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The University of Wisconsin Corn Hybrid Trials -- Selecting the Top Performers

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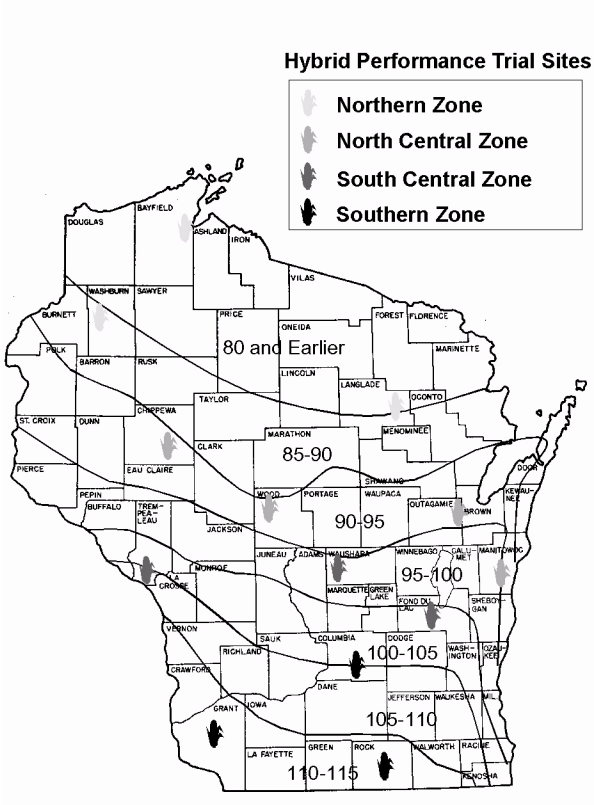
Abstract

Farmers often use a combination of on-farm, seed company, and university trials to select hybrids for planting the following year. Our objective was to evaluate selection methods for identifying and predicting future hybrid performance. A total of 24 hybrid selection schemes were evaluated using performance data from University of Wisconsin Corn Hybrid Trials conducted between 1977 and 1995. The yield rank of a hybrid in the selection year was compared to the trial average the next year. Selecting a hybrid using the results of only one trial increased grain yield 4 to 6 percent and grower return increased $12 to $17 per acre over the trial average. The hybrid selection decision was improved by using a multi-location average. Hybrids ranking in the top 10% of hybrids in a production zone and at three or more locations had grain yields 11 to 15 bushels (7 to 9% increase) and $24 to $33 more than the trial average. Since most farmers do not have the resources to conduct on-farm trials of all hybrids at several locations, using unbiased results from other trials can increase the chances for picking a top hybrid.

One of the most important decisions a corn farmer makes 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 new 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.

Prior to 1970, agronomists at the University of Wisconsin concentrated on evaluation of new hybrids developed by university corn breeding programs. Commercial hybrids sold to Wisconsin farmers were evaluated primarily for maturity. Beginning in 1972, a performance evaluation program of commercial hybrids was begun by E.A. Brickbauer. Commercial entries were solicited and entered by companies at eight locations. The number of testing sites gradually expanded to 13 locations. In 1985, P.R. Carter divided the locations into four production zones of three to four testing sites each (see map). These production zones had an “early” and “late” trial with a cut-off of 105-, 100-, and 90-day relative maturity for the Southern, South Central, and North Central production zones. When a commercial hybrid was entered into the performance evaluation program, it was tested at all locations in the production zone. In 1995, a corn hybrid silage evaluation program was initiated by J.G. Lauer. Silage yield and quality was evaluated at two sites in each production zone. Corn grain and silage performance data

Wisconsin Relative Maturity Belts



between 1977 and 1995 was compiled into a computer software program called SELECT!

How good are these trials for predicting performance of the top hybrid next year? Should a farmer conduct an on-farm trial or rely on results from seed companies and Universities to predict hybrid performance on-farm? Our objective was to evaluate selection methods for identifying and predicting future hybrid performance.

Materials and Methods

Performance data from University of Wisconsin corn hybrid trials conducted between 1975 and 1995 were analyzed. Over 30,000 hybrid-location-year tests were derived from the SELECT! database. Selection schemes were developed by selecting ranked hybrids and pooling by various combinations of years, locations and zones (Table 1). Performance was measured by determining the rank of the hybrid in the trial, the grain yield difference, relative yield and grower return difference.

