PICKING THE TOP CORN HYBRIDS: FIVE KEYS TO SUCCESSFUL SELECTION

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One of the most important decisions corn producers make is the selection of high performing, adapted hybrids. Selecting the correct hybrid can often mean the difference between profit and loss. Plant breeders and agronomists test thousands of commercial and experimental hybrids for several years at many locations over a range of plant populations and other management practices. These corn hybrid performance trials determine which hybrids have yielding ability superior to current hybrids and estimate disease resistance and other important characteristics.

What is G x E ?

The reason for conducting hybrid performance trials is to understand Genotype by Environment (GxE) interactions. If GxE did not exist we could conduct one trial at one location and use the best hybrid to plant across the entire state. Hybrids (genotypes) often respond (or interact) differently in different environments due to soils, diseases, insects, fertility, and especially weather! GxE is called different things by seed companies: "Fix / Flex," "Offensive / Defensive," and "Racehorse / Workhorse" hyrbids. Seed companies benefit greatly from on-farm hybrid trials that producers establish. They get hundreds of test plots per year, hundreds of weather patterns per year, and hundreds of disease situations per year.

Identifying high yielding hybrids with low G x E requires lots of data. It takes many years of hybrid testing to determine stability to weather patterns at a location. This is difficult because of hybrid turnover. The solution is to substitute multiple locations for multiple years to assess stability.

What you are looking for are hybrids that yield consistently well across a diverse set of conditions, especially weather and disease. You are looking for hybrids with high yield and low GxE. If you concentrate on your farm's results, you miss the benefits of multi-location testing! Do not place a HIGH priority on hybrid trials grown on your farm. Performance in one environment does not predict the future accurately. Think outside the box by looking at data from other states. Links to other university variety testing programs can be found at: http://www.ksu.edu/kscpt/nccec/ (University Crop Testing Alliance).

Hybrid Selection Strategies

Your challenge is to obtain hybrid performance data from multi- locations. Especially large groups of common hybrids grown across many locations. Emphasize locations within your latitude or hybrid 'adaptation zone.' Don't hesitate to use data outside of your 'zone'.

Identify consistent performers. There are several selection criteria to consider. Hybrids should be consistently within the upper group of hybrids as determined by a trial's Least Significant Difference (LSD) value. They should be consistently within 5 to 10% of the

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maximum yield in a trial. They should be consistently greater than 5% above the average yield of a trial.

After identifying hybrids eliminate hybrids with weaknesses for specific traits important to your farming operation, e.g., disease resistance, root and stalk strength, etc. Info about hybrid characteristics can be found on many seed company web sites.

Avoid single location-single year trials because there is not enough data to predict stability of hybrid performance across a range of growing conditions. This is why you should not place a lot of faith in the ability of your own on-farm testing to predict a hybrid's yielding ability in the future. Also, avoid side-by-side comparisons, unless they are between pairs of hybrids you've already identified as being top yielders. In other words, just because my hybrid out yields your hybrid in 752 side-by-side comparisons across 10 states, does not mean that either hybrid is the best performer in the marketplace! Also, avoid hybrids without documented comparative yield performance data over multiple locations. Don't buy on advertising or price alone! Also avoid, "Percent wins against the competition." The "competition" can be a "bunch" of unidentified hybrids that could be "dogs" for all you know. What you need to know is the "percent wins" against the best of the competition!

Use Multi-location Data and Evaluate Consistency

As farm managers we need to be able to predict next year's performance of the corn hybrids we buy. The best way to predict next year's performance is to use multi-location data of a large set of hybrids. Figure 1 provides an example of multi-location average data from the University of Wisconsin Corn Hybrid Evaluation program. Asterisks (stars) indicate that the hybrid was not statistically different from the highest yielding hybrid in the trial. Hybrids A-E represent examples of typical hybrid performance. For example, hybrid A was similar to the yield average for the zone and was starred at one location. Hybrid B was one of the top hybrids in the zone and was not significantly different from the top hybrid at two locations. Hybrid C was an average hybrid in the zone and at all three locations. Hybrid D was the top hybrid in a zone and at all three locations for two years. Finally, hybrid E yielded below the trial average for the zone and all locations.

