COMMITTEE ON
SCIENCE, SPACE
AND TECHNOLOGY
CHAIRMAN BRIAN BABIN

**SUBCOMMITTEE ON ENVIRONMENT**

**HEARING CHARTER**

***"Innovations in Agrichemicals: AI's Hidden Formula Driving Efficiency"***

**Tuesday, May 20, 2025**
**10:00 a.m.**
**2318 Rayburn House Office Building**

**Purpose**
The purpose of this hearing is to discuss innovations in the agrichemical industry as it relates to new technologies, including, but not limited to, the ways artificial intelligence (AI) has and will continue to transform the industry through improvements to research and development, testing, production, compliance, safety, reviews, and use.

**Witnesses**
- **Dr. Brian Lutz**, Vice President of Agricultural Solutions, Corteva Agriscience LLC
- **Dr. Daniel Swale**, Associate Professor, Emerging Pathogens Institute and Department of Entomology and Nematology, University of Florida
- **Dr. Boris Camiletti**, Assistant Professor, Department of Crop Sciences, College of Agriculture, University of Illinois Urbana-Champaign

**Overarching Questions**
- How can AI accelerate the discovery of new molecules, optimize chemical formulations, and predict environmental impacts in agrichemical research?
- How can AI-driven technologies improve efficiency across the agrichemical supply chain, from product inception to on-farm applications?
- What emerging technologies are currently benefiting the agrichemical sector and domestic agriculture at large?
- What actions are necessary to help the domestic agrichemical industry fully leverage AI to maintain a global edge?

- How can AI advancements in agrichemicals strengthen supply chain resilience and contribute to food security in the United States?

## Introduction

This hearing will feature testimony from the private sector and academic researchers who specialize in the intersection of agrichemicals and AI. As the Committee examines its role in the science and technology underpinning the existing pesticide regulatory framework, particularly the research and development of new agrichemical technologies, this discussion will provide valuable insights for future policymaking decisions.

## Background

AI-driven innovations are transforming the agricultural sector, reshaping research, development, production, and market accessibility, particularly in agrichemicals. As agriculture and AI increasingly intersect, AI-powered tools can analyze genomic data to enhance crop protection, accelerate discovery, optimize formulations and applications, and streamline testing, approval, and efficiencies, across the supply chain.[1] AI also aids in the prediction of chemical interactions and environmental impacts, improving sustainability and efficacy.

Agrichemical companies are rapidly adopting predictive modeling tools and other advanced technologies to inform decision-making, guide future product development, and improve market access for manufacturers and consumers by reducing research timelines.[2]

The United States remains a global leader in agriculture and agricultural research and development. The strength of America's agricultural industry is directly tied to the productivity of its producers. Maintaining long-term leadership in global food production requires a robust and resilient agrichemical industry capable of combating the growing risks of invasive species and crop diseases.

## Agrichemicals

Agrichemicals are typically defined as any chemical used in agriculture. These include, but are not limited to, pesticides, fungicides, nematicides, insecticides, herbicides, and chemical fertilizers.[3]

Pesticides are a necessary public health tool to combat infectious diseases caused by pests and disease-carrying species. In agriculture, pesticides are used to control weeds, insect infestation and diseases.[4] These include any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest; any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant and any nitrogen stabilizer.

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[1] Elżbieta Wójcik-Gront, Bartłomiej Zieniuk & Magdalena Pawełkowicz, *Harnessing AI-Powered Genomic Research for Sustainable Crop Improvement*, 14 Agriculture 2299 (2024), https://www.researchgate.net/publication/387120233_Harnessing-AI-Powered_Genomic_Research_for_Sustainable_Crop_Improvement.

[2] Corteva Agriscience, The Future of AI in Agriculture, Corteva (Nov. 1, 2023), https://www.corteva.com/who-we-are/outlook/ai-in-agriculture.html.

[3] U.S. Envtl. Prot. Agency, *What Is a Pesticide?*, EPA, https://www.epa.gov/minimum-risk-pesticides/what-pesticide (last visited May 13, 2025).