Grain yield difference = grain yield of the selected hybrids for the pooling method minus the trial average.

Relative yield = yield of selected hybrids for the pooling method) trial average

Grower return difference = grower return of the selected hybrids for the pooling method minus the trial average, where corn price = $2.65 per bushel, handling = $0.017 per bushel, hauling = $0.04 per bushel, and drying = $0.015 per point per bushel above 15.5 % moisture.

Hybrids were selected using four methods: 1) Top hybrid, 2) Top three hybrids, 3) Top hybrid in three maturity groups around the maturity cut-off for the zone, and 4) Top 10% of hybrids. Selecting the top three hybrids and the top hybrid by maturity group was an attempt to select hybrids which were more "stable" for yield.

Results and Discussion

Selection schemes differed in the number of cases which fulfilled the pooling criteria (Table 1). For example, there were 1,570 cases where hybrids ranked in the top 10% at a location in one year were tested the following year (scheme 4). There were 41 cases where the top three hybrids in a zone and at three or more locations in one year were tested the following year (scheme 14). No cases were found where a hybrid was the top performer in a zone and at three locations in one year (scheme 13).

Predicting performance based on one location

Typically, about 80 to 150 hybrids are tested in a trial at a location. When hybrids ranked in the top 10% of a trial (scheme 4) were grown the following year, grain yield was 4% above average, and profit increased $14 per acre over an average hybrid (Table 1). Hybrids ranked in the bottom 10% of a trial (scheme 18) and grown the following year would be 9 bushels lower (7% decrease) and lose $21 per acre compared to an average hybrid. If the top hybrid at a location (scheme 1) is grown the next year, grain yield

Can performance predictions be improved?

Numerous schemes can be devised. The University of Wisconsin model recommends that hybrids be selected on the basis of top performance across a production zone and at individual locations in the zone (schemes 13-16) and where possible use two or more years of data (schemes 21 and 22). Selecting hybrids using these schemes increases grain yield 11 to 15 bushels per acre (7 to 9% increase) and generated $24 to $32 more profit than the trial average.

How long should you stay with a top-performing hybrid?

A hybrid which was a top-performer in a zone and at three or more locations in a year (scheme 16) continued to return $14 to $18 more than the trial average 3 to 4 years after its top performing year (Table 4). Hybrids selected on the basis of location or zone performance (schemes 4 and 8) only returned $6 to $10 more than the trial average.

What are the chances of a top hybrid repeating its performance next year?

When a coin is flipped often enough, a 50:50 chance exists of getting either "heads" or "tails." Testing an "average" hybrid results in a 49:51 percent chance that it will be either above or below the trial average when grown the next year (Figure 1). An "average" hybrid ranks in the top 10 percent of the hybrids of a trial the following year about 7 percent of the time. However, an equal chance exists for an "average" hybrid to rank in the bottom 10 percent of the hybrids in a trial the following year.

Hybrids ranked in the top 10% of a trial and grown the following year in the same location and trial beat the trial average 71 percent of the time (Figure 2). But, a hybrid which ranked in the top 10% of the hybrids in a production zone and at three or more locations in that zone beat the trial average 81 percent of the time (Figure 3). For reference, the performance probability of hybrids ranked in the bottom 10% of a trial are shown in Figure 4.

Summary

Should farmers go through the trouble and expense of testing 80 to 150 hybrids in an on-farm test? These data suggest that a well run test across numerous locations in a production zone can predict hybrid performance at a location as well as or better than an on-farm test. Clearly, using performance information across a production zone and numerous locations and management conditions will increase your chances of picking a profitable hybrid. Certainly, an on-farm test in conjunction with seed company trials, and University trials would probably give the best information if all hybrids of interest were in the trials. Since most farmers do not have the resources to conduct on-farm trials at several locations, using unbiased results from other trials to supplement on-farm yield results can increase the chance of picking a hybrid that will do well next year.

Table 1. The combination of years, locations, zones, and selected hybrids used to create the 24 selection schemes.