Example: South Central Zone - Early Maturity Grain Trial (page 1 of 3)

100 DAY RELATIVE MATURITY OR EARLIER, BASED ON COMPANY RATING (FOND DU LAC = FON, GALESVILLE = GAL, HANCOCK = HAN)

	2009								2008					6 Test
	AVERAGE					FON	GAL	HAN	AVERAGE		FON	GAL	HAN	AVE
HYBRID	Yield bu/A	P.I. #	Moist %	Test Wt.	Lodged %	Yield bu/A	Yield bu/A	Yield bu/A	Yield bu/A	P.I. #	Yield bu/A	Yield bu/A	Yield bu/A	Yield bu/A
A 1 Loc *	229	101	18.8	55	0	207	214	265 *						
B Zone *, 2 Loc *	248 *	105 *	19.4	56	0	223 *	244	279 *						
C Average	229	100	19.7	56	1	211	249	229						
D Zone *, 3 Loc *, 2 Yrs	261 *	107 *	20.4	54	0	229 *	274 *	279 *	219 *	106 *	173 *	232 *	248 *	239 *
E Bottom 10%	178	88	20.6	56	0	156	146	232						
MEAN	227	100	19.6	56	0	205	230	248	195	101	160	206	213	216
LSD(0.10)	17	4	0.8	1	1	13	16	20	22	7	28	20	19	12

Figure 1. An example of multi-location average data from the Univ. of Wisconsin Corn Hybrid Performance Trials. The shaded areas provide the best predictor for performance.

If we grew hybrids A-E next year, what would be their likely performance? We have been able to simulate how well we can predict performance next year using the UW hybrid trials. These trials have been conducted since 1973, and we have numerous examples of hybrids selected using various strategies. We have simulated 64 different strategies using zone averages, location performance, maturity groups, trial rank (top 1 versus top 3), and starred hybrids. Figure 2 describes the results of some selection strategies.

The basic idea is that the more stars (trials where the hybrid is not significantly different from the top hybrid in a trial) a hybrid has the more likely we can predict that it will perform higher than the trial average. For example, a randomly selected hybrid has a 50:50 (above:below the trial average) chance of beating the trial average next year. A hybrid that was starred at a location and planted back to that location next year (similar to an on-farm hybrid trial) has a 72:28 percent chance of beating the trial average the next year. Likewise a hybrid that was starred for the zone, regardless of its performance at specific locations will beat the trial average 71:29 percent of the time next year. A hybrid that is starred using multi-location data (zone) and consistently performs well increases their chances of beating the trial average from 77:23, 83:17 and 87:13 as consistency increases from one location to three locations to two-years and three locations.

If a hybrid is ever average at one location it has 48:52 odds of beating the trial average the next year. If it finishes in the bottom 10% of the hybrids at one location, it has 29:71 odds of finishing above the trial average. The strategy you use makes all the difference in predicting and picking high performing hybrids for next year.