[4] *Id.*

The term “pesticide” captures a variety of agrichemical products like algaecides that kill or slow the growth of algae; antimicrobials and disinfectants that control germs and microbes like bacteria and viruses; fungicides that fight fungus like molds, mildew, and rust; insecticides that control insects; insect growth regulators that disrupt the growth and reproduction of insects; rodenticides that kill mice, rats, gophers and similar rodents; and wood preservatives that make wood resistant to pests like insects and fungus.[5]

Herbicides are chemicals designed to manipulate or control undesirable vegetation. [6] They are primarily used in row crop farming and are applied before or during planting to maximize production by minimizing other vegetation. They are also used to improve harvesting, and in forest management to prepare land for replanting after logging.[7]

Chemical fertilizers typically contain three essential plant nutrients: nitrogen, phosphorus, and potassium. Some fertilizers also contain micronutrients such as zinc to further aid plant growth.[8]

**Artificial Intelligence in Science**

Federal investment in agriculture research has historically delivered high returns and bolstered the agriculture industry at large. [9] However, producing quality research outcomes has often required significant time.

AI is widely used throughout biological science, including agricultural research and development, and machine learning processes. Some key AI terms include machine learning (ML), deep learning (DL), and neural networks (NNs).[10] ML is a broad category in which computers analyze large amounts of data using algorithms to make predictions, classifications, and identify patterns within problems that typically require the human mind to solve and is often used in the context of biological sciences. DL is a specialized form of ML that improves accuracy throughout the various layers of data and networks that are produced. NNs are sets of algorithms and techniques that process data in steps to recognize information and patterns at various levels.

In biology, AI tools are especially useful in processing large amounts of raw data, such as DNA sequences. They enable researchers to read and write data to engineer and advance new discoveries, driving innovation, leading to new and enhanced agrichemical products.

When these tools are leveraged in science, they have been proven to lower costs and accelerate the speed at which experiments can be conducted leading to new discoveries and increased efficiencies. However, a key consideration that should be addressed, especially within the context of scientific advancements that utilize AI to conduct research, is ensuring the quality of

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[5] U.S. Envtl. Prot. Agency, *Why We Use Pesticides*, EPA, https://www.epa.gov/safepestcontrol/why-we-use-pesticides (last visited May 14, 2025).
[6] U.S. Envtl. Prot. Agency, *Herbicides*, EPA, https://www.epa.gov/caddis/herbicides (last visited May 15, 2025).
[7] *Id.*
[8] U.S. Envtl. Prot. Agency, *Agriculture: Nutrient Management and Fertilizer*, EPA, https://www.epa.gov/agriculture/agriculture-nutrient-management-and-fertilizer (last visited May 15, 2025).
[9] U.S. Dep’t of Agric., Econ. Research Serv., Agricultural Research and Productivity, USDA.gov (May 19, 2025), https://www.ers.usda.gov/topics/farm-economy/agricultural-research-and-productivity.
[10] Cong. Research Serv., Agricultural Policy Report, CRS, https://www.crs.gov/reports/pdf/R47849/R47849.pdf (last visited May 15, 2025).

scientific inputs and the accuracy of algorithms. Tools like ML, DL, and NNs are only as smart as the information they are given.

## **Emerging Uses of AI in the Discovery of Agrichemicals**

The private sector and leading researchers have long utilized AI to accelerate their research and development to propel innovation in agrichemicals, especially as machine learning technologies have advanced.

AI is used in many ways within chemistry, with key applications relevant to agrichemical discovery including: [11]

- Molecular design algorithms to predict molecular properties, enabling efficient developments and designs of new compounds and materials.
- Data-driven reaction optimization to help predict reactions and optimize conditions, which can ultimately lead to new chemical reactivity.
- Predictive chemical toxicity models that enhance safety throughout the manufacturing process and reduce environmental impacts.
- Chemoinformatics to analyze and interpret large datasets, helping researchers understand complex chemical structures and processes.
- Automated lab systems that increase the precision and reproducibility of chemical experiments with minimal human intervention.
- Digital platforms and simulation software that offer virtual lab experiences, improving access, education, research, and development.
- Machine learning for predicting molecular properties, leading to efficient designs of new compounds and materials.
- Natural Language Processing that extracts chemical information from scientific literature and other relevant sources and helps to apply it in various scenarios.

