

Why we need precision agriculture?

Abstract

Due to continuous food demand worldwide from the available natural resources, looking for different agricultural practice is very important to produce adequate food quantity to feeding humanity. Precision agriculture aims to adapt, modify, and promote agricultural practices to sustain production, and provide solutions to various problems that face farmers, by enhancing farmers' awareness to deal with climate change, protect the environment, and increase profitability. Adoption of precision agriculture assists in producing enough food to feed humanity, fighting hunger, and providing other daily requirements, which represents the most prominent challenge for humanity.

Keywords: environment, food production, humanity, smart farming

Volume 9 Issue 6 - 2022

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Received: October 18, 2022 | **Published:** November 28, 2022

Background

With the steadily increasing food requirement due to the growing global population, there is a quick need to develop agricultural techniques to increase production and deal with the various problems facing agricultural production, particularly in developing countries. Currently, there are more than 7 billion people living on the Earth without enough food and daily requirements, which increase poverty, particularly in Sub-Saharan regions. The required daily-consumed food, fiber, energy, and other products already exceed various natural resources. Furthermore, according to the expectations of international organizations, the world's population is forecasted to reach about 9 billion in 2050.¹

Due to the continuous depletion of various natural resources such as agricultural lands, fresh water, and plant and animal species. Thus, providing adequate food requirements for humankind is considered the main responsibility of the agricultural sector in fighting hunger, particularly under the fluctuating conditions of climatic changes, which have severe effects on the production of different crops.² Therefore, producing enough food to feed them and provide other daily requirements represents the most prominent challenge for humanity. In light of the continuous depletion of various natural resources such as agricultural lands, fresh water, and plant and animal species by Tian.

This situation requires the accurate use of all available resources and using novel management practices, to maximize production from the same available resources, which requires the adoption of smart agriculture, particularly in developing countries. Fighting hunger and producing enough food in the future relies on the integration of various technologies that are highly efficient to increase food production and environmentally protecting.

The agricultural sector in developing countries faces various problems that affect negatively food production and increase poverty, which requires a change in agricultural strategy to increase agricultural productivity, provide adequate food, improve the quality of agricultural products, and increase the competitive ability in the global market.

Precision agriculture is the newest agricultural revolution, as it relies on various technologies such as data collection and analysis techniques, air and ground sensors, drones, robots, and self-driving agricultural machines. Therefore, there is more interest in the necessity of adopting smart farming techniques in a manner compatible with the circumstances of farmers in developing countries.

Agricultural sector in developing countries

The agricultural sector provides food, job opportunities, and income for the majority of the population in developing countries. Most of the farmers in developing countries are smallholders (with properties less than 2 ha), which represent the majority of the population. Globally, small farmers are considered a main component of the food chain supply, furthermore, about 84% of small farmers live in developing countries, particularly in Sub-Saharan and south Asia.⁴ Low income in developing countries pushes farmers to use traditional practices in agriculture, leading to a decrease in production, due to soil degradation, groundwater pollution, and loss of biodiversity because of the excessive use of pesticides.

Precision agriculture (PA)

PA aims to modify agricultural practices to sustain crop production, achieve flexibility in production systems, reduce greenhouse emissions, and reduce the use of various agrochemicals to preserve the environment. PA is considered a part of sustainable agriculture as it works to preserve natural resources, enhancing crop the productivity, reduce the negative impacts of climate change on crop productivity of, and increase profitability for farmers all over the world.⁵

There are many applications that are used as part of precision agriculture, such as irrigation water management applications, which include (rainwater harvesting, laser land leveling, precision irrigation, agricultural rotation), and agricultural climate applications (rainfall forecasting, heatwaves, humidity levels, which are correlated to irrigation management, smart fertilization, and pest control.

Why precision agriculture?

The adoption of smart farms is necessary for farmers in developing countries, using PA helps the farmers throughout the whole growth stage until the transportation of agricultural commodities to the market.

Smart agriculture is considered one of the important solutions to increase productivity and maximize the income from the unit of both soil and water, which sustain production and increase farmers' profitability.⁶

PA depends on collecting big data for various agricultural operations, such as forecasting weather conditions, determining the nutritional level of each part in the farm, in addition to following up on spreading pests and disease infections.⁷ PA determines the quantities and timing of irrigation depending on soil moisture (Figure 1), as well

as monitoring symptoms of nutrient deficiency in plants depending on phenological and physiological stages



Figure 1 Image field of Smart irrigation in Egyptian Desert (Photo by Dr. Abobatta).

Benefits of PA

- a. Increase the use efficiency of natural resources such as water, soil, and plant species.
- b. Reduce using various agrochemicals such as pesticides and fertilizers
- c. Reducing inputs and increasing the profitability
- d. Increasing food safety
- e. Protect the environment.

The main obstacles facing the adoption to PA in developing countries

- a. Poor communications and internet infrastructure in developing countries.
- b. Required high technical skills for operation.
- c. The high establishment cost.
- d. Small-scale farms are considered the main components of the agricultural sector.

Conclusion

Under increasing food demands worldwide, there are urgent requirements to use different agricultural practices to increase crop

productivity and deal with the various problems that facing the agricultural sector, particularly in developing countries

Therefore, using precision agriculture applications has become a necessity and not a luxury to increase production capacity to achieve profitability for farmers, preserve natural resources, and provide sufficient food for humanity.

Acknowledgments

None.

Conflicts of interest

Author declares there is no conflict of interest.

Funding

None.

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