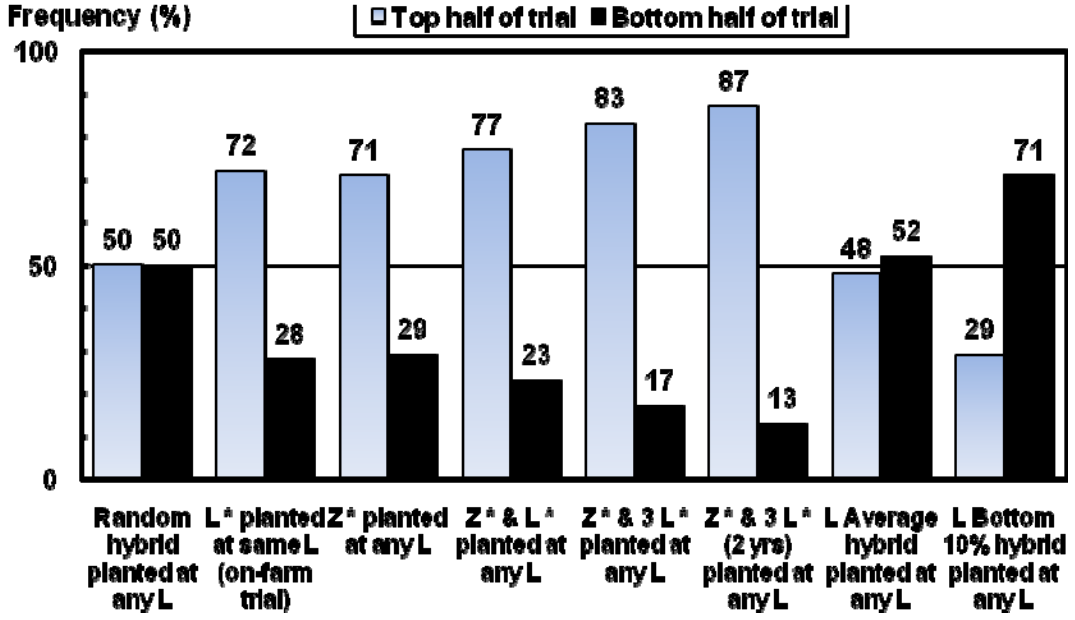

Figure 2. Next year's performance of a hybrid using various selection strategies. Simulated using UW Hybrid Trial Results 1973-2009.

Table 1. Agronomic and economic consequences of various hybrid selection strategies.

Selection scheme	N	Relative yield	Grain yield difference	Grower return difference
		%	bu/A	$/A
1 L* (on-farm)	2816	105	7	21
Z*	2405	104	7	21
Z* & 1L*	1122	106	10	28
Z* & ≥ 3L*	515	107	13	36
Z* & ≥ 3L* (2 yrs)	261	109	16	45
1 L average	4205	100	0	0
1 L bottom 10%	1122	94	-8	-22

Grower return difference ($3.50 per bushel) = grower return - trial average

The amount of yield gain ranges from -6 to 9 percent depending upon the selection strategy (Table 1). Yield gains range from -8 to 16 bu/A which is economically significant ($-22 to $45 per acre.

Not only does the way you pick hybrids influence next year's performance, but also the decision influences the economics for a number of years into the future. Table 2. describes the economic consequences of hybrid selection strategies into the future. Picking hybrids that have been starred in a zone and across 3 or more locations is better even four years into the future than using your own on-farm results.

Table 2. Economic consequences of corn hybrid selection strategies.

	Previous years		Selected year	Future years			
Selection scheme	-2	-1	0	1	2	3	4
	dollars per acre difference						
1 L* (on-farm)	31	30	68	21	15	14	11
Z*	34	31	51	21	17	15	10
Z* & 1L*	37	37	76	28	20	18	16
Z* & ≥ 3L*	52	48	63	36	30	25	17
Z* & ≥ 3L* (2 yrs)	58	57	65	45	37	31	23
1 L average	17	13	2	0	-1	-3	-5
1 L bottom 10%	-2	-10	-78	-23	-22	-19	-24

Dollars per acre difference ($3.50 per bushel) = grower return - trial average

In 1985, the approach of using zones (multi-location) average data was started within the University of Wisconsin corn hybrid evaluation program. A total of 1122 GxE hybrids have been starred within a zone and starred at least one location (Table 3). During five year increments predicted relative yield has increased using this strategy about 6% providing 9 to 11 bu/A more yield. The most recent five-year period has seen fewer examples of hybrids with this strategy and less relative and actual gain in yield. This is somewhat related to the fact that hybrids are changing so fast now, that they rarely are tested in the program more than one year. Also, we still have one more year for this five year period.

Table 3. Economic consequences of one hybrid selection strategy over time.

Z* & 1L*	N	Relative yield	Grain yield difference	Grower return difference
		Percent	bu/A	$/A
1985-1990	213	106	9	25
1990-1995	255	106	9	25
1995-2000	286	106	11	30
2000-2005	255	106	11	34
2005-2009	113	104	7	20

Grower return difference ($3.50 per bushel) = grower return - trial average

Within the hybrid trial results there are two tables (the index and the history) which users get a handle on consistency. The general principle of "the more stars, the better" applies to individual hybrids.

