

Enhancing Continuous Corn Production Under High-Residue Conditions with Starter Fluid Fertilizer Combinations and Placements

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Justification

- **Crop rotations are changing to meet rapid expansion of bio-fuel industry**
 - C-C-S and other corn-intensive rotations
 - Large amounts of biomass are produced
- **High amounts of surface residue keeps soil temps cool, which can reduce corn yield**
- **Farmers have tillage choices:**
 - moldboard plow; increases potential for erosion
 - conservation; can the yield penalty be overcome with fluid starter fertilizers?



Objectives

- Determine the effects of fluid starter fertilizer placement and combinations of 10-34-0 & 28-0-0 on second-yr corn production under reduced tillage/high-residue conditions
- Provide management guidelines on placement and rates of UAN and APP for corn producers trying to meet the growing needs for corn grain by the ethanol industry and livestock producers.
- Present economic evaluation of fluid fertilizer treatments



Experimental Procedures

Soil: Nicollet cl at So. Res. & Outreach Ctr.,
Waseca, MN

Design: Split plot with main plots (60 x 50') as tillage
and sub-plots (10' x 50') as combinations of
rates and placements of APP and UAN

Tillage: Fall Moldboard plow 9" deep

- 11% surface residue (May 11)

Fall Disk chisel 9" deep

- 50% surface residue (May 11)









Starter Treatments

Placement	APP gal/A	UAN lb N/A
Zero control	0	0
Popup	5	0
2 x 0	5	0
“	5	15
“	5	30
“	5	45



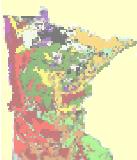
Weather

Temps: warm May-August, GDUs 27% above
normal for May and +4% for May-Sept.

Precipitation: dry May-July, particularly July 10-
Aug 3 (1.27" rainfall), limited yield
somewhat



Results



Interactions

- There were no significant ($P=0.05$ level) interactions between Tillage System and Starter Treatment.
 - thus, main effects are valid



Effect of tillage on small whole plant (V7) growth and uptake of N and P.

Tillage	DM	Uptake	
	Yield	N	P
	lb/A	----- lb/A -----	
Moldboard	820	28.8	3.08
Chisel	720	25.0	2.69
$P > F:$	0.009	0.010	0.002



Effect of starter treatments on small whole plant (V7) growth and uptake of N and P.

Starter Treatment			DM	Uptake	
Placement	APP gal/A	UAN lb N/A	Yield lb/A	N -- lb/A --	P
Zero-control	0	0	780	28.7	3.0
Popup	5	0	910	29.6	3.1
2 x 0	5	0	630	22.9	2.5
"	5	15	770	27.5	3.0
"	5	30	700	24.3	2.6
"	5	45	830	28.5	3.1
<i>LSD (0.10):</i>			80	2.9	0.4



Effect of tillage on grain yield and moisture and uptake of N and P.

Tillage	Grain		Uptake	
	Yield bu/A	Moisture %	N	P
			- - - lb/A - - -	
Moldboard	180	16.2	107	22.7
Chisel	174	16.2	101	22.3
$P > F:$	0.043	0.51	0.033	0.731



Effect of starter treatments on grain yield and moisture and uptake of N and P.

Placement	Starter Treatment		Grain		Uptake	
	APP gal/A	UAN lb N/A	Yield lb/A	H ₂ O %	N - - - lb/A - - -	P
Zero-control	0	0	176	16.3	104	21.6
Popup	5	0	181	16.1	104	21.6
2 x 0	5	0	169	16.2	100	22.2
"	5	15	182	16.3	109	24.0
"	5	30	177	16.2	105	22.5
"	5	45	177	16.1	103	22.9
<i>LSD (0.10):</i>			7	NS	5	NS



Economic return to TILLAGE

Parameter	Tillage	
	Chisel	Moldboard Plow
Corn yield (bu/A)	174.4	180.0
Gross return (\$/A) ^{1/}	654.	675.
Tillage cost (\$/A)	\$13.00	\$17.75
Return to tillage (\$/A)	\$641.00	\$657.25
Profit advantage (\$/A)	--	\$16.25

^{1/} Corn price = \$3.75/bu.



Economic return to STARTER FERTILIZER

Starter Treat ^{1/}		Corn		Gross ^{2/}	Fert.	Net
Placement	APP gal/A	UAN lb N/A	Yield bu/A	Return \$/A	Cost \$/A	Return \$/A
Zero-control	0	0	175.8	659	0	--
Popup	5	0	181.4	680	15.65	+5.
2 x 0	5	0	169.1	634	15.65	-41.
"	5	15	182.5	684	24.35	+1.
"	5	30	177.3	665	33.05	-27.
"	5	45	177.0	664	41.75	-37.

^{1/} APP = \$3.13/gal., UAN = \$1.74/gal

^{2/} Corn price = \$3.75/bu



Conclusions

- Moldboard plowing produced greater early plant growth, early uptake of N and P, corn grain yield, and economic return than did chisel tillage regardless of starter treatments.
- APP placed in the seed furrow as a pop-up or combined with UAN and dribbled on the soil surface increased early plant growth and uptake of N & P
- Grain yields were highest for the pop-up treatment and when AAP + 15 lb N as UAN was dribbled on soil surface
- Grain moisture and plant population were not influenced by tillage system or starter fertilizer treatments.



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THANKS

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