A as urea knifed in 4” deep at V5 to V6



Preplant vs. Split, 1989–92
Corn Grain Yield Summary

Sites	Total	Till	Loess	Outwash
Number	32	14	11	7
N responsive	28	14	9	5
Preplant = split	16	7	7	2
Preplant < split	8	4	1	3
Preplant > split	4	3	1	0



Preplant vs. Split, 1989–92

- Conclusions:

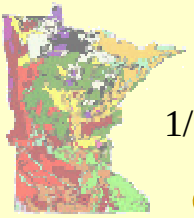
1) Grain yield responded to N at 88% of the sites.
2) Preplant application was equal to split application at 16 of the 28 responding sites (58%).
3) Split application was superior to PP application at 8 sites (28%).
   - Excessive rainfall and/or sandy soils.
4) Preplant application was superior to split application at 4 sites (14%).
   - Below-normal or above-normal rainfall and insufficient N rate applied early.
5) Split application of N out performed PP application at 3 of 5 sandy sites, 1 of 9 loess sites, and 4 of 14 till sites and only in wetter-than-normal years.

Corn yield as affected by split-N application and precipitation.

Time of N Application		Year (precip. departure)	
Preplant	12” Corn	1991 (+56%)	1992 (+16%)
- N rate (lb N/A) -		- - Yield (bu/A) - -	
0	0	84	107
60	0	143	**144**
30	30	**161**	141
90	0	158	**156**
30	60	**157**	137
120	0	165	**164**
30	90	**182**	153
Advantage for split =		+11	-11

Continuous Corn, 1987–90

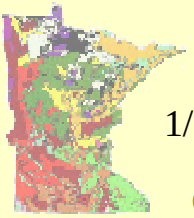
- Olmsted Co.
- Port Byron silt loam (loess)
- Chisel plow
- N Source = anhydrous ammonia (AA)



Continuous Corn, 1987–90

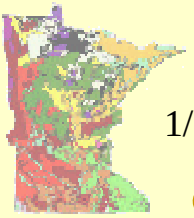
N Treatment		4-Yr Average			
		Grain	N Recovery in		NO_3-N in
Rate	Time	Yield	Grain	Silage	soil water†
lb/A		bu/A	- - - %	- - -	ppm
0	--	84	--	--	1
150	Spring PP	172	50	67	29
150	Fall	169	48	65	43
150	½ Spr. + ½ SD V6	168	46	60	47
225	Spring PP	167	33	45	43

† At a 5-ft. depth on 9/5/90.



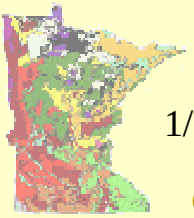
Continuous Corn, 1987–90

- Conclusions:
  1) Highest yields and N efficiency and lowest NO_3-N in soil water were obtained with the 150-lb spring preplant treatment.
  2) Yields, N efficiency, and nitrate leaching potential were not improved by fall or split application of N.
  3) Excess N (225 lb N/A) did not increase yields or N efficiency but did increase nitrate leaching potential.



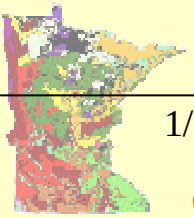
Continuous Corn, 1992–97

- Olmsted Co.
- Port Byron silt loam (loess)
- Chisel plow
- N Source = anhydrous ammonia (AA)



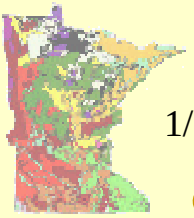
Continuous Corn, 1992–97

N Treatment		7-Year
Rate	Time	Average Yield
lb/A		bu/A
0	--	63
90	PP	129
90	? PP+ ? SD (V6-7)	134
90	Sidedress (V6-7)	127
120	PP	135
120	½ PP + ½ SD (V6-7)	137
	LSD (0.10)	3



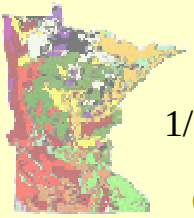
Continuous Corn, 1992–97

- Conclusions:
  1) Grain yield was 2 – 5 bu/A higher with split applications of N in these wetter years.
  2) Delaying a single sidedress application to the V6-7 stage can reduce grain yield and profitability.



Continuous Corn, 1985-87

- Waseca Co.
- Webster clay loam (glacial till)
- pH = 6.7, 6.9, and 6.9
- Moldboard plowed
- N rates = 60, 120, and 180 lb N/A (Averaged)



Continuous Corn, 1985-87

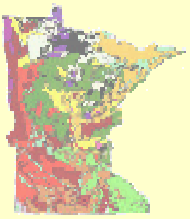
N Treatment Source – Time	Year† 1985	1986	1987	3-Yr Avg.
	- - - yield (bu/A)			- - -
Check (0 lb N/A)	66	51	87	68
AA – PP	140	117	139	132
? UAN (PP) + ? AA (SD)	143	119	146	136
? UAN (PP) + ? UAN (D-SD)‡	130	99	110	113
? UAN (PP) + ? UAN (I-SD)‡	--	106	142	--
? AA (PP) + ? UAN (D-SD)‡	--	113	141	--
LSD (0.05) =	4	7	5	

† SD UAN applied at V6-7; not incorporated in 1985, incorporated by cultivation 1 d & 2 d after application in 1986 and 1987.

‡ D-SD = surface dribble sidedress; I-SD = inject 4” sidedress.

