

Analyzing the Impact of Temperature Changes on Crop Production and Yield in Ireland (2008-2023)

1 Introduction

Ireland, known for its temperate climate, has experienced noticeable temperature variations over the past few decades. These changes can significantly alter agricultural outputs, affecting the livelihood of farmers and the country's overall food production capacity. The primary objective of this report is to analyze the impact of temperature changes on crop yields in Ireland from 2008 to 2023.

The focus of this report is on two major crop categories: "Total wheat, oats, and barley" and "Beans and peas", "Oilseed rape", and "Potatoes". These crops are vital to Ireland's agricultural economy and food supply. By examining the correlation between temperature changes and the yield of these crops, this report aims to uncover patterns and trends that can inform future agricultural practices and policies.

2 Used Data

2.1 Temperature Change Data

Metadata: <https://www.fao.org/faostat/en/#data/ET/metadata>

Description: This dataset covers temperature changes in Ireland from 1961 to 2023, compared to the 1951-1980 climatology. It provides a comprehensive overview of yearly temperature variations, condensed into meteorological years.

Columns:

- **Months:** Specifies the period (e.g., Meteorological year).
- **Y1961 to Y2023:** Yearly temperature change values in degree Celsius compared to the baseline climatology.

2.2 Crop Production Data

Metadata: Crop Production and Yield

Description: This dataset includes data on crop production in Ireland from 2008 to 2023. It focuses on various crop types, detailing the total production

volume in thousands of tonnes.

Columns:

- **Year:** The year of production.
- **Type of Crop:** The type of crop produced (e.g., Total wheat, oats and barley, Beans and peas, Oilseed rape, Potatoes).
- **VALUE:** The production volume in thousands of tonnes.

2.3 Crop Yield Data

Metadata: Crop Production and Yield

Description: This dataset records crop yield per hectare in Ireland from 2008 to 2023. It provides detailed yield information for various crop types, measured in tonnes per hectare.

Columns:

- **Year:** The year of yield measurement.
- **Type of Crop:** The type of crop yielded (e.g., Total wheat, oats and barley, Beans and peas, Oilseed rape, Potatoes).
- **VALUE:** The yield per hectare in tonnes.

Data Compliance: All datasets used in this analysis are public. Used under the terms of the FAO data license and CSO data license for educational purposes.

3 Analysis

3.1 Production vs. Temperature Change (Total wheat, oats, and barley)

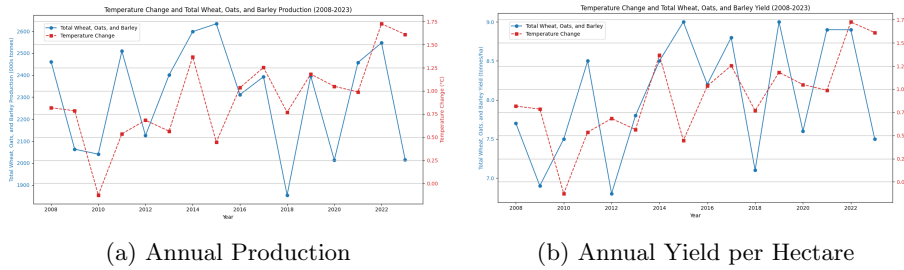


Figure 1: Total Wheat, Oats, and Barley vs. Temperature Change

Figure 1a shows the annual production of "Total wheat, oats, and barley" alongside temperature changes. Certain years with significant temperature

changes correspond to noticeable fluctuations in crop production, suggesting a potential impact of temperature on yields. Figure 1b illustrates the annual yield per hectare for "Total wheat, oats, and barley" compared to temperature changes. Similar to production, years with higher temperature deviations often show variations in yield.

3.2 Production vs. Temperature Change (Beans and peas, Oilseed rape, and Potatoes)

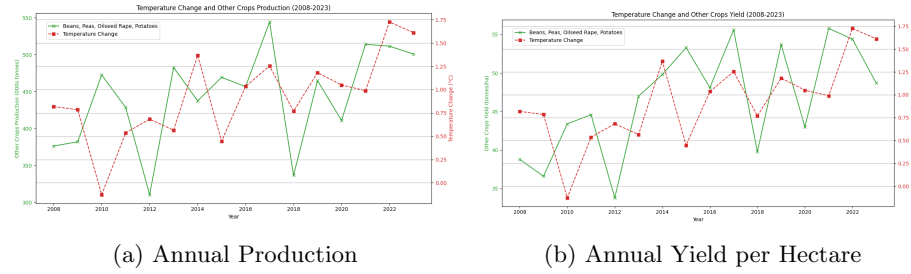


Figure 2: Beans and Peas, Oilseed Rape, and Potatoes vs. Temperature Change

Figure 2a shows the aggregated production of "Beans and peas", "Oilseed rape", and "Potatoes" alongside temperature changes. In some years, an increase in temperature correlates with an increase in production, suggesting that these crops might be more resilient to temperature variations. Figure 2b illustrates the yield per hectare for the combined crop category compared to temperature changes. The yield data for these crops indicates a varied relationship with temperature changes, highlighting the complexity of the impact.

4 Results

4.1 Total Wheat, Oats, and Barley

The correlation analysis showed a generally negative relationship between temperature changes and crop production. Certain years with significant temperature increases corresponded with noticeable drops in production, indicating that higher temperatures may adversely affect these crops. Similar trends were observed in crop yields, where years with higher temperature deviations often showed decreased yields. This suggests that "Total wheat, oats, and barley" are sensitive to temperature variations, which can negatively impact their productivity.

4.2 Beans and Peas, Oilseed Rape, and Potatoes

The analysis indicated a more varied relationship between temperature changes and the production of these crops. In some years, an increase in temperature correlated with an increase in production, suggesting that these crops might be more resilient or may even benefit from certain temperature increases. The yield data for these crops showed a complex relationship with temperature changes. While some years with higher temperatures showed increased yields, others showed decreased yields, highlighting the varied sensitivity of these crops to temperature variations.

Overall, the analysis demonstrated that temperature changes have a significant but varied impact on crop yields and production in Ireland. "Total wheat, oats, and barley" showed a clear negative correlation with temperature increases, suggesting that these crops are particularly vulnerable to rising temperatures. In contrast, "Beans and peas", "Oilseed rape", and "Potatoes" exhibited more varied responses, with some indications of resilience or potential benefits from temperature increases.

5 Limitations

5.1 Other Climatic Factors

The study focused solely on temperature changes, but other climatic factors such as precipitation, humidity, and extreme weather events also significantly impact crop yields. Including these factors could offer a more holistic view of the climatic influences on agriculture.

5.2 Crop-Specific Variability

The analysis aggregated data for specific crop categories, which may mask variability within each category. Different varieties of the same crop may respond differently to temperature changes, and a more granular analysis could uncover these nuances.

5.3 Geographical Variability

Ireland's diverse microclimates and regional differences in soil quality and farming practices were not explicitly considered. A region-specific analysis could provide more targeted insights for different parts of the country.