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Opinion

Data-Driven Agronomy: Using Big Data to Revolutionize Farming

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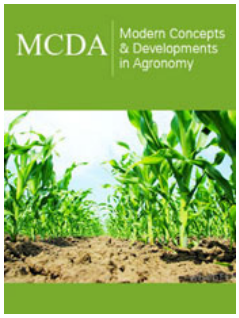
ISSN: 2637-7659



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Submission: February 21, 2023
Published: March 03, 2023

Volume 12 - Issue 3

How to cite this article: Meshach Ojo Aderele. Data-Driven Agronomy: Using Big Data to Revolutionize Farming. Mod Concep Dev Agrono. 12(3). MCDA. 000790. 2023.
DOI: 10.31031/MCDA.2023.12.000790

Introduction

Over thousands of years, agriculture has played an essential role in human society. The capacity of farmers to fully utilize the potential of their land and crops has been constrained by conventional farming practices. The world of agriculture is changing due to technology, and data-driven agronomy is at the vanguard of this revolution. According to Godfray et al. [1], there is little time left to alter agriculture; scientists should figure out how to increase food production without worsening environmental issues, adapting to climate change, and making wise use of natural resources.

Big data and sophisticated analytics are used in data-driven agronomy to enhance agricultural practices. This can include details about the soil and weather, plants and crops, market prices, and supply systems. With this information, farmers can decide when and what to grow, how to manage their land and water resources, and how to market their commodities most effectively. The advancement of technology is a great step toward expanding the agricultural industry [2].

Opportunities Provided by Data-driven Agronomy

Increased efficiency

Improvement in efficiency is one of the main opportunities provided by data-driven agronomy. Farmers can minimize waste and maximize the use of resources like water, fertilizer, and seed by using data to make informed decisions. This can result in higher agricultural yields, better crop quality, and lower costs, which can significantly affect a farm's overall profitability.

Improve sustainability

In addition to the benefits for farmers, data-driven agronomy also has the potential to improve the sustainability of agriculture. By using data to optimize resource usage, farmers can reduce their environmental impact, preserving the health of their land and the surrounding ecosystem. This can also lead to better long-term viability for their farms and the communities they serve.

Personalized farming practices

The capability of data-driven agronomy to customize farming methods is another crucial feature. Farmers may utilize analytics to identify the particular requirements of their land, crops, and growing circumstances through abundant available data. This may lead to more focused management strategies that produce better outcomes and higher returns.

Technologies at the Forefront of Data-Driven Agronomy

Precision agriculture

The development of data-driven agronomy is being made possible by several important technologies. One of these is precision agriculture, which uses sensors and cutting-edge

analytics to collect information on the soil, the weather, plant growth, and crop yields. Decisions regarding when and what to plant, as well as how to manage soil and water resources, can then be made using this information. This has been proven by Ali et al. [3] in a study that used precision agriculture techniques to optimize wheat production in the arid environments of Pakistan. The study demonstrated that precision agriculture could be used effectively in arid environments to optimize crop production while minimizing environmental impacts.

Remote sensing

Remote sensing, which uses satellites and aerial pictures to collect information on the land and crops, is another significant technique. This information can be used to locate agriculturally productive land, track crop growth, and spot problems like insect infestations and disease outbreaks. The study by Kumari et al. [4] used remote sensing techniques to map rice paddies and collect crop growth and health data. They used satellite imagery to detect changes in vegetation indices and water content and monitor rice fields for potential disease outbreaks.

Machine learning and Artificial Intelligence (AI)

Artificial Intelligence (AI) and machine learning are important new technologies that can be used to handle and analyze massive volumes of data. These technologies enable farmers to forecast crop yields, market prices, and other crucial elements that have an impact on their business. They may use this to make well-informed judgments and quickly adapt to shifting market conditions. The potential of this technology has been exemplified by Sahu et al. [5] by using various machine learning algorithms, including decision trees, random forests, and artificial neural networks, to develop models that could predict crop yields based on the collected data, with a result showing that machine learning models were able to predict crop yields with a high degree of accuracy.

Challenges of Data-Driven Agronomy

Data-driven agronomy presents innumerable opportunities, but it is important to account for some possible challenges. One of them is the requirement for an extensive and dependable data infrastructure. Farmers require access to precise and current information on weather, soil, market pricing, and other factors to maximize the use of the data at their disposal. Tools that can analyse and interpret this data meaningfully are also required.

The requirement for investing in technology and training presents another difficulty. The field of agriculture may be completely transformed by data-driven agronomy, but many farmers do not have the funds or the knowledge to do so. This may make it more difficult for farmers to profit from data-driven agronomy's advantages.

Conclusion

The future of agriculture is very promising despite the challenges of data-driven agriculture. Efficiency, sustainability, and profitability across the agricultural sector are expected to increase significantly as more farmers adopt these technologies and practices. The potential for data-driven agronomy to change the agricultural industry is enormous, and the opportunities for its future expansion and advancement are only limited by human imagination. We may anticipate a future where agriculture and the farmers who cultivate the land will be more efficient, profitable, and sustainable as we continue to collect and analyze data from farms throughout the globe.

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