

Evaluation of Specialty Corns for Value Added Grain Production

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Evaluations of Specialty Corns for Value Added Grain Production- 2000

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Several types of specialty corns are currently being marketed for value added grain production. These include **Supercede™** and **NutriDense™** corns as well as **TopCross®** corn. These specialty corns were developed with improved nutritional traits to enhance the feed value of grain. Nutritionally enhanced grains produced by these specialty corns offer major advantages over No. 2 yellow corn because they contain more protein, essential amino acids, and energy (oil) which can help livestock feeders reduce reliance on costly ingredients and supplements.

The **TopCross®** grain production system licensed by DuPont Specialty Grains has become the preferred method of producing high oil corn (HOC). The TopCross system involves planting a blend (a **TC-Blend®**) of two types of corn. Unlike the TopCross system, the Supercede and NutriDense corns are single cross hybrids. Supercede and NutriDense corn hybrids have been licensed to seed companies for distribution by Dow AgroSciences and ExSeed Genetics, respectively.

In 2000, we conducted performance tests to evaluate the agronomic performance and grain quality characteristics of HOC TC Blends and Supercede and NutriDense corn hybrids corns that are commercially available to Ohio corn growers. Sources of seed used in the 2000 tests are listed in Table 1.

Evaluations of NutriDense and Supercede corns were conducted at the OSU-OARDC Research Farm at Wooster in northeast Ohio and the OSU-OARDC Northwest Branch Research Farm near Hoytville in northwest Ohio. Twelve NutriDense hybrids, two Supercede hybrids, and a single cross high oil corn hybrid were planted at each site. Four conventional single cross hybrids were also included as checks.

Evaluations of HOC TC Blends were established at the OSU - OARDC Western Branch Research Farm near South Charleston (S. Charleston) in southwest Ohio and the OSU-OARDC Northwest Branch Research Farm. Six high oil TC Blends representing four seed companies were planted at each site. The male fertile grain parents (Pfister 2652 and Pioneer Brand 34B23) of two of the TC Blend entries were included in the trials as checks.

Data from the nutritionally enhanced corn hybrid and HOC TC Blend tests were analyzed as three replication, randomized complete block design experiments at each location. The least significant differences at probability level 0.05 (LSD 0.05) and coefficients of variation (CV%) were calculated from the location analysis of variance.

Testing nutritionally enhanced specialty corns is more difficult than testing conventional corn hybrids due to isolation requirements. If pollen from conventional (low oil, low protein) corn hybrids pollinates nutritionally enhanced corn hybrids, then the specialty traits may not be fully expressed.

We followed a testing protocol for comparing TC Blends and conventional hybrids that was recommended by Optimum. A similar procedure was used in Ohio State University field studies from 1995 to 1997 to compare high oil TC Blends and their conventional counterparts. The TC Blends were isolated from conventional corn hybrids (corn hybrid checks) by at least 40 rows planted to TC Blends to ensure minimum pollen contamination by conventional corns.

We also followed a testing protocol for comparing nutritionally enhanced Supercede/ NutriDense corn hybrids with conventional corn that is similar to that recommended by Dow AgroSciences. Nutridense and Supercede hybrids were separated from conventional hybrid checks by at least 20 rows planted to a Nutridense or Supercede corn hybrid to minimize pollen contamination.

Table 2 indicates cultural practices and soil types associated with each test. Growing season rainfall and temperatures along with long term averages are shown in Tables 3 and 4.

Shortly before harvest, ten ears were randomly selected from plants in a 50-foot length of row in the center of each plot. In the TC Blend plots, only the male sterile grain parent plants were sampled for ears. These ears were shelled and oil, protein, and starch content were determined on a subsample of grain from each plot by near infrared transmittance (NIRT) analysis. In the HOC TC Blend evaluations, metabolizable energy (M.E.) and lysine were estimated by calculation. Final plant stand, number of stalk lodged plants (stalk breakage below the ear), and barren (including nubbin ears) plants were recorded at harvest. Plots were harvested by combine and grain yields were adjusted to 15.5% moisture.