Every Hybrid Must Stand on Its Own

Evaluating transgenic hybrids is often more complex than normal hybrids. First you need to know the performance of a hybrid compared to other hybrids with similar traits, if others exist. Evaluate grain yield, output trait “yield” or quality, and other important characteristics. Finding comparative data in public or private trial reports may be difficult.

Second, you need to compare specialty hybrids to “normals.” Compare the best specialty hybrids in a trial with the best normal hybrids. University trials work well for this, assuming that companies enter the best hybrids of these traits in the trials. This strategy is useful for comparing Bt vs. non-Bt hybrids, RR vs. non-RR hybrids, waxy vs. normal starch hybrids.

Third, you need to compare the best performance compared to the best “normal” hybrids in the marketplace (yield versus economics). Comparison to “normal” version of same hybrid is not important because you have access to all hybrids sold in the marketplace.

Table 4 describes the performance of six hybrid "families" where transgenic trait(s) were inserted into a common isoline or family of genetics. Hybrid performance was statistically significantly different between hybrids.

“Bottom line: Each hybrid must stand on its own for performance." Do not select hybrids based on family (sister) performance.

Buy the Traits You Need

Not all fields require transgenic traits. We need to remember that **transgenic traits do not add to yield, they protect yield.** If you do not need transgenic traits then do not buy them. This is more difficult than it sounds, especially for smaller seed companies and inventory control. It is easier for some seed companies to limit their inventory and carry hybrid products with more rather than fewer traits. For most producers in Wisconsin rotations involving alfalfa do not require traits for corn rootworm control. Likewise corn has a number of good herbicide treatments available, so Roundup Ready™ and Liberty Link™ traits may not be needed.

Table 4. Relative performance among "Families" compared to the trial average.

Family	Specialty Trait	N	Grain yield
			Bu/A
A12	DBT418	12	5 [b]
	Mon810	3	27 [a]
	MonGA21	23	4 [b]
	Normal	88	5 [b]
C216	Mon810	30	13 [a]
	Mon810+Mon863+Nk603	5	-2 [b]
	Normal	9	6 [ab]
E424	Bt11+Mon863+T25	4	6 [a]
	MonGA21	4	-15 [b]
B441	Mon810	23	2 [a]
	Mon810+Mon863+Nk603	6	-10 [b]
	Nk603	13	-7 [b]
	Normal	2	-2 [ab]
D340	Mon810	6	11 [ab]
	Mon810+Mon863+Nk603	5	-3 [b]
	Normal	9	13 [a]
F393	Mon810	18	7 [a]
	Mon810+Mon863+Nk603	8	-5 [b]

Pay Attention to Seed Prices

Before the commercialization of transgenic hybrids, it was rare that seed price had a dramatic influence on a hybrid selection decision. Often premium hybrids would cost more because they were consistently better performing. So even though cost was greater, they were worth it and usually more than offset the premium price.

Today, the price difference between non-transgenic and transgenic hybrids is so great that growers must factor into their decision seed price. A good performing non-transgenic hybrid will cost $100 to $150 per bag, while high performing transgenic hybrids easily run $225 to $300 per bag. Some of the new SmartStax™ are projected to be above $350 per bag. Remember from Table 1 that we can at best predict a 16 bu/A gain over an average hybrid. The yield gain is likely lower. USDA data indicates average yield gains of 1.5 to 2.0 bu/A per year with some of the best counties at ~4 bu/A per year. Your annual yield gain is how premium seed will be paid for.

A seed price calculator was developed to help producers with this decision. It is located at http://corn.agronomy.wisc.edu/Season/DSS.aspx. The spreadsheet can be used for any crop. Users can input various costs for herbicides, insecticides, etc.

Conclusions

Hybrid selection requires a lot of research and homework of the data to make sense out of it. It can be challenging because multiple location performance data are often difficult to obtain. It can be challenging because performance data often require further analysis and scrutiny. But the payoff is that it can improve net profits due to higher and more consistent hybrid yields on your farm.