

2017 Corn Management Yield Potential

Part 1: Yields

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Research Approach

The objective of the Corn Management Yield Potential (MYP) trial is to identify ‘Racehorse’ hybrids, or hybrids that have greater than average yield increases with high-yield crop management, and ‘Workhorse’ hybrids, or hybrids with acceptable yields in a low fertility environment [i.e. tolerant to nitrogen (N) loss]. In our approach, ‘Racehorse’ hybrids are the genotypes that have greater yield increases in the following categories: (i) N fertilizer (yield change between 0 and 280 lb N acre⁻¹ at 32,000 plants acre⁻¹), (ii) an intermediate plant population (yield response between 32,000 and 38,000 plants acre⁻¹ at 280 lb N acre⁻¹), (iii) high plant population (yield change between 38,000 and 44,000 plants acre⁻¹ at 280 lb N acre⁻¹), and (iv) narrower row spacing (yield change between 30 and 20 inches row spacing at 44,000 plants acre⁻¹ and 280 lb N acre⁻¹). On the contrary, hybrids with high Check Plot yield (at 0 lb N acre⁻¹) and a large yield increase with low N (yield change between 0 and 60 lb N acre⁻¹ at 32,000 plants acre⁻¹) were considered ‘Workhorse’ hybrids.

For 2017, the trial was planted using a precision plot planter with variable seeding rate capability (SeedPro 360, ALMACO, Nevada, IA) at Yorkville, IL (16 May), Champaign, IL (19 April), and Harrisburg, IL (9 May). Plots were 17.5 feet in length with 30 or 20-inch row spacing and two rows in width. Force 3G insecticide was applied at planting and Bicep II Magnum (2.5 qt/A) was applied prior to planting as a pre-emergence herbicide. Nitrogen treatments were broadcast applied with urea at 0, 60, and 280 lb N acre⁻¹ between the V4-V6 developmental stages at Yorkville, IL (6 June), Champaign, IL (22 May), and Harrisburg, IL (1 June). Forty- eight hybrids represented by seven different seed brands, with comparative relative maturities (CRMs) ranging from 104-118 days were evaluated (Table 1). Treatments included: (i) 32,000 plants acre⁻¹ at 30-inch row space and 0 lb N acre⁻¹, (ii) 32,000 plants acre⁻¹ at 30-inch row space and 60 lb N acre⁻¹, (iii) 32,000 plants acre⁻¹ at 30-inch row space and 280 lb N acre⁻¹, (iv) 38,000 plants acre⁻¹ at 30-inch row space and 280 lb N acre⁻¹, (v) 44,000 plants acre⁻¹ at 30-inch row space and 280 lb N acre⁻¹, and (vi) 44,000 plants acre⁻¹ at 20-inch row space and 280 lb N acre⁻¹. At maturity, plots were harvested with a two-row plot combine and grain yield is reported as bushels acre⁻¹ at 15.5% moisture concentration. Data also collected and considered were soil test values (Table 2) and weather (Table 3).

Table 1. The distribution of 48 hybrids evaluated in the Management Yield Potential trial in 2017 grown at Yorkville, Champaign, and Harrisburg, IL. Hybrids are sorted by company, brand, and CRM.

