Fluid Fertilizers for Sustainable Residue Removal in High-Yielding Corn Production Systems

Laura Gentry[1], Kyle Vogelzang[2], & Fred Below[3]

[1]IL Corn Grower's Association, Adjunct Faculty UIUC

[2]Evergreen FS, Inc.

[3]Crop Physiology Laboratory, Crop Sciences Dept., Univ. of IL Urbana-Champaign

2014 Fluid Fertilizer Forum – Feb. 17-18th, 2014 Scottsdale, AZ

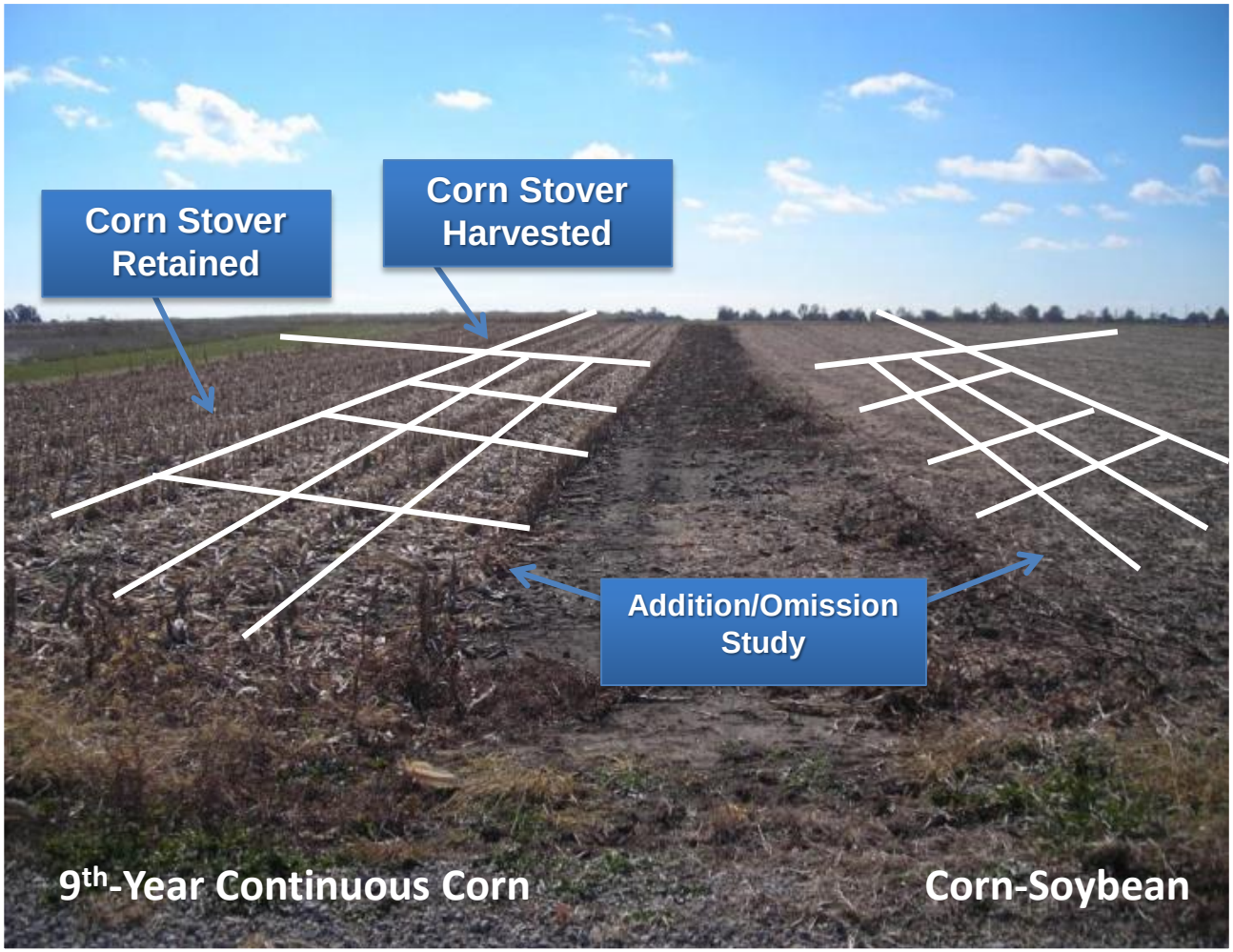
Crop Physiology

Study Objectives

- Assess effects of partial stover removal on **corn yield, root biomass, and nitrogen use efficiency** with advanced vs. traditional crop inputs and plant populations
- Evaluate the combined effects of crop inputs and plant population on nutrient removals with stover harvesting

