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New and Advanced Technology in Today's Agriculture

Savitri Chakraborty[1]* and Subhasish K Chakraborty[2]

[1]Savi Agrotech Consultant, Pittsburgh, PA, USA

[2] MBIC, Carnegie Mellon University, Pittsburgh, USA

***Corresponding Author:** Savitri Chakraborty, Savi Agrotech Consultant, Pittsburgh, PA, USA.

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Abstract

With the increase in world population the trend of today's agriculture is towards sustainable crop production to feed the growing population. Agriculture is going through a dramatic transformation as GPS (Global Positioning System), UAV (Unmanned air vehicle), VRT (Variable Rate Technologies) and other advanced technologies are being developed to optimize management practices including application of agrochemicals.Earlier farming practices assumed that the field to be cultivated is homogenous in nature and management practice was recommended based on what was best for field as a whole. With the advent of precision agriculture the outlook changed. Since the fields are not homogenous hence uniform application of agricultural inputs may result in wastage and may not result in maximum yield or profits. Precision application has several potential advantages over traditional farming practices such as higher average yields, lower input cost and also less environmental contamination due to precise application.

Keywords: *Technology; agriculture; GPS; UAV; VRT*

Introduction

The trend of today's agriculture is towards sustainable inputs and to reduce the cost of production to minimum. Keeping in mind the dire consequences arising out of indiscriminate use of pesticide, fertilizer and other inputs the focus of farming is on need based application. Thus came about the demand for precision farming, which addresses the area of sustainable crop production. The world's population is expected to reach 9 billion in year 2050 [1]. Thus resulting in nearly doubling the global food and fiber demand. Providing safe and nutritious food to all is indeed a challenge which can be combated by changes and advances in agricultural system. Intensification of agriculture through the use of high yielding crop varieties, fertilizers, irrigation and crop protection remain the most likely option to solve this problem. With the use of technology the number of people fed has also increased from 19 people in 1940 to 155 people today [2]. Today there is also an increased emphasis on improving the nutritional values of foods (e.g. protein content in grain, essential amino acids, and vitamins in food), reducing post-harvest losses, improving stress tolerance or reducing reliance on chemical crop protection products.

Agriculture is going through a dramatic transformation as robotics and machine vision systems are being developed and used to optimize management practices including the application of agrochemicals [3]. It is important to know the tools and techniques that create the infrastructure of this modern form of agricultural management to understand fully how precision farming works.

The Global Positioning System (GPS)

The philosophy behind precision farming or site specific management is to apply production inputs like chemical fertilizer, pesticide as needed and only where needed for economic production [4]. The GPS is the heart of precision agriculture (PA). It requires high level of data processing and the software used for this is known as GIS (Geography Information System) software. The GIS has proved to be a successful tool in natural resource management [5]. Precision agriculture requires high level of data processing and the different types of data include yield, soil pH, nutrient status, pest infestation during crop scouting. These are then interpreted and fertilizers and agricultural inputs are applied according to need. For Remote Mountain areas which are usually inaccessible researchers developed a low cost GPS based protocol to create high resolution digital elevation model [6].

The GIS is currently being used on small Asian farms. The purpose of applying this system is to encourage farmer to use the internet and to obtain free information on the soil properties of their farm. It can be used to identify which areas are suitable for arable land and to identify the best crop for a particular region [7].

Unmanned air vehicle (UAV)/drone

Crop scouting of hundreds or thousands of acres of land was impossible by the old method of walking through field. Agricultural drones helps to scout, diagnose and address distressed areas in less time more accurately. UAV / drone flies over the field to find the stressed areas through crop health analysis. Image created is then geo- referenced and need based actioned is taken. Normalized difference vegetative index (NDVI) is an index of plant greenness or photosynthetic activity thus reflecting the health of plant as well as to determine the harvesting schedule. Unmanned air vehicles will revolutionize agriculture and ecology [8].