Hybrid	Brand	Company	CRM	Yorkville	Champaign	Harrisburg
G05B91-3010	Golden Harvest	Syngenta	105	X	X	
SL5536ZL-3010	Golden Harvest	Syngenta	105	X	X	
G06Z97-3120	Golden Harvest	Syngenta	106	X	X	
G07F23-3111	Golden Harvest	Syngenta	107	X	X	X
G09A86-3111	Golden Harvest	Syngenta	109	X	X	X
G09Y24-3220	Golden Harvest	Syngenta	109	X	X	X
SK6405-3220	Golden Harvest	Syngenta	110	X	X	X
G10T63-3122	Golden Harvest	Syngenta	110	X	X	X
G11X64-3010	Golden Harvest	Syngenta	111		X	X
G12W66-3000GT	Golden Harvest	Syngenta	112	X	X	X
G14R38-3122	Golden Harvest	Syngenta	114	X	X	X
G14V04-3000GT	Golden Harvest	Syngenta	114		X	X
G15L32-3111	Golden Harvest	Syngenta	115	X	X	X
SL8675-3110	Golden Harvest	Syngenta	116		X	X
G18D87-3111	Golden Harvest	Syngenta	118		X	X
6538SSRIB	Stone	Monsanto	115	X	X	X
6188SSRIB	Stone	Monsanto	111	X	X	X
5848SSRIB	Stone	Monsanto	108	X	X	X
DKC62-52	DeKalb	Monsanto	112	X	X	X
DKC63-21	DeKalb	Monsanto	113	X	X	X
DKC64-34	DeKalb	Monsanto	114	X	X	X
DKC60-87	DeKalb	Monsanto	110	X	X	X
DKC66-74	DeKalb	Monsanto	116	X	X	X
DKC65-94	DeKalb	Monsanto	115	X		X
210-26STXRIB	Channel	Monsanto	110	X	X	X
212-20STXRIB	Channel	Monsanto	112	X	X	X
215-75STXRIB	Channel	Monsanto	115	X	X	X
D51SS54	Dyna-Gro	CPS	111	X	X	X
D52SS91	Dyna-Gro	CPS	112	X	X	X
D52SS63	Dyna-Gro	CPS	112	X	X	X
D54VC52	Dyna-Gro	CPS	114	X	X	X
D54DC94	Dyna-Gro	CPS	114	X	X	X
D56VC46	Dyna-Gro	CPS	116	X	X	X
D57VC51	Dyna-Gro	CPS	117	X	X	X
D58VC65	Dyna-Gro	CPS	118	X	X	X
D55VC45	Dyna-Gro	CPS	115	X		X
4895SS/RIB	Croplan	WinField	108	X	X	X
5887VT2P	Croplan	WinField	108	X		X
6110SS/RIB	Croplan	WinField	110	X	X	X
5290DGVT2P	Croplan	WinField	112	X	X	X
6594SS/RIB	Croplan	WinField	113	X	X	X
6640VT3P	Croplan	WinField	113	X	X	X
5678VT2P	Croplan	WinField	116	X	X	X
7927VT3P/RIB	Croplan	WinField	117	X	X	X
8621VT2P/RIB	Croplan	WinField	117	X	X	X
4488SS	Croplan	WinField	104	X		
P1197AMXT	Pioneer	Pioneer	111	X	X	X
P1311AMXT	Pioneer	Pioneer	113	X	X	X

Table 2. Preplant soil test values for the 2017 Yorkville, Champaign, and Harrisburg, IL field sites, obtained from 1 to 6 inches deep and extracted using Mehlich III.

Location	OM	pH	CEC	P	K	Ca	Mg
	%		meq/100g	ppm	ppm	ppm	ppm
Yorkville	4.1	7.0	21.1	34	171	2939	711
Champaign	3.8	6.0	22.3	78	222	2846	470
Harrisburg	2.3	6.2	13.8	31	114	1945	165

Table 3. Precipitation and temperature during the production season at Yorkville, Champaign, and, Harrisburg, IL in 2017 compared to the 30-year average (Ave.). Values were obtained from the Illinois State Water Survey.

Month	Yorkville, IL				Champaign, IL				Harrisburg, IL			
	Precip. (in)		Temp. (°F)		Precip. (in)		Temp. (°F)		Precip. (in)		Temp. (°F)	
	2017	Ave.	2017	Ave.	2017	Ave.	2017	Ave.	2017	Ave.	2017	Ave.
April	6.9	4.0	54	50	5.8	3.7	57	52	14.1	4.4	61	56
May	4.7	4.3	58	61	5.9	4.9	61	63	4.8	5.1	66	66
June	1.8	4.3	72	70	2.1	4.3	73	72	2.3	4.5	74	75
July	7.0	4.7	74	74	2.8	4.7	76	75	1.2	3.8	79	78
Aug.	2.8	4.1	70	72	2.2	3.9	71	73	4.2	3.0	73	77
Sept.	0.1	3.1	68	65	0.8	3.1	69	66	1.5	3.1	70	69

The treatments were arranged in a split block experimental design with four replications. Data were analyzed using analysis of variance with the PROC MIXED procedure of SAS (SAS V8 Institute, Cary, NC) and means were separated using Fisher's protected LSD test at the 0.10 level of significance. Normality for residuals and outlier observations were evaluated using PROC UNIVARIATE in SAS. Row spacing, hybrid, N fertilizer rate, and plant population were considered fixed effects, while block and interactions with blocks were considered random effects.