Results

NutriDense and Supercede Hybrid Evaluations

In 2000, grain yields of the NutriDense and Supercede nutritionally enhanced hybrids ranged from 84 to 132 Bu/A at Hoytville and from 66 to 117 Bu/A at Wooster (Table 5). The nutritionally enhanced hybrids averaged yields that were 14% and 30% less than the conventional hybrids at Hoytville and Wooster, respectively. This was in marked contrast to the 1999 tests in which yields of most of the Supercede and NutriDense hybrids were not significantly different from the conventional check (data not shown). In 2000, severe stalk lodging was a major factor contributing to the lower yields of the NutriDense and Supercede at Wooster. Common rust was more serious problem in the nutritionally enhanced corns than conventional corns at Hoytville. Nevertheless, at both locations in 2000, there were Supercede and NutriDense hybrids that produced yields that were not significantly different from the conventional checks.

In 2000, grain produced by the NutriDense, Supercede, and single cross high oil corn was characterized by higher oil content than grain of conventional corn hybrid (5.1% vs. 4.0 % at Hoytville, 5.5% vs. 4.3% at Wooster) (Table 6). Significant differences in grain oil content existed among the nutritionally enhanced hybrids at each location, with oil levels ranging from 4.7% to 6.0% at Hoytville and from 5.0% to 6.5% at Wooster.

At Hoytville and Wooster in 2000, most of the NutriDense and Supercede hybrids

exhibited significantly higher grain protein levels than the conventional corn (Table 6). Grain protein levels of nutritionally enhanced hybrids averaged 1.9 percentage points higher than the conventional corn at Hoytville, but only 0.9% higher at Wooster. Similar differences in grain protein content were observed between test locations in 1999. At both locations, there were also significant differences in grain protein among the nutritionally enhanced corn hybrids. Averaged across locations, starch levels in grain were 2.8 percentage points less in nutritionally enhanced corn compared to conventional corn.

HOC TC Blend Evaluations

Grain yields of HOC TC Blends ranged from 115 to 136 Bu/A at Hoytville and 147 to 156 Bu/A at S. Charleston (Table 7). Yields of TC Blends averaged about 9% (13 Bu/A) less than yields of the check hybrids at Hoytville, but about equal to the yields of the check hybrids at S. Charleston. At Hoytville, the TC Blends produced yields that were significantly less than the top yielding check hybrid. At S. Charleston, most of the TC Blends produced yields that were equal to or not significantly different from the highest yielding check hybrid. Grain drydown at both test locations was rapid and the grain moisture levels of most TC Blends and checks was below 20% at harvest. Differences in harvest population between TC Blends and check hybrids were not significant. Stalk lodging averaged 13% at Hoytville and 17% at S. Charleston. Lodging was similar for TC Blends and conventional corn checks.

TopCross grain produced by the TC Blends was characterized by higher oil content than grain of conventional corn hybrids (7.0% vs. 3.8% at Hoytville; 7.2% vs. 4.3% at S. Charleston) (Table 8). There were significant differences in grain oil content among the six TC Blends at each location with oil levels ranging from 6.4% to 7.5% at Hoytville and 6.4% to 8.1% at S. Charleston. Estimates of metabolizable energy for non-ruminants were consistently greater in TopCross high oil grain than in grain of check hybrids (Table 8). Grain protein levels of TopCross grain were higher than conventional grain. At Hoytville, the highest TopCross grain protein level was 9.5% and the highest conventional was 8.5%; at S. Charleston the highest TopCross protein level was 9.1% and the highest conventional was 8.4%. Estimates of lysine content were higher in TopCross grain than in grain of check hybrids at both locations, whereas starch levels were lower in TopCross grain compared to grain of conventional corn.

For more information on the production, marketing, and use of HOC TC Blends and nutritionally enhanced corn hybrids, check out the ***Specialty Corns for Value Added Grain Production*** Web Site (<http://www.oardc.ohio-state.edu/hocorn/>).

TC-Blend® and **TopCross®** are registered trademarks of DuPont Specialty Grains. **Supercede™** and **NutriDense™** are trademarks of Dow AgroSciences and ExSeed Genetics, respectively

Table 1. Sources of seed evaluated in the nutritionally enhanced corn evaluations, 2000.