Variable Rate Technologies (VRT)

There are machines that can change their application rate in response to their problem. Thus the cost of production is also reduced. Profitability of crop production with VRT for P and K applications were studied in comparison to uniform rate technology (URT) in a corn and soybean field rotation in Indiana. It was found that crop production was more profitable in field using VRT [9]. The newest area of sensor use is in irrigation where the sensors measure water needs of the plant and hence helps to optimize water use and avoid yield loss.This in combination with VRT can control the rate of water applied. Another type of sensing system is satellite or aerial imaging called remote sensing. The satellite shoots image of key agriculture areas every three to four days to note differences in crop health. Growers can then apply nutrients based on a prescription from satellite images.

By using swath control and (VRT) the cost of agricultural inputs in production can be reduced. Thanks to GPS mapping the equipment in field already can recognize where it has already sprayed and the swath control shuts off sections of applicator as it enters the overlap area, thus saving the farmer from applying fertilizers or pesticides in the same area twice.

RFID (expansion should be done) tags are handy device for livestock management. It helps in keeping a track of individual animals and thus animals are accounted for

Advances in Genetic Engineering: Mini chromosome technology promises to deliver multiple stacked traits in a single corn hybrid faster and more efficiently than today's stacking technologies. According to the technology developed by Syngenta and chromatin a new mini chromosome is developed that contains a given desired trait or traits.

Computer vision based system / technology for crop yield estimation: This is also an important criterion in apple orchard management and grape vineyards. To deal with this challenge researchers at Carnegie Mellon University (Robotic Institute) have developed a computer vision based system / technology for automated rapid and accurate yield estimation. An autonomous orchard vehicle is used as a supported platform for automated data collection. The system scans both sides of the trees in orchard. A computed vision algorithm detects and registers fruits from acquired sequential images and then generates fruit counts as crop yield estimation [10].

Plant pest recognition and detection is vital for food security, quality of life and stable agricultural economy. Researchers have come up with method to automatically detect and recognize plant pest population using K-means clustering algorithm and corresponding filters [11].

Monitoring of health and detection of diseases in plant and trees is critical for sustainable agriculture. The two major categories for non-invasive monitoring of plant diseases are (i) spectroscopic and imaging techniques (ii) volatile organic compounds profiling based techniques for recognizing plant diseases. These methods of disease detection have been reported to detect plant diseases accurately. Thus they can be used for plant disease control and management [12-13].

It has also been reported that detection and control of downy mildew disease in grape vineyard or field have been done by raspberry pi module installed in a robo-car [14]. When the disease is detected the signal is transmitted to another electro mechanical module. Then pesticide is sprayed automatically on the infested area by using electro mechanical system. Hence it also cut the cost of labor as well as reduces the spread of disease.The appropriate and precision calibration of sprayers helps in minimizing the amount of pesticides lost during spraying [15]. Spray drift of pesticide is an important and costly problem causing environmental contamination. Droplet sizes are influenced by various nozzle types and different spray pressure [16].

In the mid-western United States chlorophyll meters a recent development in agriculture are used for corrective nitrogen (N) management where N fertilizers are applied based only on crop needs to ensure increases in fertilizer use efficiency and return on fertilizer investment.

Conclusion

The world's populations are predicted to reach 9.6 billion in 2050. To feed the growing mass of population and to combat hunger, it is imperative to develop new technologies that will lead to sustainable production of food. For sustainable production of food we have to come up with new and advanced technologies. The emerging technology will improve farmer'sproductivity and will also transform the infrastructure of agri-business.

Potential for precision farming can be drastically different for different crops. Studies have revealed that corn was more receptive to precision farming with reference to nitrogen fertilizer input whereas for cotton the result differed. Technology has tremendous implications. It is also important to understand the magnitude of possibilities associated with cutting edge agriculture. With proper guidelines for understanding yield and profit potential in specific crops, producers can hence determine if the particular crop will be adapted to precision agriculture technology.

