Single-site variety data would be best if weather never varied. But since it does, province-wide crop insurance data helps select the "weatherproof" varieties.

Scanning data from the 10-million-acre test plot

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If you are like most growers, you've selected varieties for your farm based on your own experience combined with analysis of published regional yield and agronomic data. That typically includes data on yield, maturity, and disease resistance as observed under controlled trial conditions. Information on other traits such as flooding tolerance, drought resistance, and frost tolerance is not usually available.

Growers also know that on-farm conditions can influence variety performance. For example a disease-resistant variety in an untreated field may consistently out-yield other varieties in a location with high disease pressure, even though it does not rank among the top yielders in published trial data from sites without this disease pressure.

Is there a way for Manitoba growers to get information on the "on-farm" performance of varieties? Yes — you're reading it right now.

Yield Manitoba provides major crop yield data at the risk area level. For yield data at the rural municipality level, and for other crops, check out the variety query tool on the Manitoba's Management Plus Program website, www.mmpp.com

By providing production insurance client data in aggregate form, Manitoba Agricultural Services Corporation (MASC) has essentially turned Manitoba into one large 10-million-acre on-farm "test-plot." It provides Manitoba growers with unbiased information on reported yields for both old and new varieties under on-farm conditions. Combining this information with trial data from such sources as *Seed Manitoba* enables growers to make the most profitable variety choice for their farm.

Keep in mind that as long as you stick within recommended varieties, a change in variety is not usually as risky or as costly as other changes in farming practices.

Yield is what makes most growers their money. Cost of production is largely fixed once they decide to plant an acre of crop, so anything they can do to increase yields without increasing costs increases profitability. That's why it is critically important that growers chose their varieties wisely. Also don't be afraid to switch, any time lag between an improved variety's availability and it's acceptance can result in profit or loss.

Accounting for variability

Varieties which perform consistently across various locations are preferred over varieties which only respond well at a single site — even if that site is near your farm. Growers need to look at data covering as many sites as possible to confidently predict what variety will work best at their farm. Growing seasons everywhere are highly variable and not much weather happens at other sites in the province that couldn't happen at your farm.

If you want to plant a variety most likely to achieve or exceed its expected yield regardless of conditions, you need to look at variability. The yield variability of a typical variety is shown in Figure 1. Note how the yields are skewed left. This left skewing is common for yield distributions in Manitoba. The left or negative skewing means that it is easier to get a lower yield than it is a higher yield!

Invigor 2573 Canola Crop Distribution (2002-2004)

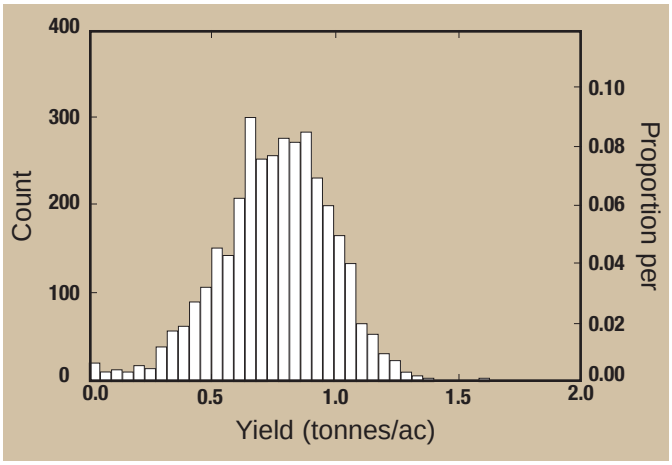

Figure 1. Yield distribution of Invigor 2573 Canola in Manitoba over the period 2002 to 2004. Based on farm yields reported to MASC.

Table 1: A listing of the days to maturity (DTM), median yield and C.V. for some major varieties of crops grown in Manitoba. Based on farm yields reported to MASC over the period 2002 to 2004.

