

BACKGROUND

Beck's Hybrids is the third largest seed company in the U.S., dedicated to serving farmers throughout the Midwest.

Motivation

Crop yield is important for farmers; it decides income, resource efficiency, and profitability. In corn crops, kernel traits can be related to yield and other metrics which determine seed quality.

Goal

Our goal was to determine how kernel depth (KD) relates to key field performance metrics. Once we know the effects of KD, Beck's can use this to improve breeding strategies and select consistently superior hybrids.

METHODOLOGY

We split the project scope into three main tasks to consider the goals from thoughtful angles.

Analyzing Key Hybrids

By slimming down to important hybrids, we can make conclusions more efficiently, and also compare behavior with full data

- Select hybrids with greatest average percent of median yield per location
 - Isolates environmental factors and outliers on key hybrids
- Compare Linear Regression & Correlation (Fig 1.) of chosen hybrids
- Select set for kernel trait analysis

Environmental Index and Response

Traits are defined by the genetics interacting with the environment.

- Defined **Environment Index(EI)** - Avg yield per Location
- Evaluated **hybrid sensitivity to environmental changes**. Using linear regression, we predicted yield as environment worsened to evaluate **resilience of each hybrid**. (Fig 2.)
- Evaluated **hybrid stability** (Fig 3.) using sensitivity & yield

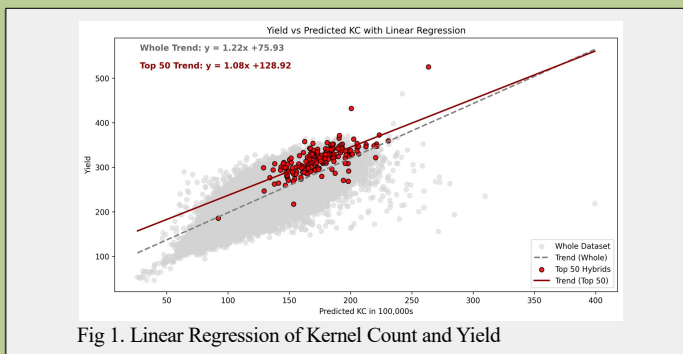


Fig 1. Linear Regression of Kernel Count and Yield

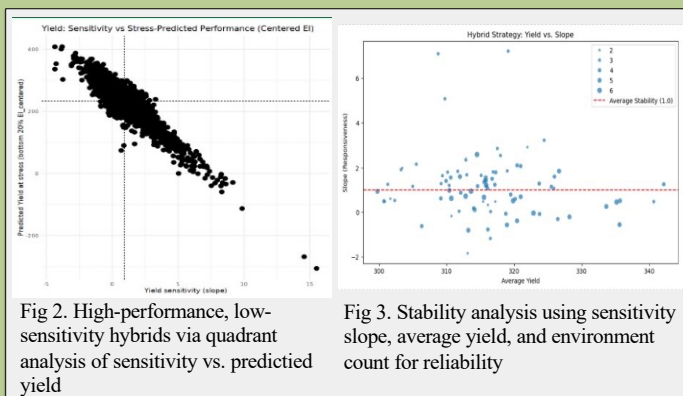


Fig 2. High-performance, low-sensitivity hybrids via quadrant analysis of sensitivity vs. predicted yield

Fig 3. Stability analysis using sensitivity slope, average yield, and environment count for reliability

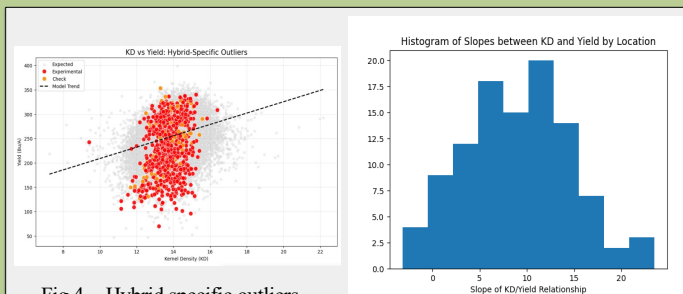


Fig 4. - Hybrid specific outliers in KD/Yield

Fig 5. - Histogram of locations by KD/Yield relationship

METHODOLOGY

Outliers and Case Study Analysis

Hybrids and locations tend to have a positive correlation between KD and Yield. We examined the hybrids and the locations where this was **not** the case (Fig 4.) to find an explanation for these outliers.

- Performed linear regression on KD / Yield and looked specifically at locations with negative slope (Fig 5.)
- Examined the outlier locations and compared them against weather and soil data

CONCLUSION

From this research, we found:

- Key hybrids tend to produce more kernels to create consistent yields despite variation in kernel volume
- Based on EI analysis we identified optimal hybrids that demonstrate high stability and yield performance
- a low influence on KD/Yield correlation, some environmental factors do have an influence on whether a given location has a stronger relationship between Kernel Depth and Yield

Future Work

- Investigate the tradeoff between kernel count and kernel volume
- Incorporate weather data for more accurate environmental representation
- Integrate more meaningful cluster algorithms to find archetypes

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