



Hybrid Stability

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Corn seed salesmen will be calling on growers to book the hybrids that they will grow next year. One of the hybrid's traits that they may talk about is "stability". I've heard that term for many years and often wondered what it meant; I haven't seen it defined in company literature. And the term "racehorse" is also often used in the same discussion of stability. I've often asked what is meant by these terms and get different replies, but the description usually is "it's a hybrid that does well on your best land". Right or wrong, this implied to me that those hybrids described as racehorses might not then do as well as others on lower yielding fields. Then, what hybrids should one chose to grow on the lower yielding fields? Do "racehorse hybrids" exist? These questions haunted me for some time until I looked into the matter further. This paper describes my findings and conclusions.

Plant breeders define variety stability as a variety that is not influenced by the environment. They calculate the stability index as the linear regression coefficient of the yield of a variety grown in several environments as a function of the environmental index. The environmental index is the difference of the average yields at one location from the average yields of all locations. They define a stable variety as one having a regression coefficient (b value) that is not different from 1.0. That is graphically described in Figure 1.

If a variety has a regression coefficient that is greater than 1.0, then it performs better in high yielding environments than do other varieties. I'll call these "racehorse" hybrids. Varieties that have a regression coefficient less than 1.0 would perform better than others in a low yielding environment. I called these hybrids "workhorses". These situations are also graphically represented in Figure 1.

I wondered, "are there such corn hybrids as racehorse and workhorse as described here"? If so, corn growers should know this to improve corn hybrid selection and where they position them on their farm.

The first data set I used was the Minnesota County Corn Growers Yield trials. I chose the ten highest yielding hybrids, ten that yielded near the average, and the ten lowest yielding hybrids and conducted the stability regression analysis for each of the 30 hybrids. The lowest yielding environment had an average yield that was 80 bu/a lower than the highest yielding environment, so the environments represented a wide yield range for yield potential.

Within each of the three groups, there was no statistical difference among regression coefficients, so the averages of the group of ten hybrids are shown in Figure 2. The ten highest yielding hybrids had an average regression coefficient of 0.94, which is not statistically different from 1.0. So, all the ten high yielding hybrids were stable hybrids and there were no racehorses in the group (none with b values statistically greater than 1.0). The ten highest yielding hybrids averaged 184 bushels per acre across all environments and they had higher yields than the other groups when grown in low yielding as well as high yielding environments.

The ten average yielding hybrids had an average regression coefficient of 0.93, which is also not different from 1.0. They were also stable hybrids, but had and

average yield level of 7 bu/a less than the average of the ten highest yielding hybrids.

The ten lowest yielding hybrids had an average regression coefficient of 1.0 with an average yield of 171 bu/a. In this group, there were no regression coefficients greater than or less than 1.0, so all were stable hybrids, but with lower yields in all environments.

I've analyzed other yield data sets and have found similar results. I've concluded that hybrids today are stable and are unlikely to have regression coefficients that are different from 1.0. Seed companies test hybrids over many environments before a hybrid is commercially released and one of the criteria for release is overall good average performance (or a regression coefficient of 1.0). This analysis also reconfirms for me what I have told corn growers for many years - "Good yielding hybrids are good yielding hybrids in all environments." To this end, corn growers need to get unbiased yield information and chose the higher yielding hybrids to increase their chances of choosing hybrids that will perform well next year.

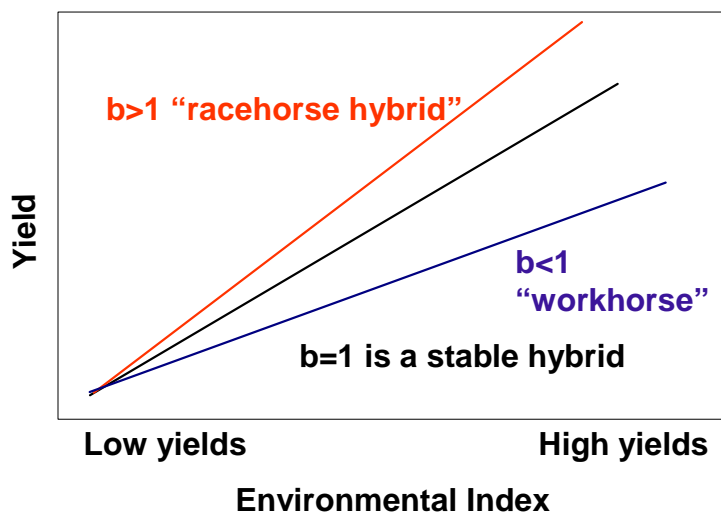


Figure 1. Graphic representation of a stable crop variety represented by the center line with a regression coefficient of 1.0. A racehorse hybrid is represented by the b greater than 1 line and a workhorse with a b less than 1.

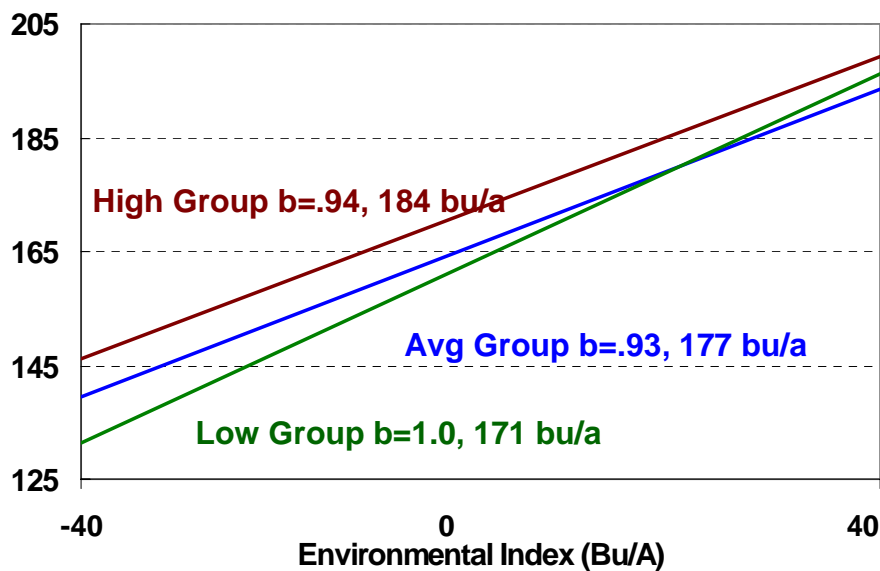


Figure 2. Stability and average yields of a group of ten high yielding hybrids, ten average yielding, and the ten lowest yielding hybrids grown in the Minnesota Corn Growers Yield Trials in 2003.