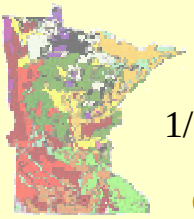
Continuous Corn, 1985-87

- Conclusions:
  1) Split application with ? of the N applied sidedress as AA increased corn yield 4 bu/A (NS) over a single preplant application of AA.
  2) Yields were reduced dramatically (23 bu/A) when ? of the UAN was sidedress dribbled and incorporated with cultivation.
  3) Yields were 7 to 32 bu/A greater when sidedress UAN was injected 4” deep.



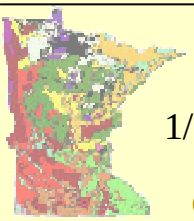
Corn-Soybeans, 1987–93

- Waseca Co.
- Canisteo clay loam (glacial till)
- pH = 7.6
- One-pass (field cultivation) tillage
- N rate = 135 lb N/A as AA
- Tile drainage study



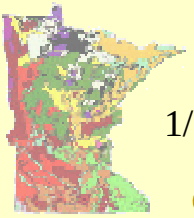
Corn-Soybeans, 1987–93

Application Time	N-Serve	7-yr Avg. Yield	N Recovery
		bu/A	%
0-lb Check	--	95	--
Fall (late Oct.)	No	131	31
“	Yes	139	37
Spring PP	No	139	40
40% PP+60% SD V8	No	145	44
	LSD (0.10):	4	



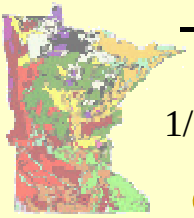
Corn-Soybeans, 1987–93

- Conclusions:
  1) Highest yields and N recovery were obtained with the split-applied treatment. Moreover, there was no interaction between year and treatment, but greatest response to split N tended to occur in the wet years (1990–93).
  2) Nitrate losses in tile drainage water ranked in the order: fall N > split N > spring N = fall N + N-Serve.



Split N Options, 2001-02

- Webster clay loam
- Studies: Two tillage systems
  - One-pass, spring field cultivate
  - Fall strip tillage
- Previous crop: soybeans
- N rate: 100 lb N/A
- Time of application and N source
  - Fall: AA
  - Spring preplant: AA, urea, UAN
  - Planting: UAN (dribble or spray)
  - Sidedress: UAN at V3-4 (coulter injection)

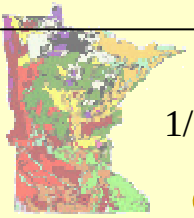


Split N Options, 2001-02†

Time of Application and Source of N ‡				Yield
Fall AA	Preplant	Planting UAN	Sidedress UAN	(bu/A)
None	None	None	None	118
w/N-S, 100				**167**
w/N-S, 80		Dribble, 20		154
w/N-S, 80			Coulter, 20	**169**
w/N-S, 60		Dribble, 40		155
w/N-S, 60			Coulter, 40	**169**
	AA, 100			164
	AA w/N-S			165
	Urea bdct incorp.			165
	UAN bdct incorp.			163
		Dribble, 40	Coulter, 60	**175**
		Broadcast, 40	Coulter, 60	**177**
			LSD (0.10):	10

† One-pass tillage

‡ w/NS=with N-Serve

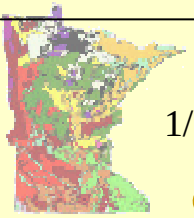


Split N Options, 2001-02†

Time of Application and Source of N ‡				Apparent N
Fall AA	Preplant	Planting UAN	Sidedress UAN	Recovery
				%
w/N-S, 100				63
w/N-S, 80		Dribble, 20		48
w/N-S, 80			Coulter, 20	60
w/N-S, 60		Dribble, 40		46
w/N-S, 60			Coulter, 40	56
	AA, 100			60
	AA w/N-S			59
	Urea bdct incorp.			63
	UAN bdct incorp.			59
		Dribble, 40	Coulter, 60	**65**
		Broadcast, 40	Coulter, 60	**73**
			LSD (0.10):	9

† One-pass tillage

‡ w/NS=with N-Serve



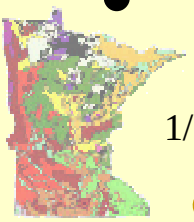
Split N Options, 2001–02

- Conclusions:

1) Averaged across both years, greatest yields and N response occurred with the “weed and feed” program where UAN was split between 40 lb N/A broadcast preemergence and 60 lb N/A sidedressed at V3-4.
2) Lowest yields frequently occurred when 40 lb N/A as UAN was applied near the seed row at planting.
3) Apparent N recovery averaged across the two years ranged from 46 to 73%.

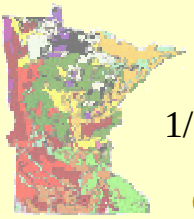
Factors enhancing split N performance

- Sandy, coarse-textured soils
- Above-normal growing season rainfall
  - Especially May and June
- Apply 40 to 60 lb N/A when broadcasting preplant portion
- When the preplant portion is dribbled within 2” of the row, use no more than 20 lb N/A
- Inject sidedress portion 4” deep by V4



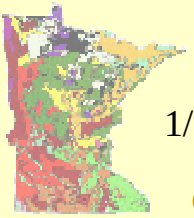
Factors affecting future of split N application

- Greater environmental and economic pressures
- Less fall application
- Less AA application
- Greater availability of equipment and time
- Greater emphasis on synchronizing N availability with N uptake curve
- Greater use of remote sensing as a diagnostic tool
- P-based manure application
  - Supplemental N needs



Split Application of N: Summary

- Nitrogen timing BMP's must be tailored to soil and climatic conditions. Factors such as extra labor / time demand, equipment needed, carryover of unused N, potential for using remote sensing or a soil N test to determine sidedress rate of application, and input / output economics must be carefully considered on those soils where a yield response to split application is less likely.



THANK YOU

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