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Managing Corn to Maximize Ethanol/Biofuel Potential

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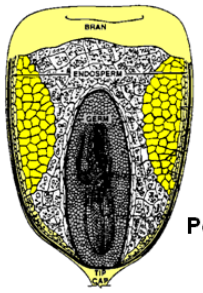
Key Points

1. Corn has significant potential as a biofuel. The highest potential ethanol yield from grain in Wisconsin has been recorded at 777 gallons/A (PEPS, 2007).
2. Ethanol production (gallons per acre) is driven by grain yield. Management practices that improve grain yield will maximize ethanol production from grain.
3. A small increase in ethanol quality (gallons per bushel) is significant to ethanol plants. For example, a 1% increase in ethanol per bushel increases production of a 50 MG plant about 500,000 gallons ethanol.
4. The management decision that most influences ethanol quality (gallons per bushel) is hybrid selection.
5. The management decisions of plant density, date of planting, tillage, rotation, and fungicide have little impact on ethanol quality (gallons per bushel).
6. Future research will concentrate on ethanol production from stover. Our hypothesis is that traits and management practices that improve silage quality for dairy cows will be most beneficial for ethanol production.

Corn Has Significant Potential for Biofuels

	2005	2010	2015	2020
Grain Endosperm				
Bu/Ac	150	180	200	**250**
Gal/Bu	2.5	2.7	2.8	**2.8**
Gal/Ac	390	486	560	**700**
Grain Pericarp				
Ton/Ac	0	.45	.500	**.625**
Gal/Ton	0	40	60	**90**
Gal/Ac	0	18	30	**56**
Stover				
Ton/Ac	0	2.5	2.75	**3**
Gal/Ton	0	40	60	**90**
Gal/Ac	0	100	165	**270**

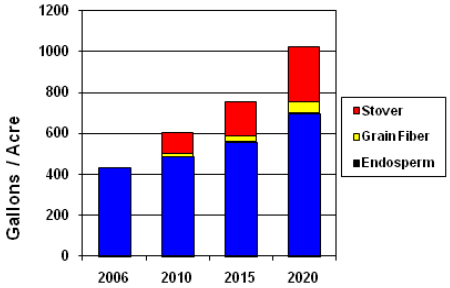


Ethanol Productivity Potential

Endosperm → 435 Gal/Acre @ 150 bu/ac grain yield

Pericarp → 18 Gal/Acre (2010)

Stover → 100 Gal/Acre (2010)



1,000 gallons / acre by 2020?

Source: Hitz, 2006

Table 1. Corn response to hybrid during 2008 at Arlington, WI (n= 3 reps).

Relative Maturity	Grain yield	Ethanol	
Days	bu/A	Gal/bu	Gal/A
82	200	2.91	582
84	192	2.87	552
85	214	2.86	612
87	184	2.86	526
90	214	2.87	616
92	190	2.92	554
96	223	2.91	647
97	209	2.90	606
99	236	2.92	691
100	239	2.93	700
104	203	2.87	583
104	258	2.90	750
108	234	2.90	678
108	257	2.89	743
112	237	2.89	686
113	247	2.88	711
LSD(0.10)	25	0.03	76

Table 2. Corn response to plant density during 2008 at Arlington, WI (n= 16).

Target density	Plant density	Grain yield	Ethanol	
plants/A	plants/A	bu/A	Gal/bu	Gal/A
14000	14267	176	2.87	505
20000	20928	202	2.85	575
26000	27746	231	2.87	663
32000	33459	236	2.89	681
38000	38983	238	2.90	689
44000	44097	233	2.90	676
50000	49147	233	2.89	676
56000	50315	233	2.90	677
LSD(0.10)	1435	8	0.01	24

Table 3. Corn response to planting date during 2008 at Arlington, WI (n= 8).

Planting date	Grain yield	Ethanol	
	bu/A	Gal/bu	Gal/A
April 24	214	2.84	608
May 01	220	2.84	624
May 15	226	2.84	643
June 02	179	2.84	510
June 15	130	2.81	364
LSD(0.10)	17	NS	49

Table 4. Corn response to tillage during 2008 at Arlington, WI (n= 84).

Tillage	Grain Yield	Ethanol	
	bu/A	Gal/bu	Gal/A
Conventional	235	2.93	689
No-Till	213	2.91	620
LSD(0.10)	7	0.01	20

Table 5. Corn response to rotation during 2008 at Arlington, WI (n= 24).

Rotation	Grain yield	Ethanol	
	bu/A	Gal/bu	Gal/A
CC	178	2.88	511
CS	197	2.89	569
CSW	202	2.89	585
CWS	209	2.87	598
LSD(0.10)	NS	0.01	NS

Table 6. Corn response to fungicide during 2008 at Arlington, WI (n= 24).

Fungicide	Grain yield	Ethanol	
	bu/A	Gal/bu	Gal/A
Headline SBR	194	2.88	560
Quadris	201	2.89	579
Quilt	199	2.87	572
UTC	191	2.89	553
LSD(0.10)	NS	0.01	NS