Company/Address	Brand
Beck's Superior Hybrids 6767 E. 267 th St. Atlanta, IN 46031 (800-937-2325)	Beck
Bird Hybrids 3282 E. St. Rt. 18 Tiffin, OH 44883-9669 (419-448-1844)	Bird
Croplan Genetics P.O. Box 64281 St. Paul, MN 55164 (800-851-8810)	Croplan
Exceed Genetics, L.L.C. 401 Frederica St. Bldg D, Suite 202 Owensboro, KY 42301 (800-233-8942)	Exseed
Monsanto 3100 Sycamore Rd DeKalb, IL 60115 (815-758-9323)	Asgrow
Mycogen 1340 Corporate Ctr Curve Eagan, MN 55121-1233 (800-380-7282)	Mycogen
Pfister Hybrid Corn Company P.O. Box 187, 187 N Fayette St El Paso, IL 61738 (309-527-6000)	Pfister SuperKernoil
Pioneer Hi-Bred Int'l., Inc. P.O. Box 756 Bryan, OH 43506 (800-874-8718)	Pioneer
Seed Consultants 648 Miami Trace Rd. SW P.O. Box 370 Washington C.H., OH 43160-0370 (800-708-2676)	Seed Consultants
Seedway RR5, Box 157 Mifflinburg, PA 17844 (800-836-3720)	Seedway

Table 2. Test plot locations, cultural practices and soil types for the nutritionally enhanced corn evaluations, 2000.

Location	Planting Date	Fert Rate/A	Tillage	Seeding Rate	Harvest Date	Previous Crop	Plot Size	Soil Type
OARDC Wooster Campus Wooster Wayne County Northeast Ohio	5/17/00	180 # N 0# P 0# K	Conventional	32000	11/8/00	Soybean	10' x 80'	Canfield Silt Loam
OARDC Northwest Branch Near Hoytville Wood County Northwest Ohio	5/16/00	232# N 0# P 0# K	Conventional	32000	10/12/00	Soybean	10' X 80'	Hoytville Silty Clay
OARDC Western Branch Near South Charleston Clark County Southwest Ohio	4/27/00	180# N 0# P 0# K	Conventional	32000	10/10/00	Soybean	10' x 200	Kokomo Silty Clay Loam

Table 3. Precipitation for 2000 nutritionally enhanced corn evaluations.

Month	Wooster	Hoytville	S. Charleston
	-----inches-----		
April	3.9 (3.3)*	1.8 (3.3)	5.4 (4.0)
May	4.5 (3.9)	4.0 (3.4)	3.5 (4.6)
June	3.4 (3.9)	4.4 (3.6)	10.1 (4.2)
July	1.8 (4.1)	2.2 (3.8)	3.4 (4.1)
Aug	3.4 (3.6)	3.2 (3.0)	1.6 (3.5)
Sept	2.7 (3.1)	1.8 (2.7)	2.6 (3.0)
Total	19.7 (21.9)	17.4 (19.8)	26.6 (23.4)

* Long term averages in parentheses

Table 4. Air temperatures for 2000 nutritionally enhanced corn evaluations.

Month	Wooster	Hoytville	S. Charleston
-----degrees F-----			
		-	
April	48.8 (48.1)*	47.9 (48.9)	50.2 (51.0)
May	62.3 (58.5)	62.9 (59.8)	54.6 (61.3)
June	69.1 (67.6)	69.2 (69.5)	70.2 (70.3)
July	68.8 (71.5)	69.8 (72.8)	70.3 (73.8)
Aug	68.6 (69.9)	69.3 (70.6)	69.8 (72.0)
Sept	61.9 (63.4)	62.6 (64.0)	62.7 (65.2)
Avg	63.3 (63.2)	63.6 (64.3)	64.6 (65.6)

* Long term averages in parentheses

Table 5. Agronomic performance data from the nutritionally enhanced corn hybrid evaluations at Hoytville and Wooster, Ohio, 2000.