Crop	Variety	Rel DTM	N of Cases	Median Unit	C.V.
RS Wheat	AC Barrie	99	11447	41.6 bu/ac	0.341
RS Wheat	AC Superb	101	2589	50.4 bu/ac	0.309
RS Wheat	AC Domain	97	4022	42.7 bu/ac	0.308
RS Wheat	AC Intrepid	95	924	42.1 bu/ac	0.307
Win Wheat	CDC Falcon	331	1988	63.8 bu/ac	0.304
Win Wheat	CDC Harrier	335	521	52.7 bu/ac	0.334
Win Wheat	CDC Raptor	335	242	54.7 bu/ac	0.310
Win Wheat	CDC Clair	334	395	55.4 bu/ac	0.375
Arg Canola	Invigor 2573 (LT)	97	2788	34.7 bu/ac	0.296
Arg Canola	Invigor 2663 (LT)	96	2826	35.9 bu/ac	0.288
Arg Canola	45H21 (RT)	96	2889	34.8 bu/ac	0.288
Arg Canola	34-55 (RT)	96	2962	32.0 bu/ac	0.326
Arg Canola	46A76 (ST)	98	2327	30.1 bu/ac	0.371
Soybeans	OAC Prudence	120	683	19.2 bu/ac	0.672
Soybeans	90A07	120	572	24.9 bu/ac	0.587
Soybeans	90B11 (RT)	130	254	17.0 bu/ac	0.719
Soybeans	Gentleman	115	423	26.4 bu/ac	0.496
Soybeans	Costaud	116	180	22.9 bu/ac	0.506
Navy Beans	Envoy	99	1105	1,450.8 lbs/ac	0.594
Navy Beans	Regent	102	339	1,367.0 lbs/ac	0.673
Navy Beans	Navigator	103	238	1,464.0 lbs/ac	0.607
Navy Beans	AC Cruiser	104	106	1,100.2 lbs/ac	0.687

Pulling out the weatherproof varieties

Yield is a function of genetics and environment, but because breeders have selected for uniformity, and since modern management practices are relatively similar, yield variability is mainly the result of environment. That being the case, varieties with little yield variability can be considered relatively "weatherproof" compared to varieties that have greater yield variability.

Measuring variability enables growers to understand how weatherproof a variety is. Simply put, the more variable a variety's yield, the more likely it is to achieve yields significantly below the expected yield. A measure of variability that is commonly used is called the Coefficient of Variation (C.V.). The larger the C.V., the greater the variability. In the case of variety yields, the lower the C.V. value the more "weatherproof" is the variety.

Table 1 lists the C.V. values for several major varieties of some crops grown in Manitoba from 2002 to 2004. The 2002 crop year was characterized by weather extremes from heavy rains to heat, but crops averaged not too bad. The 2003 crop year had record-breaking yields even though there was drought and heat stress in the latter part of the growing season. The 2004 season was one of the coldest on record, resulting in a significant number of crops that failed to mature. The net result being that yield data from this three-year period reflects a wide mixture of crop stresses.

Analyzing the variation

Table 1 lists the C.V. of yields from the four main red spring wheat varieties. They ranged from 0.30 to 0.34. AC Barrie had the highest C.V. indicating this variety had the highest yield variability. AC Barrie was also the variety with the lowest average yield.

If I had to speculate on why, I would guess it is the result of it being such a dominant variety with a lot of bin-run seed being used. AC Superb, the latest-maturing variety listed had the highest median yield, 50 bu/ac.

The C.V. of yields from the four main winter wheat varieties is also listed in Table 1. They ranged from 0.30 to 0.38. CDC Falcon was the variety with the lowest C.V. and also was the earliest-maturing and had the highest median yield, 64 bu/ac . The highest C.V. was associated with CDC Clair indicating it has the most variability.

Table 1 also lists the C.V. of yields from the five main canola varieties. Values ranged from 0.29 to 0.37. It is interesting that the latest-maturing variety, 46A76, had the lowest median yield and the highest yield variability.

The highest median yield, 36 bu/ac, and lowest yield variability was associated with Invigor 2663, one of the earliest-maturing varieties. This serves to indicate just how important maturity can be for varieties. These five varieties only differ in maturity ranking by three days but under short-season conditions that is all it takes to have a significant yield impact.

The C.V. for yields of the five major varieties of soybeans are also listed in Table 1. Values ranged from 0.50 to 0.72 . Similar to canola the earliest maturing variety, Gentleman, had the least yield variability and the highest median yield, 26 bu/ac. At the other extreme, the variety with the lowest median yield and highest yield variability was 90B11, it is also the latest-maturing variety. These results illustrate the importance of growing earlier maturing soybean varieties under short season conditions

Finally, Table 1 also lists the C.V. for the yields of the four major navy bean varieties. The C.V. values ranged from 0.60 to 0.69. Envoy was the variety with the lowest yield variability and it had the second-highest yield, at 1,451 lbs/ac. Envoy was also the earliest-maturing variety. AC Cruiser, the latest maturing variety, had the lowest

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yield variability and the lowest median yield. Again these results illustrate the importance of growing earlier maturing varieties under short season conditions.