The areas of food production, agriculture and food security faces challenge. Currently there are a billion people who are undernourished today. Food production will have to increase by 70% until 2050 to accommodate the worldwide demand. The challenge is that world population is growing but the amount of arable land available is limited. High yielding varieties and innovative crop protection products can contribute to safeguard the supply of food.

New technology plays a critical role in finding new solutions and tools to increase crop yields on every area of cultivable land. Today's research concentrates not only on increasing the production of food but also the nutritional content of food. In developing world in particular increasing the micronutrient and vitamins in staple food is a key factor in solving the malnutrition problem faced in developing countries. Furthermore since the climate is also undergoing change it is important that the crops are well adjusted to the changing scenario. The collaboration among different researchers, scientist, farmers and consumers is needed to bring about a sustainable solution to the crisis. Technology will create better farming system, more nutritious food and will also address the issues that come with climate change and sustainability.

Bibliography

1. Simmons J. "Technology's role in the 21st century making safe, affordable and abundant food a global reality". *Elanco Animal health* (2011): 1-12.

2. Prax V. "American family farmer's feed 155 people each-2% American farm". Retrived from https://suite.io/valerie-prax/3fb622m

3. T Simonite. "Robot farmhands prepare to invade the countryside". New Scientist. June 1, 2009.http://www. Neuroscientist.com/article/dn17224-robot farmhands-prepare-to-invade-the-countryside html? Full= true & print= true (accessed July 14 2013) (2009)

4. Stephen W Searcy. "Precision farming: A new approach to crop management". *Texas Agricultural Extension Service: Texas A & M University system* (1997): 1-4.

5. Bussink C. "GIS as a tool in participatory natural resource management: Examples from the Peruvian Andes". *Mountain Research and Development* 23.4 (2003): 320-323.

6. Matthew Fry., *et al.* "A Low-Cost GPS-Based Protocol to Create High-Resolution Digital Elevation Models for Remote Mountain Areas". *Mountain Research and Development* 35.1 (2015): 39-48.

7. Mandal SK and Maity A. "Precision farming for small agricultural farms: Indian scenario". *American journal of Experimental Agriculture* 3.1 (2013): 200-217.

8. K Anderson and KJ Gaston. "Lightweight unmanned air vehicles will revolutionize spatial ecology". *Frontiers in Ecology and Environment* 11.3 (2013): 138-146.

9. Yuliya Bolotova. "Crop production using variable rate technology for P& K in the United States Midwest: Evaluation of profitability". *American Agricultural Economics Association Annual meeting. Long Beach, California.* (2006): 23-26.

10. Wang Q., *et al*. "Automated crop yield estimation for apple orchards". *In proceedings International Symposium of Experimental Robotics. Qubec city* (2012): 1-15.

11. FaithpraiseFina., *et al.* "Automatic plant pest detection and recognition using k-means clustering algorithm and correspondence filter." *International journal of Biotechnology and research* 4.2 (2013): 189-199.

12. Sankaran S., *et al.* "A review of advanced techniques for detecting plant diseases". *Computers and Electronics in Agriculture* 72.1 (2010): 1-13.

13. Patil JK and Kumar R. "Advances in image processing for detection of plant diseases". *Journal of Advanced Bioinformatics Applications and Research* 2.2 (2011): 135-141.

14. Kadam V and Shukla M. "Detection and control of downy mildew disease in grape field". *International Journal of advances in Engineering and technology* 7.3 (2014): 827-837.

15. Bonds J and Jan L. "Calibration of crop protection equipment". *From abstract of papers 248 ACS National Meeting and Exposition, San Francisco, CA- USA.* Aug 10-14. Agro-531(2014).

16. Chakraborty S., *et al*., "Comparative assessment of spray coverage, bio-efficacy, and drift of methomyl (Lannate 12.5 L) using a Constant Flow Valve and a 60450 nozzle on Cotton (GossypiumherbaceumL.) and okra (AbelmoschusesculentusMoench)". *International Pest Control* 45.2 (2003): 94-97.

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