Scheme	Pooling method: Years	Pooling method: Trials [H]	Hybrids selected	Cases	Grain yield difference	Relative yield	Grower return difference
					bu/A	percent	$/A
1	1	L	Top one	232	7	106	16
2	1	L	Top three	643	7	105	17
3	1	L	Top one MG [I]	478	5	104	12
4	1	L	Top 10%	1,570	6	104	14
5	1	Z	Top one	148	8	105	17
6	1	Z	Top three	473	8	106	19
7	1	Z	Top one MG	324	6	104	14
8	1	Z	Top 10%	953	7	105	16
9	1	Z and 1L	Top one	63	10	108	23
10	1	Z and 1L	Top three	432	8	106	18
11	1	Z and 1L	Top one MG	176	6	105	16
12	1	Z and 1L	Top 10%	549	8	105	18
13	1	Z and 3L	Top one	0	--	--	--
14	1	Z and 3L	Top three	41	15	109	33
15	1	Z and 3L	Top one MG	33	11	109	25
16	1	Z and 3L	Top 10%	208	11	107	24
17	1	L	Average	2,327	0	100	-1
18	1	L	Bottom 10%	614	-9	93	-21
19	2	L	Top 10%	460	11	107	25
20	2	Z	Top 10%	302	13	109	31
21	2	Z and 1L	Top 10%	126	14	109	32
22	2	Z and 3L	Top 10%	138	13	108	31
23	2	L	Average	561	-1	100	-2
24	2	L	Bottom 10%	126	-18	86	-42

[H] L = Location and Z = Production Zone

[I] MG = Top hybrid for three Maturity Groups for the zone

Table 2. Grower return over time of corn hybrids selected using various schemes.

Selection scheme	Previous years		Selected year	Future years			
	-2	-1	0	1	2	3	4
	dollars per acre difference [H]						
4	23	20	52	14	10	10	6
8	23	23	44	16	14	10	7
12	25	26	58	18	14	11	9
16	38	37	51	24	23	14	18
17	11	9	0	-1	-2	-3	-4
18	-5	-9	-60	-21	-20	-23	-23

[H] **difference = grower return of selected hybrids - trial average**

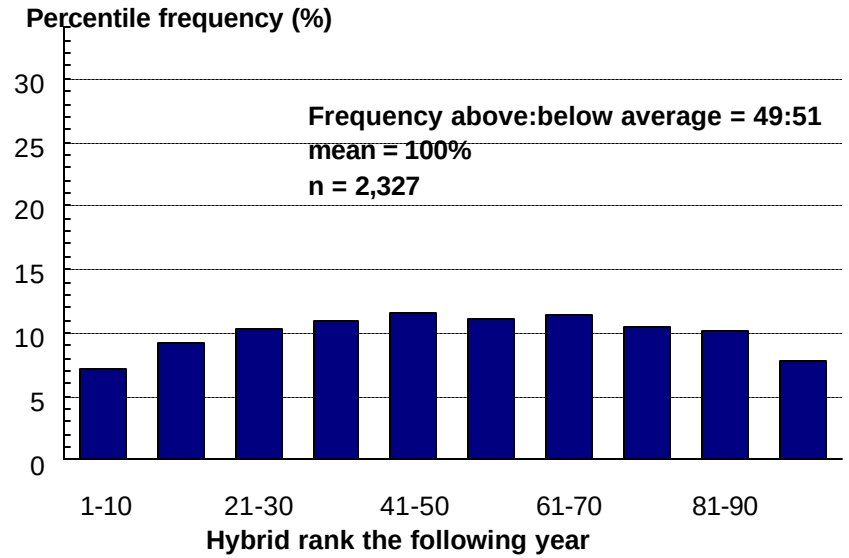


Figure 1. Performance the following year of average corn hybrids selected by location (Scheme 17).