Pulling out weatherproof traits

Again, one of the deficiencies of variety trial data is that traits such as flooding tolerance, drought resistance, and frost tolerance are not usually available. MASC is uniquely positioned to provide some insight on these traits — after all MASC tracks which fields in its 10-million-acre test plot have suffered yield losses due to drought, excess moisture, etc.

Table 2 illustrates what percentage of production insurance payments were made to a specific variety for a particular post-harvest cause of loss from 2002 to 2004. There is a column listing the variety's market share. If a variety is as susceptible to a particular cause of loss as any other variety the payouts for that cause of loss should not be different than its variety market share. If the payments are greater than anticipated, then that variety is more susceptible to that cause of loss than other varieties. The alternative is also true.

Wheat

If you recall the data in Table 1, AC Barrie was the least weatherproof RS wheat variety. The data in Table 2 illustrates that compared to other RS wheat varieties AC Barrie has been disproportionately susceptible to excess moisture (the excess moisture per cent of payouts is much greater than its market share).

The data also indicates that AC Superb has been relatively susceptible to fall frost whereas AC Barrie has been relatively fall frost-tolerant. AC Superb has been relatively drought-tolerant and AC Domain has been relatively tolerant of excess moisture. It is also interesting to note that hail payout amounts are consistent with market share for each RS wheat variety, which would be expected with a random peril which is variety-independent. These RS wheat results indicate that varieties not only differ in how weatherproof they are, but also in what perils they are more or less susceptible to.

Oilseeds and beans

Except for canola variety 46A76, the results in Table 2 do not indicate one canola variety is more or less susceptible to any of the perils listed. This may be an artifact of the robust nature of current varieties or a result lowered data sensitivity because any one variety has only a relatively small portion of the market share. If you recall the data in Table 1 indicated that 46A76 was the least weatherproof canola variety. The data in Table 2 illustrates that compared to other canola varieties 46A76 has been disproportionately susceptible to frost (the frost per cent of payouts is much greater than its market share).

Except for the soybean variety Gentleman, the results in Table 2 do not indicate one variety is more or less susceptible to any of the perils. This may be an artifact of the limited regional distribution of soybeans resulting in lowered data sensitivity. More years of data or a more regionally limited analysis might result in more distinctions between varieties. The data in Table 1 indicated that Gentleman was the most weatherproof soybean variety. The data in Table 2 illustrates that compared to other soybean varieties Gentleman may have been disproportionately resistant to frost (the frost per cent of payouts is much less than its market share).

The results in Table 2 do not indicate any one navy bean variety is more or less susceptible to any of the perils. This may be an artifact of the limited regional distribution of navy beans resulting in lowered data sensitivity. More years of data or a more regionally limited analysis might result in more distinctions between varieties. Nonetheless, there are hints at trends, such as the navy bean variety Regent being susceptible to drought. Additional data or analysis would be required to clearly identify these traits.

Table 2: A listing by variety of the variety market share and relative post harvest production insurance payment amounts attributed to various causes of loss as a per centage of total crop payments for that cause of loss. Based on farm yields reported to MASC for some major varieties of crops grown in Manitoba over the period 2002 to 2004.