Yield Results

Environmental conditions in 2017 created relatively consistent hybrid performances across the three locations of the trial (Table 3). April started the season warm but very wet, especially at Harrisburg, which led to relatively late planting there. Summer was drier, except for heavy rains in July at Yorkville. Most notably, at all sites, August was much cooler than normal, promoting good grain fill and yield, while September was warmer than normal, with no early frost. Summaries of the yield values for all treatment combinations are described for Yorkville, Champaign, and Harrisburg below (Tables 4-6). Overall average check plot yield (0 lb N acre⁻¹) was 225, 211, and 232 bu acre⁻¹ at Yorkville, Champaign, and Harrisburg, IL, respectively. Higher check plot yields at Yorkville and Champaign were associated with high residual N, mineralized from soil organic matter. An exceptionally high check plot yield in Harrisburg can be credited to timely rains and a cooler than average August. Overall average yield increase over the check plot using low N was 38, 44, and 46 bu acre⁻¹ and using high N was 60, 55, and 54 bu acre⁻¹ at Yorkville, Champaign, and Harrisburg, IL, respectively. Compared to previous years, hybrids demonstrated less yield

response to nitrogen fertilization. This is associated with high check plot yields due to high N availability in Yorkville and Champaign and optimal growing conditions in Harrisburg.

Overall yield increases due to increasing to the moderate plant population was 10, 7, and 15 bu acre⁻¹ and the highest plant population increased yield by an additional 0, 4, and 5 bu acre⁻¹ for Yorkville, Champaign, and Harrisburg, respectively. Optimal growing conditions across all locations allowed a majority of the hybrids tested to tolerate higher plant populations. Many hybrids demonstrated yield potential exceeding 300 bu acre⁻¹, which can be attributed to planting higher populations. The overall average yield response to narrower row spacing was 16, 6, and 8 bu acre⁻¹ at Yorkville, Champaign, and Harrisburg, respectively. Consistent across all locations, narrower row spacing decreased inter-plant competition and increased individual plant yield under higher plant densities. Narrower row spacing proved to be a better management of higher plant populations, allowing for increased top end yields.

At Yorkville, IL, hybrids did not show a response from the intermediate to the high plant population, but demonstrated a large response to using narrower row spacing. As a result, a new Crop Physiology Lab yield record of 379 bu acre⁻¹ was achieved with Croplan 7927VT3P/RIB when placed in a narrower row arrangement. Other hybrids achieving exceptional yields when placed in narrower rows at Yorkville were DeKalb DKC65-94, Channel 215-75STXRIB, Pioneer P1311AMXT, and Dyna-Gro D55VC45. The range in yield responses to both narrower row spacing and increased plant population at Champaign, IL was a good reminder that not all hybrids are created equal. When switching from 30 to 20 inch rows, Golden Harvest G18D87-3111 increased in yield by over 50 bu acre⁻¹, yet Croplan 6640VT3P decreased in yield by more than 50 bu acre⁻¹. An example of a hybrid showing a positive yield response to both intermediate and high plant population would be Golden Harvest G12W66-3000. In contrast, an example of a hybrid that did not tolerate increased plant population and showed a decrease in yield at Champaign was Pioneer P1311AMXT. The highest yielding site on average across the three locations was Harrisburg, IL. High check plot yields and large yield increases from fertilization even with 60 lb N acre⁻¹ fertilizer were the main reasons for such a high trial average yield of 286 bu acre⁻¹. Examples of hybrids with a high check plot yield and above average response to 60 lb N acre⁻¹ at Harrisburg are Golden Harvest G14V04-3000GT and Dyna-Gro D54DC94.

Similar to previous years, there was large genetic variation of corn hybrids in response to different agronomic conditions. The objective of the MYP trial is to identify the impact of the most important agronomic factors on grain yield for different corn genotypes and develop parameters that allow agronomists and farmers to better position their products. In an additional, more in depth report, each hybrid will be characterized based on their performance under each treatment combination and ‘Racehorse’ and ‘Workhorse’ will be estimated. ‘Racehorse’ and ‘Workhorse’ indices will support agronomic decisions in order to express a hybrid’s maximum yield potential using the recommended crop management system.

Table 4. Individual yield values of all hybrid entries ($n = 44$) grown under two levels of row spacing (30 and 20 inches), three levels of plant population (32,000, 38,000, and 44,000 plants acre⁻¹) and three levels of N supply (0, 60, and 280 lb N acre⁻¹) at **Yorkville, IL** in 2017. Trial means and hybrid yield ranges are shown for comparison. Hybrids are sorted by relative maturity within each brand. Each value is the average of four replications.