One Full Replication

- 9th Year CC vs. Corn after Soybean
- Corn Stover Retained vs. 50% Harvested
- Addition/ Omission Study



Crop Physiology

Standard vs. Advanced

Fertility	No P, S, or Zn based on soil test 100 lbs/a P_2O_5 MicroEssentials SZ (12-40-0-10S-1Zn)
Nitrogen	180 lb N/a pre-plant UAN 180 preplant + 60 lb N/a sidedress
Genetics	RR Refuge Hybrid Triple Stack Hybrid
Population	32,000 plants/a vs. 45,000 plants/a
Fungicide	No Fungicide vs. Strobilurin (@ R1)

Crop Physiology

2011 Yields

Technology	9th-Year Cont. Corn		Corn After Soybean
	Stover Retained (bu acre^{-1})	Stover Removed (bu acre^{-1})	Stover Retained (bu acre^{-1})
High Tech	**164**	**184**	179
HT-FERT	162	135	175
HT-N	159	160	158
Traditional	**146**	**159**	156
TRAD+FERT	169	166	163
TRAD+N	164	166	175

Greatest advantage of stover removal is in high-population, high-input systems, although both systems benefitted.

- In t… over retenti…
- When stover is <u>retained</u> in the HT-CC or in the C-S system, eliminating P, S, and Zn application did not affect yields.
- When stover is <u>removed</u> in the HT-CC system, eliminating P, S, and Zn application strongly reduced yields.

Crop Physiology

Nutrients in CC Stover – 2011

avg. stover removal = 1925 lb/a

	Stover Produced (lb/a)	%P	%K	%S	P_2O_5 reduction (lb/a) w/ stover removal	K2O reduction (lb/a) w/ stover removal	S reduction (lb/a) w/ stover removal	Yield change (bu/a)
High Tech	6586 (30% removal)	0.125	1.19	0.068	5.5	53	1.3	**-49**
Trad	5753 (33% removal)	0.130	1.15	0.057	5.7	51	1.1	**+7**

2012 Yields

	9th-Year Cont. Corn		Corn After Soybean
Technology	Stover Retained (bu acre^{-1})	Stover Removed (bu acre^{-1})	Stover Retained (bu acre^{-1})
High Tech	95	113	168
HT-HYBRID	80	88	149
Traditional	85	83	138
TRAD+HYBRID	132	130	149
LSD (P<0.10) (within rotation trt)	7	7	7
LSD (P<0.10) (btn rotation trts)	18		

Crop Physiology

2013 Yields

	11th-Year Cont. Corn		Corn After Soybean
Technology	Stover Retained (bu acre^{-1})	Stover Removed (bu acre^{-1})	Stover Retained (bu acre^{-1})
High Tech	153	145	154
HT-HYBRID	137	140	149
HT-FERT	140	137	144
Traditional	136	129	148
TRAD+HYBRID	147	143	150
TRAD+FERT	142	158	151
LSD (P<0.10) (within rotation trt)	*7*	*7*	*7*
LSD (P<0.10) (btn rotation trts)	*17*		

Crop Physiology

Nutrient removal per ton stover harvested– 2011

	%P	%K	%S	P_2O_5 removed per ton stover harvested (lb/ton)	K_2O removed per ton stover harvested (lb/ton)	S removed per ton stover harvested (lb/ton)
High Tech	0.125	1.19	0.068	5.8	55	1.36
Trad	0.130	1.15	0.057	5.9	53	1.12

Effect of Year/Conditions on Harvest Index

	2011	
Technology Trt.	**Yield (bu/a)**	**HI**
HT	164	0.50
-FERT	162	0.51
-N	159	0.48
-HYBRID	158	0.49
TRAD	146	0.49
+FERT	169	0.49
+N	164	0.50
+HYBRID	145	0.48

Conclusions (last year)

- To maximize yields in continuous corn
  - Maintain moderate plant population (~32 ppa)
  - Higher levels of N, P, S, Zn were beneficial
- N fertilizer recovery efficiency was equal or greater in high-population, high-input systems relative to more traditional farmer practices

Conclusions

- Stover removal increased corn yields in CC high-population, high-input systems by ~18 bpa in 2011 and 2012, but not 2013
- In the high-population, high-input system:
  - stover removal without P, S, and Zn fertilization resulted in yield reductions
  - stover removal increased plant-availability of N

Crop Physiology

Conclusions

- **Each growing season's unique conditions dictate which management decision will be the most influential for increasing yields**

SPECIAL THANKS!

- Fluid Fertilizer Foundation
- The Mosaic Company
- Syngenta
- IL Nutrient Research & Education Council

For more information:
Crop Physiology Laboratory at the University of Illinois:

http://cropphysiology.cropsci.illinois.edu

Crop Physiology