Type	Brand/Hybrid	Hoytville			Wooster			Avg of 2 sites		
		Yield	Grain Moist	Final Stand	Yield	Grain Moist	Final Stand	Yield	Grain Moist	Final Stand
		Bu/A	%	Plants/A	Bu/A	%	Plants/A	Bu/A	%	Plants/A
Nutritionally Enhanced Corns	Beck EX1924	94	20.3	28641	95	19.9	33505	95	20.1	31073
	Bird ND70	98	17.0	28278	90	21.1	30928	94	19.1	29603
	Bird ND74	111	23.1	29222	98	23.1	32234	105	23.1	30728
	Croplan TR1049ND	132	20.7	28423	117	19.2	31436	125	20.0	29930
	Croplan E557	104	14.8	26717	*	22.1	25809	-	18.5	26263
	Croplan E560	88	18.7	28895	79	23.3	31835	84	21.0	30365
	Croplan E565	89	18.5	27697	72	21.7	30347	81	20.1	29022
	Exseed 5109ND	101	16.5	28786	93	20.6	30383	97	18.6	29585
	Exseed 5110ND	84	18.6	28786	106	23.5	32089	95	21.1	30438
	Mycogen 2654	123	16.4	27697	77	19.1	31472	100	17.8	29585
	Mycogen 2655	108	14.0	27406	*	17.1	31291	-	15.6	29349
	Seed Consultants 11N00	96	21.3	29585	80	20.0	33323	88	20.7	31591
	Seedway 618HOC	90	19.5	25737	66	24.5	26281	78	22.0	26009
	Wellman WIN 109	89	17.6	28496	76	24.4	31472	83	21.0	29984
	Wellman WIN111	96	18.2	28423	100	20.4	30601	98	19.3	29512
	AVG	100	17.3	26371	88	20.1	29894	94	18.7	27679
Normal	Beck 5305	-	-	-	119	22.7	29258	-	-	-
	Mycogen 2657	111	18.6	25265	-	-	-	-	-	-
	Pfister 2652	104	21.3	27479	127	21.6	30565	116	21.5	29022
	Pioneer 34B23	128	18.2	27443	131	21.1	30819	130	19.7	29131
	Pioneer 34K77	119	17.2	27080	118	18.5	29730	119	17.9	28405
	AVG	116	18.8	26817	124	21.0	30093	120	19.9	28455
	LSD (0.05)	13	NS	1965	29	2.6	1578			
	CV%	7.5	16.4	4.3	17.9	7.3	5.4			

* Severe lodging and weathering prevented yield determination.

Table 6. Grain quality data from the nutritionally enhanced corn hybrid evaluations at Hoytville and Wooster, Ohio, 2000.

Type	Brand/Hybrid	Grain Composition on a Dry Wt Basis*								
		Hoytville			Wooster			Avg of 2 sites		
		Oil	Protein	Starch	Oil	Protein	Starch	Oil	Protein	Starch
		-----%-----	-----%-----	-----%-----	-----%-----	-----%-----	-----%-----	-----%-----	-----%-----	-----%-----
Nutritionally	Beck EX1924	5.1	11.5	69.2	5.1	9.0	70.3	5.1	10.3	69.8
Enhanced	Bird ND70	5.0	11.4	69.8	5.3	8.5	70.0	5.2	10.0	69.9
Corns	Bird ND74	4.7	9.8	70.9	5.0	6.7	71.6	4.9	8.3	71.3
	Croplan TR1049ND	5.1	10.6	69.8	5.2	7.2	71.1	5.2	8.9	70.5
	Croplan E557	5.5	9.7	69.1	6.2	6.5	69.6	5.9	8.1	69.4
	Croplan E560	4.8	11.2	70.0	5.3	6.4	71.4	5.1	8.8	70.7
	Croplan E565	5.1	11.3	69.4	5.0	7.5	71.1	5.1	9.4	70.3
	Exseed 5109ND	4.9	11.3	69.8	5.1	7.1	71.4	5.0	9.2	70.6
	Exseed 5110ND	4.9	11.1	69.6	5.1	7.3	71.5	5.0	9.2	70.6
	Mycogen 2654	5.6	9.3	69.2	6.5	7.3	68.6	6.1	8.3	68.9
	Mycogen 2655	5.4	9.4	69.3	6.5	6.5	69.2	6.0	8.0	69.3
	Seed Consultants 11N00	5.0	12.2	68.7	5.1	7.2	71.1	5.1	9.7	69.9
	Seedway 618HOC	6.0	9.6	68.8	6.3	8.1	68.6	6.2	8.9	68.7
	Wellman WIN 109	4.9	10.3	70.5	5.1	7.5	71.1	5.0	8.9	70.8
	Wellman WIN111	4.9	11.5	69.4	5.0	8.8	70.5	4.9	10.2	70.0
	AVG	5.1	10.7	69.6	5.5	7.4	70.5	5.3	9.1	70.1
Normal	Beck 5305	-	-	-	4.2	6.2	73.1	-	-	-
	Mycogen 2657	3.9	8.4	72.8	-	-	-	-	-	-
	Pfister 2652	4.1	8.7	72.0	4.5	6.9	72.1	4.3	7.8	72.1
	Pioneer 34B23	3.7	8.6	72.9	3.9	6.0	73.6	3.8	7.3	73.3
	Pioneer 34K77	4.2	9.6	72.5	4.4	6.8	73.2	4.3	8.2	72.9
	AVG	4.0	8.8	72.6	4.3	6.5	73.0	4.2	7.7	
	LSD (0.05)	0.3	1.2	1.1	0.4	1.6	0.9			
	CV%	3.5	7.3	1.0	4.2	13.2	0.7			