Seed Brand Hybrid	Row Spacing					
	30 inches			20 inches		
	Plant Population (plants/acre)					
	32,000	38,000	44,000	32,000	38,000	44,000
Nitrogen Level (lbs/acre)						
0	60	280	280	280	280	280
----- bushels/acre -----						
Golden Harvest						
SL5536ZL	191	198	212	222	225	229
G05B91-3010	205	251	260	253	273	280
G06Z97-3120	218	260	277	273	286	262
G07F23-3111	223	260	284	296	287	318
G09Y24-3220A	218	251	275	300	275	291
G09A86-3111	240	266	288	280	302	317
SK6405-3220	234	283	302	297	305	336
G10T63-3122	248	282	323	348	327	334
G12W66-3000GT	206	274	294	293	292	310
G14R38-3122	208	278	264	274	277	301
G15L32-3111	233	279	288	302	298	280
Channel						
210-26STXRIB	238	266	268	280	291	283
212-20STXRIB	208	235	274	267	292	313
215-75STXRIB	228	253	273	283	279	356
DeKalb						
DKC60-87	212	247	263	274	261	294
DKC62-52	218	263	292	314	310	321
DKC63-21	202	254	280	291	280	296
DKC64-34	224	253	273	320	289	323
DKC65-94	239	265	295	320	327	360
DKC66-74	235	274	307	319	314	338
Stone						
5848SSRIB	210	254	272	265	287	310
6188SSRIB	222	241	280	274	288	331
6538SSRIB	225	250	282	293	293	325
Dyna-Gro						
D51SS54	201	246	271	272	272	307
D52SS63	243	245	277	295	299	265
D52SS91	234	241	272	308	312	309
D54DC94	200	244	282	279	285	310
D54VC52	249	263	299	306	305	316
D55VC45	233	270	293	322	312	352
D56VC46	243	275	303	328	320	319
D57VC51	227	248	281	273	279	329
D58VC65	240	267	285	295	300	311
Croplan						
4488SS	219	261	277	290	295	279
4895SS/RIB	206	268	272	250	272	296
5887VT2P	220	252	274	285	296	289
6110SS/RIB	263	273	287	294	287	286
5290DGV2P	246	327	319	337	336	333
6640VT3P	221	259	278	281	272	285
6594SS/RIB	210	264	298	287	299	298
5678VT2P	216	254	277	292	295	326
7927VT3P/RIB	235	285	333	356	327	379
8621VT2P/RIB	256	299	318	323	328	334
Pioneer						
P1197AMXT	221	276	314	331	312	317
P1311AMXT	246	308	331	341	327	356
LSD ($P \leq 0.10$)	30	30	30	30	30	36
Mean	225	263	286	295	295	311
Range	191-263	198-327	212-333	222-356	225-336	229-379

Table 5. Individual yield values of all hybrid entries ($n = 44$) grown under two levels of row spacing (30 and 20 inches), three levels of plant population (32,000, 38,000, and 44,000 plants acre⁻¹) and three levels of N supply (0, 60, and 280 lb N acre⁻¹) at **Champaign, IL** in 2017. Trial means and hybrid yield ranges are shown for comparison. Hybrids are sorted by relative maturity within each brand. Each value is the average of four replications.

Seed Brand Hybrid	Row Spacing					
	30 inches				20 inches	
	Plant Population (plants/acre)					
	32,000	38,000	44,000	44,000		
	Nitrogen Level (lbs/acre)					
	0	60	280	280	280	
----- bushels/acre -----						
Golden Harvest						
G05B91-3010	182	217	236	230	229	233
SL5536ZL	170	207	219	222	232	198
G06Z97-3120	216	249	260	255	258	256
G07F23-3111	223	280	282	273	297	265
G09A86-3111	228	263	264	296	297	282
G09Y24-3220A	205	280	284	290	311	279
SK6405-3220	227	261	271	284	281	301
G10T63-3122	190	260	283	297	291	304
G11X64-3010	208	245	253	280	273	282
G12W66-3000GT	185	240	227	257	279	273
G14R38-3122	203	240	262	279	270	275
G14V04-3000GT	197	236	266	268	265	301
G15L32-3111	227	249	268	268	248	291
SL8675-3110	220	286	296	312	321	318
G18D87-3111	250	269	286	293	262	321
Channel						
210-26STXRIB	219	255	265	283	286	276
212-20STXRIB	207	272	259	273	295	291
215-75STXRIB	222	257	271	267	281	275
DeKalb						
DKC60-87	208	249	273	271	271	300
DKC62-52	187	254	279	262	270	303
DKC63-21	184	242	243	240	261	281
DKC64-34	208	245	262	277	271	328
DKC66-74	221	236	264	274	272	285
Stone						
5848SSRIB	198	239	270	281	281	310
6188SSRIB	213	261	265	253	275	306
6538SSRIB	208	249	259	231	274	249
Dyna-Gro						
D51SS54	219	251	244	272	277	286
D52SS63	218	251	260	265	266	272
D52SS91	205	260	241	274	282	260
D54DC94	218	261	285	282	285	272
D54VC52	201	264	273	277	288	296
D56VC46	201	269	261	279	297	280
D57VC51	230	271	270	302	282	282
D58VC65	226	276	284	277	298	299
Croplan						
4895SS/RIB	209	239	238	258	249	289
6110SS/RIB	216	262	258	245	267	250
5290DGV2P	236	280	292	276	292	300
6594SS/RIB	185	230	228	240	251	261
6640VT3P	215	263	271	279	285	231
5678VT2P	233	279	303	262	274	282
7927VT3P/RIB	210	242	251	300	284	290
8621VT2P/RIB	233	275	314	302	289	298
Pioneer						
P1197AMXT	203	251	259	309	296	303
P1311AMXT	205	245	291	274	253	286
LSD ($P \leq 0.10$)	32	31	32	36	33	39
Mean	211	255	266	272	276	282
Range	170-250	207-286	219-314	222-313	230-321	198-328