## **Emerging Uses of AI in the Application of Agrichemicals**

Precision agriculture often employs AI and refers to certain technologies that can make agricultural producers more efficient, particularly regarding on-farm uses and applications.[12] These technologies are often used in the application of agrichemicals. Examples of AI innovations in precision agriculture include tools that help determine optimal planting, watering, and harvesting times, as well as estimate crop yields with high accuracy. These insights are derived from algorithms that integrate data from GPS, satellite imagery, smart sensors, known as the Internet of Things (IoTs), and other information like weather data. Additionally, AI tools can identify plant diseases before they become visible, allowing producers to better mitigate risk.[13]

When properly trained, AI systems can guide the precise application of agrichemicals like pesticides and fertilizers, ensuring treatments are applied only where and when needed. This helps prevent overuse, minimizes waste and runoff, and can contribute to both environmental

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[11] Valentine P. Ananikov, Top 20 Influential AI-Based Technologies in Chemistry, 2 Artificial Intelligence Chemistry (2024), https://www.sciencedirect.com/science/article/pii/S2949747724000332.

[12] U.S. Gov't Accountability Office, GAO-24-105962*, Precision Agriculture: Benefits and Challenges for Technology Adoption and Use*, (2024), https://www.gao.gov/products/gao-24-105962.

[13] Prem Rajak et al., Internet of Things and Smart Sensors in Agriculture: Scopes and Challenges, Journal of Agriculture and Food Research (2023), https://www.sciencedirect.com/science/article/pii/S2666154323002831?via%3Dihub.

stewardship and increased crop productivity and yields.[14]

The federal government has made significant investments in the research and development of these tools, particularly through the United States Department of Agriculture and the National Science Foundation, and with private research partners. The private sector has also heavily invested in this space to accelerate research and development for their tools and products.

**<u>Jurisdiction</u>**

The House Committee on Science, Space, and Technology has jurisdiction over the scientific and technological components of EPA's pesticide regulatory framework.[15] Specifically, the Committee oversees:

- The scientific integrity of EPA's pesticide risk assessments and data evaluation processes.
- Research and development of new pesticide technologies.
- EPA's use of scientific data in regulatory decisions, such as toxicology studies or environmental impact assessments.

The House Committee on Agriculture[16] has jurisdiction over the implementation and pesticide registration decisions authorized under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[17] The EPA ultimately implements FIFRA at the agency level and governs the registration, distribution, sale, production, and use of pesticides in the United States.[18]

The House Committee on Science, Space, and Technology does not have jurisdiction over FIFRA or oversee broader regulatory decisions or enforcement related to pesticides; its authority is limited to the scientific and technological aspects of EPA's pesticide regulatory framework.[19]

The House Committee on Energy and Commerce has jurisdiction over broader environmental regulations, including certain pesticide-related issues such as water contamination and endangered species protections.[20]

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[14] U.S. Gov't Accountability Office, GAO-24-105962*, Precision Agriculture: Benefits and Challenges for Technology Adoption and Use*, (2024), https://www.gao.gov/products/gao-24-105962.

[15] House Committee on Science, Space & Technology (Republicans), *Environment*, https://science.house.gov/ (last visited May 15, 2025).

[16] House Committee on Agriculture, *Rules and Jurisdiction*, https://agriculture.house.gov/about/rules-and-jurisdiction.htm (last visited May 15, 2025).

[17] *7 U.S.C. §§ 136–136y (1996).*

[18] U.S. Environmental Protection Agency, *Summary of the Federal Insecticide, Fungicide, and Rodenticide Act*, https://www.epa.gov/laws-regulations/summary-federal-insecticide-fungicide-and-rodenticide-act (last updated Apr. 25, 2025).

[19] House Committee on Science, Space & Technology (Republicans), *Environment*, https://science.house.gov/ (last visited May 15, 2025).

[20] House Committee on Energy and Commerce, *Jurisdiction*, https://energycommerce.house.gov/ (last visited May 15, 2025).