* Oil, Protein and Starch by NIR

Table 7. Agronomic performance from the High Oil Corn TC Blend®
Performance Test at Hoytville and S. Charleston, Ohio, 2000.

		Hoytville				S. Charleston			
Type	Brand/Hybrid	Grain			Stalk	Grain			Stalk
		Yield	Moist	Final Stand	Lodge	Yield	Moist	Final Stand	Lodge
		Bu/A	%	Plants/A	%	Bu/A	%	Plants/A	%
High Oil TC Blends	Asgrow RX730TC	129	13.9	29025	11.4	149	16.7	29853	14.1
	Croplan 6607ED	126	14.1	29724	9.3	152	17.1	31073	9.4
	Croplan 6611ED	115	15.8	28472	18.0	155	19.1	29330	10.7
	Pfister SK2550-19	136	16.9	28763	13.1	152	21.0	30202	12.3
	Pfister SK2652-19	122	13.5	28298	10.0	147	17.4	30376	30.4
	Pioneer 34B25	134	14.9	28763	16.5	156	18.4	29679	16.9
	AVG	127	14.9	28841	13.1	152	18.3	30086	15.6
Normal	Pfister 2652	132	13.0	28909	9.7	148	17.4	29621	21.1
Hybrids	Pioneer 34B23	147	14.1	28181	15.3	157	18.9	28828	13.9
	AVG	140	13.6	28545	12.5	153	18.2	29225	17.5
	CV%	4	5.8	3	15.2	3	4.1	3	37.7
	LSD	9	1.5	NS	3.5	7	1.3	NS	10.1

Table 8. Grain quality data from the High Oil Corn TC Blend® Performance Test at South Charleston, Ohio, 2000.

Type	Brand/Hybrid	Grain Quality on a Dry Wt Basis*									
		Hoytville					S. Charleston				
		Oil	Protein	Starch	M.E.	Lysine	Oil	Protein	Starch	M.E.	Lysine
		%	%	%	Kcal/lb	%	%	%	%	Kcal/lb	%
High Oil TC Blends	Asgrow RX730TC	6.8	8.5	69.1	1545	0.33	6.4	8.2	70.1	1535	0.32
	Croplan 6607ED	6.4	8.3	70.2	1528	0.32	6.6	8.3	69.8	1543	0.32
	Croplan 6611ED	6.9	9.5	68.2	1555	0.34	7.4	8.8	68.2	1565	0.34
	Pfister SK2550-19	7.5	9.4	67.2	1503	0.34	8.1	9.1	66.4	1524	0.35
	Pfister SK2652-19	6.8	8.7	68.7	1552	0.33	6.7	8.5	69.1	1549	0.32
	Pioneer 34B25	7.6	8.8	67.2	1566	0.34	7.8	8.7	67.0	1574	0.34
	AVG	7.0	8.9	68.4	1542	0.33	7.2	8.6	68.4	1548	0.33
Normal	Pfister 2652	4.0	8.5	72.9	1476	0.29	4.2	8.4	72.9	1462	0.30
Hybrids	Pioneer 34B23	3.5	8.2	73.9	1483	0.29	4.4	8.0	73.2	1469	0.29
	AVG	3.8	8.4	73.4	1480	0.29	4.3	8.2	73.1	1466	0.30
	CV%	5.1	3.2	0.9	2	1.41	3.3	2.5	0.5	1	0.89
	LSD	0.6	0.5	1.0	43	0.03	0.4	0.4	0.6	33	0.03

*Oil, Protein and Starch by NIT; M.E. and Lysine by calculation.

M.E. is Non-Ruminant Metabolizable Energy Content.