Science Societies

Explainable AI helps describe how weather conditions impact sunflower yield

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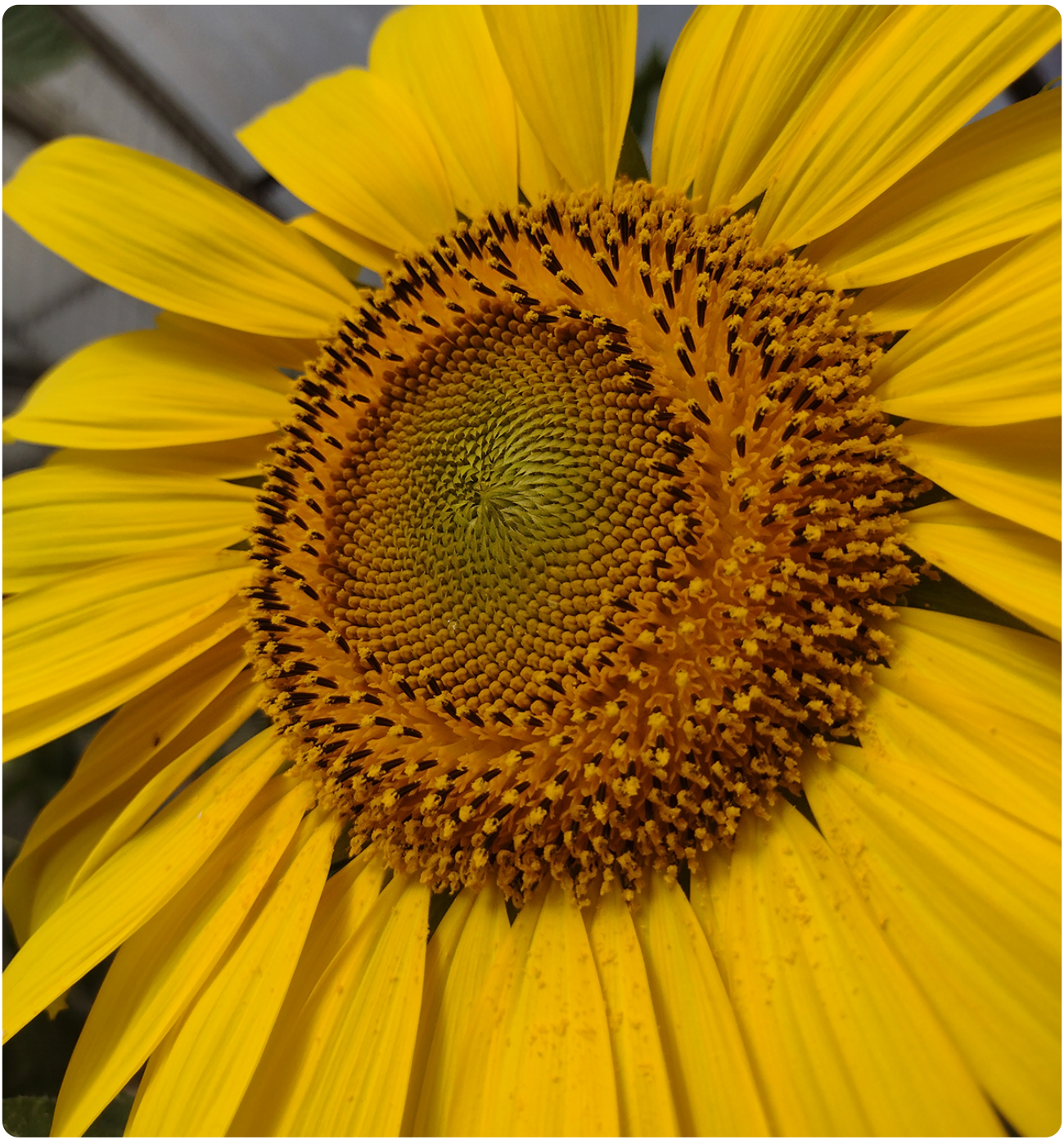

Hybrid oilseed sunflower in bloom. Photo courtesy of Chase Mason, University of British Columbia Okanagan.

Extreme weather events threaten crop yields under intensifying global climate change. Analysis of historical yield data can help provide insights into future impacts, but these kinds of large national datasets are complex with substantial noise obscuring underlying patterns. Artificial intelligence (AI) can assist with analysis, but many AI models are “black boxes” that are not transparent—hindering understanding of what factors drive changes in yield.

Current efforts in AI research aim to develop transparent model outputs where human users can fully understand exactly how the algorithm came to a certain conclusion or result. A research team applied so-called Explainable AI models to this problem, piercing the black box. They combined half a century of county-level yield data for oilseed sunflower across the United States with meteorological data over the same period to build interpretable models. The models identify which weather factors in which months of the year most strongly raise or lower yields and the specific temperature and precipitation tipping points beyond which yields decline in a specific region. While the impact of summer heatwaves and drought align with existing agronomic knowledge, other factors reducing yield include warmer and drier winters—an impact outside the growing season itself.

Researchers highlight how Explainable AI can generate new insights from historical datasets with application to diverse crops beyond the largest commodities, informing management decisions for more growers.

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Majumder, S., & Mason, C. M. (2025). Sunflower yield modeling with explainable artificial intelligence: Historical weather impacts across half a century of American production. *Agronomy Journal*, *117*, e70204. https://doi.org/10.1002/agj2.70204

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