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Proposal

Precision Agriculture: Future of crop cultivation

Key words:

*Precision agriculture, global food shortage, unmanned aerial vehicles, crop pesticide, satellite imagery, drones, remote sensing, data science, soil monitoring, autonomous vehicles, climate change, crop quality, aerial spraying, future of agricultural technology, economic benefits, agricultural investors*

Description:

Precision agriculture is the practice of using technology in farming for better crop production. It can potentially fight global food shortages and save the environment from agricultural damage. The application of precision farming methods speeds up the cultivation process and use fewer resources.

Overview:

The latest reports claim that about 795 million people in the world were undernourished in 2014-16. Hunger and malnutrition are the leading risk to health (United Nations, Food). Contrarily, crops worth $120 billion are destroyed every year by insects alone in US (Montalvo). Shortage of food is estimated to increase by 25% in coming years due to extreme climatic conditions (United Nations, Food). Precision agriculture is the solution to the increasing demands of food production around the world. The use of technology to yield better crops has well advanced since 1960s when the first precision farming tools were developed (History of PA). Precision agriculture enable farmers to accurately monitor pest, water, soil and other crucial factors of farming. It includes “GPS guidance, control systems, sensors, robotics, drones, autonomous vehicles, variable rate technology, GPS-based soil sampling, automated hardware, telematics, and software” (Schmaltz). The focus of this research is precision farming using aviation technologies. This consists of analyzing field imagery using satellites and drones; aerial spraying; and analyzing crops and soil via sensors. Traditional farming methods were to give equal resources all throughout the field, without checking if some part needs it or not. Pesticides were spread equally over the field even though some area didn’t need it. There were no methods to analyze the productivity of land and no methods for early detection of moulds. After the introduction of modern farming methods, many of such problems came to an end. Drones and satellites are used by many farmers to check the crops for better understanding of the land requirements. This saves a lot of resources and has decreased soil damage due to heavy use of pesticides. It is highly effective in the countries where crop demand is high and the availability of agricultural resources are limited. The sensors are able to detect any oncoming pest attack due to which crops can be saved from damage at an early stage (Agriculture’s improving image). The use of technology in agriculture not only benefits the farmers, but also positively impacts the global economy. It is estimated that “agricultural tech start-ups have raised over $800M in the last 5 years” (AI, Robotics). In addition, the data collected using agtech can be utilized for research purposes. It can also guide farmers and scientists on how to improve the farming conditions such as soil quality and pest control. Precision agriculture has the capability to collect huge amount of useful data in short periods of time to suggest the best course of actions (Schmaltz). Precision agriculture practices can turn the issue of global food shortage into food security in a sustainable manner.

Technical sources:

Bansod, Babankumar, and Rangoli Singh, and Ritula Thakur, and Gaurav Singhal. “A comparision between satellite based and drone based remote sensing technology to achieve sustainable development: a review.” *Journal of Agriculture and Environment for International Development*, 15 November 2017, http://www.iao.florence.it/ojs/index.php/JAEID/article/view/690/232. Accessed 9 June, 2018.

This source presents a comparison between satellite-based remote sensing and the use of unmanned aerial vehicles (UAV) for precision farming. The report briefs about how satellites were introduced to improve farming practices. Agtech is used for soil monitoring, crop classification, insect identification and many other farming practices. This helps to prevent damages from the environment and result in better crop yielding. The writer puts a light on the early use of technology in farming and how it advanced to drones and better sensors. The document includes many benefits of UAV such as its capability to take multispectral images with precise resolution. Table 2 shows the effectiveness of UAV over other remote sensing platforms. UAV comes with great usability, however, it has some technical constraints. It costs more because it requires a specialist to feed in data about each crop, land, environmental conditions and other geographical information. It is important to make UAV fully autonomous so it can perform all tasks without any manual input. It is a very useful resource to learn about the limitations and future developments of UAV.

