Beck's Hybrids – Seed Quality and Germination

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Introduction

Beck's is the largest family-owned retail seed company and the third-largest seed brand in the U.S. dedicated to shipping their hybrid seed to farmers throughout the Midwest.

- Beck's Hybrids gave our team data on field and germination lab results.

- We used R to clean the data and create new datasets that contain certain parts of the data.

- We used Python to manipulate the data to show results and to create graphs out of the cleaned data.

- This includes germination results, application of herbicides, planting and harvesting dates, and harvested moisture values.
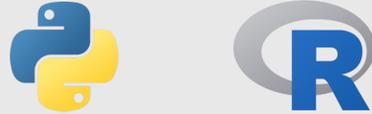
Over the course of the fall and spring semesters, our team has split into sub teams to better focus on our tasks.

- In the fall, the groups were focused on Planting/Harvesting Dates, and Moisture Levels teams.
- This spring semester, we have been working as Hybrid Placement, and Defol Vigor teams.

Our goal is to identify factors of Beck's seed germination process that they can control.

Fall 2023 Research

We found the final yield of the crop data from 2021. We then sorted this by each date of the planting and harvest seasons.

Final Yield by Female Plant Date

Final Yield by Harvest Date

- Main planting season was from late April to all throughout May.
- Highest yield for planting season was shown in late May.

- Main harvesting season centralized around October.
- Harvesting season was shown to have an upward trend from late September to all of November.
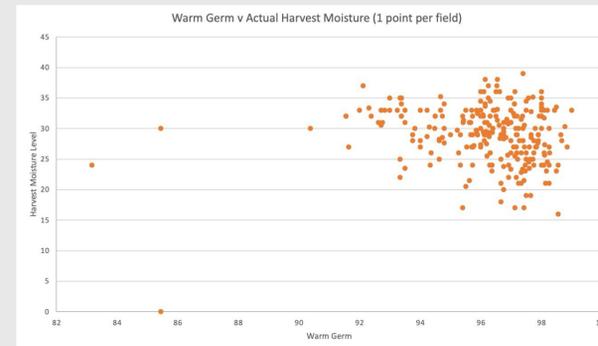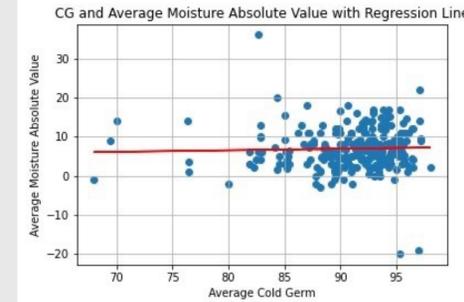
Fall 2023 Research (cont'd)

- Comparing cold germination with the absolute value deviation from recommended moisture.

- Added trendline to look at the correlation between cold germination and average absolute value.

- No clear trend is shown.

CG and Average Moisture Absolute Value with Regression Line

- Seed moisture values graphed with warm germination values.

- This shows a trend that less moisture in the seed will give a better germination score.

Warm Germ v Actual Harvest Moisture (1 point per field)

Spring 2024 Research

Defol is a herbicidal chemical defoliant that can be sprayed on plants and crops to make them dry down faster than usual. We found and compared the influence defol has on Beck's saturated germination tests for the years 2021 - 2023.

Saturated Cold Germ With Defol / Saturated Cold Germ Without Defol

These graphs are comparing how the use of defol affected Beck's saturated cold germination (SAT) tests across three years of testing. SAT is a test to see if seeds will germinate in very harsh weather conditions like being at a low temperature and covered in a lot of water.

We found that there is a big difference in saturated germ when using defol versus when it is not used.

There is a statistically significant difference between the group that used defol and the one that did not use defol, with a P-value of 2.2e-16 after testing with T test.

Spring 2024 Research (cont'd)

We found the twenty highest yielding hybrids across three years worth of data. We then sorted this data across the locations that grew these top hybrids.

- Not all locations grew all twenty top hybrids.
- MTP grew all twenty while REM grew one.
- PAR and BIF are similar in geographical location.
- PAR grew six of the hybrids, and BIF grew eight, but still had similar yield.

