

Translating Yield Decline to a Potential “Death Date”

NYU Stern CSB analyzed research on the impact of climate change on crop yield to arrive at a potential “death date,” as defined on page 3

- Climate change will continue to disrupt the US food system across crop production, logistics, manufacturing, and distribution
- We looked at existing research on how climatic shocks and extreme weather will drive crop scarcity (by lowering crop yields) which contribute to price spikes (due to scarcity), creating more volatile crop pricing and availability
- These price increases may push input costs of current food products to extreme levels, moving them out of their everyday and affordable price points
- Our analysis used instances where yields declined due to weather or other ‘system shocks,’ and examined associated price impacts
- We quantified that relationship and applied it to different future yield decline scenarios to see how prices may change

Arriving at a Soybean's Potential “Death Date” (1 of 2)

- **Researched Impact of Climate Change on Yield Decline for Soybeans:**
 - Analyzed ~ 35 academic studies that explore the past and future impacts of climate change for core sandwich ingredients; we prioritized US-focused studies, but also analyzed a few global studies
 - **Application to soybean analysis:** We examined ~9 studies that focused specifically on soybeans. We prioritized this [study](#) published in *Nature - Scientific Reports* to inform the basis of analysis. The study included adaptation benefits (e.g. soy bred to manage for drought or extreme rain) which were subtracted from the climate-related reductions to productivity, for a more conservative approach. Key statistic: “*Rising temperatures will cause a 26-57% yield loss in soy crops in the United States by 2050.*” We modeled a 26% reduction, a 42% reduction and a 57% reduction, ultimately using 26% in our analysis.
- **Analyzed Impact of Weather/Extreme Shocks on Soybean Yield Decline & Price:**
 - **Crop Forecasts vs. Actuals:** Leveraged USDA data on soybean planting to analyze pre-planting yield forecasts and compared to harvest actuals (**Soybean sources:** [Source](#); [Source](#))
 - **Weather Events:** Mapped extreme weather events by year to explore connections between yield declines and extreme weather
 - **Calculated Notable Decreases/Increases:** Looked at periods where forecasts vs. actuals deviated and quantified the deviation; calculated relevant price changes
 - **Application to soybean analysis:** [In 2003, a year of extreme weather in soybean growing regions](#), the price of soybeans increased 17.38% over the previous year, and yields declined 4.51% (These price and yield trends are derived from analyzing [forecast](#) vs. [actual yield](#) data, and relevant [pricing data](#))

Arriving at a Soybean's Potential “Death Date” (2 of 2)

- **Quantified Assumptions and Projected Price Increases:**
 - Quantified the 2003 price increase/yield decline ratio
 - Applied that ratio to % declines identified from previously mentioned academic studies (e.g., if yields decline 4.51%, and prices go up 17.38%, what happens if yields decline 26%). To be as conservative as possible, the team used the 26% yield decline scenario (the most lowest decline % from the [study](#) cited previously)
 - **Application to soybean analysis:** Used [soybean pricing](#) and applied relevant % increase to model price increases out to 2050 (e.g., under a 26% yield decline scenario, what will happen to prices by 2050)
 - We then converted the pricing into the relevant soybean oil pricing
- **Selected a Potential “Death Date”:**
 - We selected potential “death dates” based on when the price for the ingredient (in this case soybean oil) would push the finished food product outside the everyday and affordable category
 - The ‘cut-off’ was selected using data from Hellmann’s ingredient pricing information

Sources

- Impacts of Climate Change on US Soybean Production (*Leveraged information from sources listed below to understand consensus that climate change and its related outcomes will impact soybean production*)
 - ([US Bureau of Labor Statistics](#), [Nature - Scientific Reports, Agriculture, Journal of Agriculture and Food Research, Environmental and Resource Economics, Weather and Climate Extremes, Agriculture, Climate, USDA](#))
- US Soybean Yield Forecasts & Actual Yield
 - ([USDA](#), [USDA](#))
- US Soybean Pricing
 - ([NASS | USDA](#), [NASS | USDA](#), [Trading Economics](#))
- Global Soybean Production
 - ([USDA](#))
- Global Soybean Pricing
 - ([Macro Trends](#))
- Soybean Oil Pricing
 - ([Markets Insider](#), [Department of Agricultural and Consumer Economics University of Illinois](#))