Crop	Variety	Variety Share	Frost	Exc Moisture	Drought	Hail
RS Wheat	AC Barrie	49.7%	31.6%	72.3%	46.4%	49.8%
RS Wheat	AC Superb	9.0%	27.3%	3.6%	0.7%	10.2%
RS Wheat	AC Domain	17.7%	12.3%	7.9%	20.7%	18.0%
RS Wheat	AC Intrepid	3.7%	6.1%	1.5%	4.1%	2.1%
Arg Canola	Invigor 2573 (LT)	10.3%	4.3%	3.7%	8.7%	4.1%
Arg Canola	Invigor 2663 (LT)	11.0%	9.4%	4.8%	6.6%	7.2%
Arg Canola	45H21 (RT)	8.0%	5.1%	6.7%	4.7%	3.7%
Arg Canola	34-55 (RT)	8.7%	9.3%	11.4%	6.9%	10.8%
Arg Canola	46A76 (ST)	8.3%	13.6%	8.2%	10.5%	7.1%
Soybeans	OAC Prudence	19.3%	28.4%	35.0%	19.6%	13.8%
Soybeans	90A07	21.3%	24.6%	14.1%	13.8%	53.5%
Soybeans	90B11 (RT)	7.7%	16.9%	10.4%	8.8%	0.0%
Soybeans	Gentleman	21.7%	4.9%	11.6%	32.0%	0.0%
Navy Beans	Envoy	63.7%	55.3%	67.0%	50.6%	35.3%
Navy Beans	Regent	15.7%	21.1%	10.4%	42.7%	0.0%
Navy Beans	Navigator	9.3%	8.8%	10.3%	2.5%	48.5%
Navy Beans	AC Cruiser	4.7%	5.8%	5.6%	4.2%	1.5%

Winterkill ratings

Because of an interest in winterkill as a cause of loss for winter wheat, Table 3 was created. It lists what percentage of production insurance payments were made to a specific variety for a particular reseeding cause of loss over the period 2002 to 2004. There is also a column listing the variety's market share. If a variety is as susceptible to a particular cause of loss as any other, variety the payouts for that cause of loss should not be different than its variety market share. If the payments are greater than anticipated, then that variety is more susceptible to that cause of loss than other varieties. The alternative is also true.

Data in Table 1 indicates that CDC Clair was the least-weatherproof winter wheat variety. Table 3 illustrates that

DENNIS LANGE

Weatherproofing: *Crop insurance data for the past two years can give you an idea of which varieties have stood up best to wet weather in the past two years.*

compared to other winter wheat varieties CDC Clair, has been disproportionately susceptible to excess moisture (the excess moisture per cent of payouts is much greater than its market share). The results also indicate that AC Falcon has been relatively susceptible to winterkill whereas the other varieties have not. More years of data or a more regionally limited analysis might result in more or different distinctions between varieties.

Weatherproof means "resistant to bad weather." This analysis of the "10-million-acre test plot" results has shown that some varieties are more weatherproof than others and that some of this weatherproofing may be the result of tolerance to some identified perils. With more refined analysis of the data, one could make recommendations for specific variety traits, such as flooding tolerance, drought resistance, winterkill susceptibility and frost tolerance. I'll leave that for someone else.

Table 3: A listing by variety of the variety market share and relative reseeding production insurance payment amounts attributed to various causes of loss as a per centage of total crop payments for that cause of loss. Based on farm yields reported to MASC for some major varieties of winter wheat grown in Manitoba over the period 2002 to 2004.

Crop	Variety	Variety Share	Frost	Exc Moisture	Drought	WinterKill
Win Wheat	CDC Falcon	59.3%	66.7%	71.5%	43.7%	88.3%
Win Wheat	CDC Harrier	15.3%	12.7%	0.2%	31.8%	3.0%
Win Wheat	CDC Raptor	5.0%	1.9%	0.0%	3.0%	2.0%
Win Wheat	CDC Clair	14.0%	12.8%	25.7%	14.6%	5.1%

How to calculate a C.V.

To identify which varieties are weatherproof, you can compare their C.V. of yields by simple number-crunching. You likely already have the capability — most advanced calculators and most spreadsheets make it easy to calculate the average and standard deviation of a list of numbers. A C.V. is the ratio of standard deviation divided by the average (in Microsoft Excel C.V. = STDEV <range of list of numbers>/AVERAGE <range of list of numbers>).

So where do you get the "list of numbers?" For starters you can list out the annual yield results from *Yield Manitoba* for all (or any combination of) risk areas and derive the corresponding C.V. for each variety of interest.

Remember that the lower the C.V., the more consistent has been that variety's yield over a range of environments and the more likely you are to achieve your expected yield if you select that variety.

Common sense should prevail when number-crunching. The best C.V. values are derived from yields obtained from several locations and years. Additionally, you need to compare varieties using similar datasets. Comparing a C.V. for a variety derived for one set of location or years with the C.V. for another variety from a completely different set of locations or years simply doesn't cut it.