Table 6. Individual yield values of all hybrid entries ($n = 44$) grown under two levels of row spacing (30 and 20 inches), three levels of plant population (32,000, 38,000, and 44,000 plants acre⁻¹) and three levels of N supply (0, 60, and 280 lb N acre⁻¹) at **Harrisburg, IL** in 2017. Trial means and hybrid yield ranges are shown for comparison. Hybrids are sorted by relative maturity within each brand. Each value is the average of four replications.

Seed Brand Hybrid	Row Spacing					
	30 inches				20 inches	
	Plant Population (plants/acre)					
	32,000		38,000		44,000	
Nitrogen Level (lbs/acre)						
	0	60	280	280	280	280
----- bushels/acre -----						
Golden Harvest						
G07F23-3111	224	258	263	276	284	293
G09A86-3111	222	275	272	287	299	308
G09Y24-3220A	224	284	281	298	304	301
SK6405-3220	231	285	300	320	337	317
G10T63-3122	218	282	293	309	309	338
G11X64-3010	211	254	272	271	287	288
G12W66-3000GT	219	271	273	288	299	326
G14R38-3122	213	258	264	280	280	278
G14V04-3000GT	250	287	287	321	334	324
G15L32-3111	238	271	288	281	279	305
SL8675-3110	247	300	319	332	343	370
G18D87-3111	259	304	311	324	328	362
Channel						
210-26STXRIB	216	260	271	280	289	281
212-20STXRIB	221	274	270	301	295	296
215-75STXRIB	241	287	287	309	312	308
DeKalb						
DKC60-87	231	274	292	303	298	316
DKC62-52	227	282	291	298	303	302
DKC63-21	247	258	286	303	311	296
DKC64-34	242	278	296	303	321	340
DKC65-94	240	277	286	293	299	297
DKC66-74	240	273	300	301	298	315
Stone						
5848SSRIB	231	263	263	286	298	291
6188SSRIB	236	275	273	309	303	321
6538SSRIB	229	276	265	292	290	282
Dyna-Gro						
D51SS54	224	279	285	292	284	302
D52SS63	233	266	259	293	302	304
D52SS91	214	283	271	290	290	311
D54DC94	243	300	284	308	313	333
D54VC52	239	276	275	301	306	323
D55VC45	217	270	277	293	295	312
D56VC46	229	288	308	320	320	344
D57VC51	253	291	314	324	328	341
D58VC65	237	296	311	324	317	322
Croplan						
4895SS/RIB	223	251	286	273	294	283
5887VT2P	221	260	272	289	278	276
6110SS/RIB	231	262	266	274	283	275
5290DGVT2P	258	292	308	319	324	329
6594SS/RIB	223	263	272	284	297	297
6640VT3P	228	285	279	288	300	299
5678VT2P	266	310	311	325	323	332
7927VT3P/RIB	235	283	291	317	328	342
8621VT2P/RIB	256	288	299	318	324	340
Pioneer						
P1197AMXT	225	298	303	320	338	353
P1311AMXT	217	298	307	315	318	329
LSD ($P \leq 0.10$)	20	20	20	18	17	19
Mean	232	278	286	301	306	314
Range	211-266	251-310	259-319	271-332	279-343	275-370