Lan, Yubin, and Chen Shengde, and Bradley K Fritz. “Current status and future trends of precision agricultural aviation technologies.” *International Journal of Agricultural and Biological Engineering*, vol. 10, no. 3, May 2017, pp. 1-17, https://ijabe.org/index.php/ijabe/article/view/3088/pdf. Accessed 10 June 2018.

Precision agriculture aviation technology (PAAT) has helped reduce the pesticide residues and environmental damages while enhancing the quality of crops. This paper summarizes three main components of PAAT which are remote sensing, aerial spraying and ground verification technologies. Remote sensing is one of the most important components of precision ag which provides high-resolution imagery and data of land and crop diseases. It is achieved through the use of satellites, aircraft and unmanned aerial vehicles (UAV). Aerial spraying is crucial for pest control in the fields. It includes manned aircraft based spraying and UAV-based spraying. This method is widely used during sudden pest breakouts in the field and on lands which are difficult for ground-based systems, for example, rice. Moreover, ground verification technology is an important step to check the accuracy of aerial spraying. These systems consist of two components to analyze the trajectory and deposition of pesticide droplets and to suggest improvements for aerial spraying. Furthermore, the paper puts light on the future development of PAAT.

Shitu, G. A., and M. S. Nain, and Rashmi Singh. “Developing extension model for uptake of precision conservation agricultural practices in developing nations: learning from rice–wheat system of Africa and India.” *ResearchGate*, March 03, 2018, https://www.researchgate.net/publication/323430446\_Developing\_extension\_model\_for\_uptake\_of\_precision\_conservation\_agricultural\_practices\_in\_developing\_nations\_Learning\_from\_rice-wheat\_system\_of\_Africa\_and\_India. Accessed 8 June, 2018.

The United Nations claims that “The world needs to produce at least 50% more food to feed 9 billion people by 2050. But climate change could cut crop yields by more than 25%” (United Nations, Food). The article discusses the current food production status in India and Africa; and how climate change is affecting the agriculture. Around 80% of the crop comes from small farmers who are vulnerable to climate changes and they have low coping capabilities. The crop soil is degraded and resources such as water and fertilizers are limited. Some places have high heat waves whereas other places have increasing cold winter temperature. This drastic change in weather conditions is leading to the loss of crops by huge percentages. Due to such problems, it is highly needed to adopt precision agriculture practices in developing countries. The writer describes the practice of precision agriculture using 4Rs. It means that agtech enable farmers to use the right input and the right place at the right time with the right method. As a result, food scarcity can be changed to secure food production with the help of better agricultural practices.

Research Questions:

1. Compare and contrast drones and satellite imagery. Which method is more effective and why?
2. What are some challenges faced by farmers and new investors in the adoption of precision farming methods?
3. Discuss the economic and environmental impact of precision agriculture.

These research questions focus on how technology used in farming is impacting the world on a larger scale. Land imagery obtained with the help of satellites is an old existing technology. Nowadays drones are being sent to the fields to get more precise crop and land information. The comparison between the two, helps us understand the necessity of agtech adoption. On the other hand, millions of dollars are being invested into agriculture and still many farmers cannot afford the technology. Good equipment is required for the better use of resources such as water, fertilizers and soil. It is vital to understand and help small farmers overcome the obstacles they face while adapting to new technology. Precision agriculture is a revolution in the farming sector which also impacts many other sectors. It is important to question and learn about how it impacts the environment and the economy of the world. Agriculture technology holds the power to cut down global food crisis with better crop yields.

Conclusion:

Precision farming is a very interesting and useful topic. The gist of this research report is to understand the technology used in agriculture and its effects. It is important to learn how scientific advancements can help combat global issues like food scarcity, soil degradation and high chemical toxicity in food. This report explores various aspects and outcomes of precision agriculture. Things like economic benefits and advanced technology usage make the reader understand the financial investment aspect of modern farming. Whereas, the detailed investigation about practices of precision farming helps provide real-time data for R&D. Agricultural technology consists of many components which will be analyzed in this report.

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