Total Yield in Top 20 Highest Producing Hybrids by Growing Location
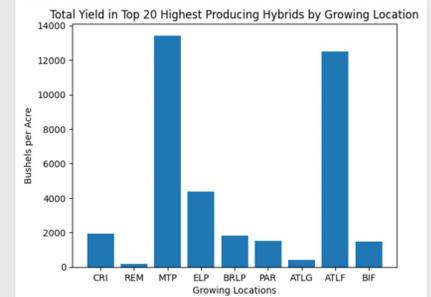
We then took the top producing hybrid and looked at its results across the locations growing it.
While the two images are similar, we did find some interesting differences.

- CRI produced the second least of this top hybrid.
- MTP and ATLF have high-producing hybrid yield results.

Top Producing Hybrid (6374P2) by Growing Location
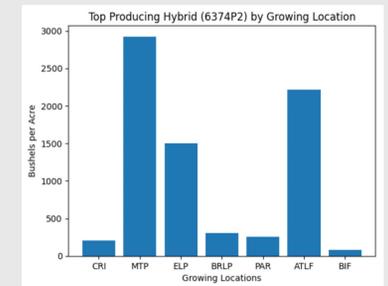
Conclusion and Future Work

We have learned a great deal about the power that data has in a commercial seed production operation. We have only begun to show some of what is possible when working with this data. While further research could still be used to expand upon our results, we found:
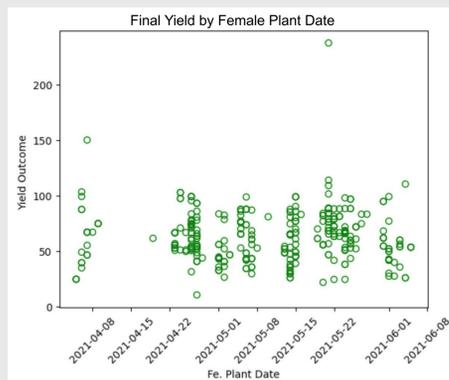- Defol negatively affects the vigor of seedlings.
- Lower moisture values increase germination scores.
- Plant and harvest dates show when planting can be most effective.
- Plant and harvest dates are weather-dependent and harder to control.
- Studying high-yielding hybrids over multiple locations reveals insightful information about the effect of growing location.

For future work, we are hoping to learn more about and understand further details as to how weather affects seed germination processes.
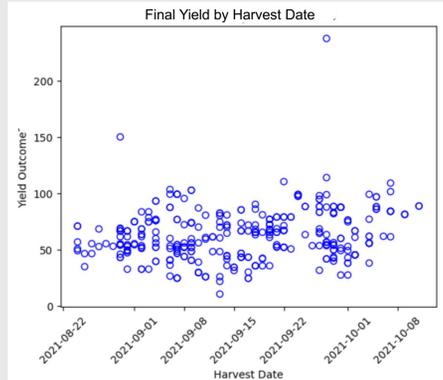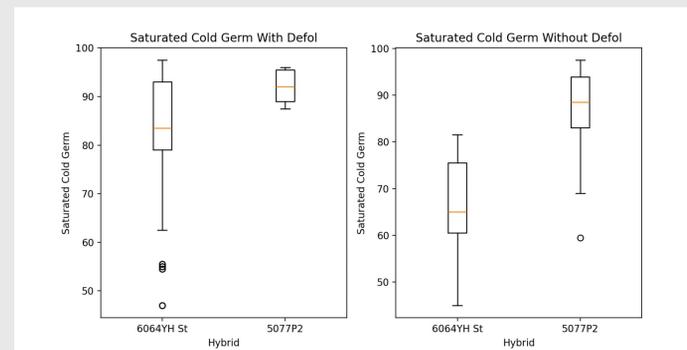
Acknowledgements

References and Sources

- Beck's Spring 2021-Fall 2023 Hybrid Data: Hirschfeld, Will. "Re. New Data!" Received by Mihika Deshmukh, 30 Jan. 2024
- https://www.youtube.com/playlist?list=PLikcTHOT0V5LTACj8KIL87DMHPAKeP8Fq
- https://www.betterseed.org/treated-seeds/
- https://www.betterseed.org/resources/key-seed-legislation/