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Drone and its Applications in Agriculture

(*Ravi Saini and Asheesh Kumar)
Ph.D. Research Scholar, Division of Soil Science and Agricultural Chemistry,
ICAR-Indian Agricultural Research Institute, New Delhi, India, 110012
*ravisaini09121998@gmail.com

The global population is increasing day by day and projected to reach 9 billion people by 2050, consequently the agricultural consumption will also increase. So, there is an urgent need increase agricultural production to meet the food demand of each and every person. In present scenario, agriculture sector is dealing with the lot of problems, one of the innumerable problems is labour unavailability for farming. Other problems are extreme weather events, inadequate and inefficient application of fertilizer, diseases, allergies and other health problems due to application of agricultural chemicals. Technological progress made in supervision, monitoring and management have opened a new era in which many traditional agricultural practices are outdated. Their replacement with new technologies falls into the "precision farming" category, which involves application of the agronomic variables in the right place, at the right time and with precise control over the amount of material inputs or crop production (Kalamkar *et al.*, 2020). One of the major advanced technology currently being used in precision farming in drone technology. Use of drone in agriculture offer potential for facing several major or minor challenges. The major applications of drone in agriculture are crop monitoring, irrigation, field and soil analysis and bird control.

Basic concept of Drones

A drone or UAV (Unmanned Aerial Vehicle) is a flying device that can fly a pre-set course with the help of an autopilot and GPS coordinates. Sometimes the term UAV is used to refer to the complete system, including ground stations and video systems (Ahirwar *et al.*, 2019). Drones are remote controlled aircraft with no human pilot on-board. Despite some minor limitations, these tools can provide valuable data that can then be used to influence policies and decisions. Till now, drones are primarily used for surveillance in industrial sectors such as, mining and construction, army, and hobbyists. But now, drone technology is increasingly available for use in various sectors of agriculture as well. Though the technology is still nascent in India, many companies are trying so that it is easily available to Indian farmers and ready to be used to increase efficiency in agricultural production.

Figure 1 Image of drone (Ahirwar *et al.*, 2019)

Applications of drone in agriculture

I. Soil and field analysis

Drones can be used for soil and field analysis in agriculture for efficient field planning. They can be used to mount sensors to evaluate soil moisture content, terrain conditions, soil erosion, nutrients content, and fertility of the soil.

II. Crop surveying and monitoring

Crop surveillance is the supervision of crop progress from sowing to the time for harvest. It includes fertilizer application at the right time, checking for pest attack, and monitoring the effect of weather conditions.

III. Irrigation monitoring and management

Irrigation is always been troublesome for farmers. Drones that are equipped with thermal cameras can help to spot irrigation issues, or areas that are receiving too little or excessive moisture.

IV. Plantation

Drones can help in planting trees and crops, which was done by farmers before. Drone planting is a newer technology and not as widely used, but some firms are experimenting with drone planting. This technology will not only save labor but also help in saving fuels.

V. Livestock management

Drones can be used to monitor and manage huge livestock as their sensors have high-resolution infrared cameras, which can detect a sick animal and take actions accordingly.

VI. Crop spraying

Crops require regular fertilization and spraying in order to maintain high yields. Traditional methods are inefficient, burdensome and costly. Agri-drones can be used to spray chemicals as they have reservoirs, which can be filled with fertilizers and pesticides for spraying on crops in very little time, as compared to traditional methods.

VII. Plant health assessment

Constant surveys are necessary to monitor the health of the soil and the crop. Manually, this is laborious, time taking and error prone. Drones can do the same job in a matter of hours. With infrared mapping, drones can gather information about both the health of the soil and the crop.

VIII. Prepare for weather glitches

Weather conditions can prove to be a farmer's best friend and worst enemy. Drones can be used to detect upcoming weather conditions. And this information can be used by farmers to be better prepared for managing crop accordingly.

IX. Monitor growth

Crops need to be surveyed and monitored to ensure that the right amount of yield will be available at the time of harvest. It is also important for future planning. Drones can provide accurate data about every stage of crop growth, and report any variations before they become a crisis.

X. Avoid overuse of chemicals

Drones can prove to be especially effective in reducing the overuse of pesticides, insecticides, and other chemicals. These chemicals indeed help to protect the crop. But, their overuse can prove to be detrimental. Drones can detect minute signs of pest attacks, and provide accurate data regarding the degree and range of the attack.

Limitations of agri-drones

- **Connectivity issue-** Often, online coverage is unavailable in rural areas. Under such circumstances, a farmer needs to invest in internet connectivity.
- **Weather dependent-** Under rainy or windy weather conditions, it is not advisable to fly drones.

- **Knowledge and Skill**- Using new technology is a welcoming change but using it daily requires the right skillset and adequate knowledge. Either farmer must acquire the knowledge or remain dependent on an experienced person.

Conclusions

Drones are helpful for farming management in terms of observing, measuring, and taking action based on real-time crop and livestock data. Looking further into the future, drone technology is going to change the agriculture sector. Many Indian startups are also showing interest in the industry and aiming to invest in low-cost drones, which can help farmers and simultaneously create employment opportunities for the rural youth and enhance the knowledge of farmers as well.

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