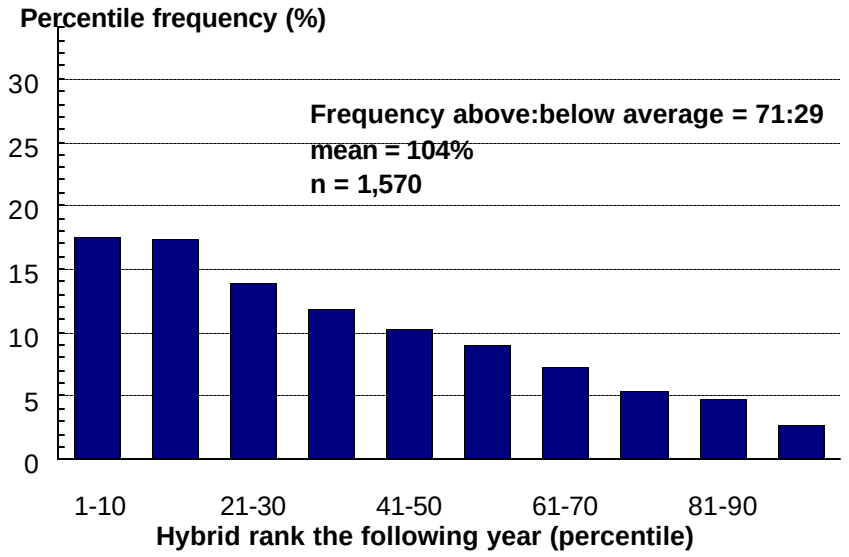


Figure 2. Performance the following year of the top 10% of the corn hybrids selected by location (Scheme 4).

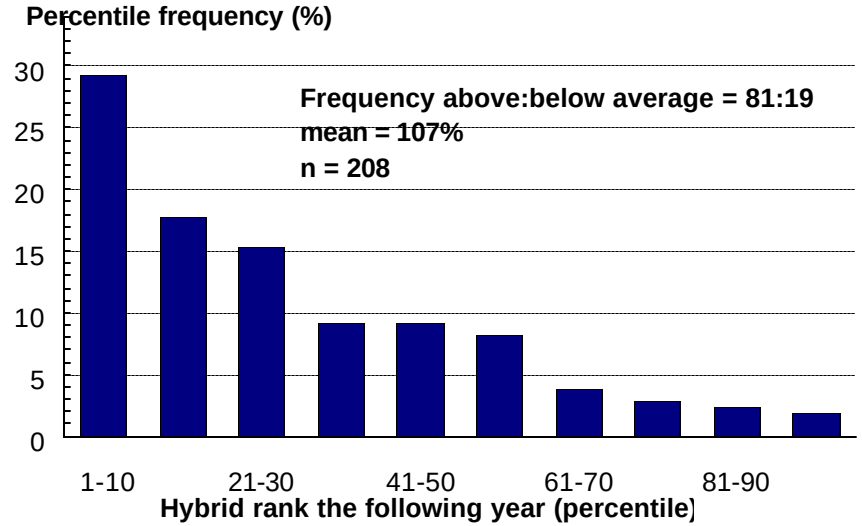


Figure 3. Performance the following year of the top 10% of the corn hybrids selected by performance zone and three or more locations (Scheme 16).

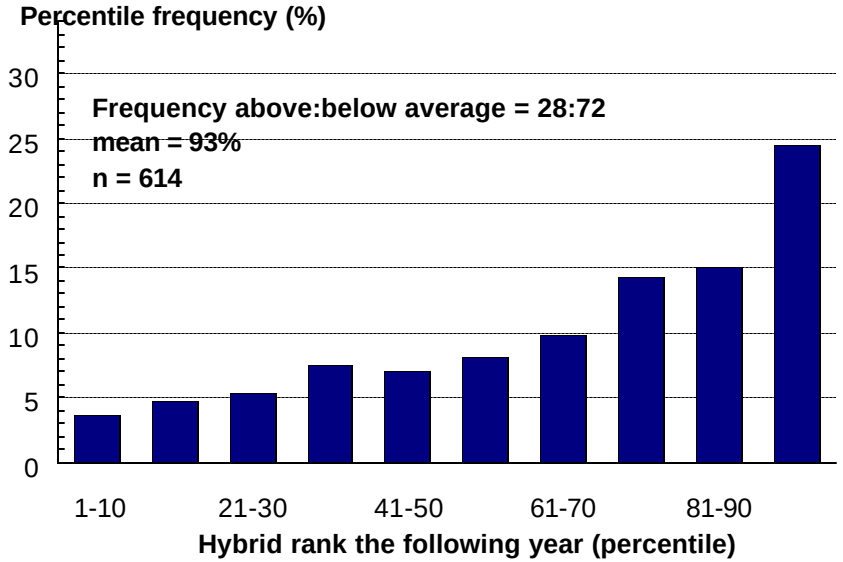


Figure 4. Performance the following year of the bottom 10% of the corn hybrids selected by location (Scheme 18).