Revolution of Indian Agriculture Through Drone Technology

Ekta Joshi*, Deep Singh Sasode, Neelam Singh and Namrata Chouhan

Dept. of Agronomy, College of Agriculture, RVSKVV, Gwalior M.P. (474 002), India

Keywords
Agricultural productivity, Crop insurance, Drone technology.

Introduction

To adapt agriculture to climate change and scarce resources availability such as land and water, here is an urgent need to increase food production by almost 50 percent by 2050 to feed a burgeoning population. In this context, agriculture has to look towards emerging technologies for solutions to enhance decision making through accurate, reliable and timely information to overcome some of the challenges. The global addressable market for drone application in agriculture is estimated as USD 32.4 billion. India, being a largely agrarian society, has a lot to gain if it taps the full potential of agri-drones. These drones can help our farmers increase production by using these drones for:

- Prevention of environmental damage;
- Effective monitoring of crop health;
- Getting insights into the soil health; and,
- Planning irrigation and the proper use of resources compost.

The majority of applications is based on drones as a mobile, aerial platform for advanced image data acquisition. The Indian government has launched an online platform called Digital Sky Platform for the registration of drones and their operators and on the other, there are 35 drone startups in the country that are working to raise the technological capabilities and reduce the prices of agriculture drones.

Application of Drone Technology in Agriculture Sector

A. Crop spraying

For crop spraying the drone technology needs to be paired and synchronized with the imaging, processing and automated analytics capabilities in order to address the affected areas or plants with precision. To cover an area
of a hectare in ten minutes, the spraying drones have tank capacity of over ten litres of liquid pesticide with discharge rate of over a litre a minute. Mapping and imaging capabilities of drone platforms with a range of sensors not only improves the dosage in the affected areas, but also reduces the overall use of chemicals within the area. The drone technology can be used throughout the whole production process in order to plan production better and therefore improve productivity. The fusion of advanced aerial information acquired with the help of drones with data from other sources such as weather forecasts and soil maps can help to refine the final information and enable the farmer to take full advantage of the farm and maximize the yields to their natural limits.

**B. Crop production**

In supporting precision farming, drones can do soil health scans, monitor crop health, assist in planning irrigation schedules, apply fertilizers, estimate yield data and provide valuable data for weather analysis. Data collected through drones combined with other data sources and analytic solutions provide actionable information. With help of multispectral and hyper-spectral aerial and satellite imagery the Normalized Difference Vegetation Index (NDVI) maps are formed. There are strong correlations between crop yield and NDVI values. So, on basis of NDVI values the crop growth at key stages can be tracked, differentiate between crops and crop stages, soil from grass or forest and detect plants under stress. In agricultural mapping tools use of NDVI data, in combination with other indexes such as the Crop-Water Stress Index (CWSI) and the Canopy-Chlorophyll Content Index (CCCI) provides valuable insight into crop health. The basic principle of NDVI relies on the fact that leaves reflect a lot of light in the near infrared (NIR). When the plant becomes dehydrated or stressed, the leaves reflect less NIR light, but the same amount in the visible range (Figure 2). Drones such as the DJI Agras MG-1 (DJI, 2017) are designed for precision variable rate application of liquid pesticides, fertilizers and herbicides.

**C. Forestry**

The drone technology is being used to improve forest management and operational planning, including the monitoring of illegal activities and encroachment. For valuation, monitoring and research of open forests the drone-based forest and landscape mapping is done to provide a new perspective to forestry. The large and high resolution orthomaps are prepared by stitching together hundreds of pictures taken by drones and then these orthomaps can then be integrated into GIS systems and used for analysis, planning and management. These drones imagery provides relatively accurate and timely forest inventory information at a local scale. Drones technology is also being used in collecting various forest metrics such as carbon sequestration, tree canopy analysis, conservation features, tracking native species, monitoring biodiversity and ecological landscape features.

**D. Livestock and wildlife conservation**

Drones fitted with high definition thermal cameras are also used to track, inspect and monitor livestock remotely. With help of drone imaging and mapping

![Figure 1: The advantages of drone technology in agriculture sector](image)

![Figure 2: Drone based weedicide/ pesticide application in crop field](image)

![Figure 3: NDVI and plant health](image)
capabilities it is easy to count and taking stock of herds of animals. With the application of high resolution infrared cameras, every single animal is a separate heat mark enabling counting with an accuracy higher than using conventional methods. The development of applications of infrared cameras in herds monitoring allows even more sophisticated tasks. Focusing on a single animal with a high-resolution infrared camera enables assessment of its health based on a temperature comparison, allowing swift identification and treatment of ill animals.

E. Crop insurance

Nowadays, drone technology is more and more often employed in insurance, with agriculture claims management being one of the key applications. Drones are also increasingly used in the agricultural insurance and assessment sector, including in insurance claims forensics. In India the Pradhan Mantri Fasal Beema Yojana (PMFBY) makes it mandatory to use exponential technology including remote sensing in addition to using drone imaging to detect fraudulent claims and discrepancies. As drone imagery is very useful in giving an accurate estimate of loss so farmers can claim crop insurance by capturing drone feeds as evidence. Companies such as Skymet are using drones to provide agriculture survey services to insurance companies and the state governments of Maharashtra, Gujarat, Rajasthan and Madhya Pradesh in the Republic of India.

Case Studies in India for Application of an Unmanned Airborne Drone Technology

Case I: The government of Assam, the Republic of India has partnered with Tata Consulting Services (TCS) to use drones to conduct surveillance, identify unauthorized settlements and to deter poachers in Kaziranga National Park (Muggeridge, 2017) spread over 480 square kilometres. Drones fitted with thermal cameras can identify poachers from their heat signatures even if they are hiding in thick foliage. This effort has proved beneficial for the vulnerable one-horned rhino.

Case II: In Maharashtra where sugarcane farmer crop was struck by wilt disease and was diagnosed and saved from being destroyed by agri-drones that captured data with NDVI (Normalised Difference Vegetation Index) and RGB sensors. The agri-drone that helped farmer in Maharashtra was designed and manufactured by Bengaluru-based 3Thi Robotics, which is working to raise awareness about UAVs among farmers through real-life demonstrations of their usefulness.

Constraints for Drone Technology in India

The use of agri-drones can transform the agriculture sector in India but the need of the hour is the creation of solid infrastructure and appropriate policies, say drone manufacturers in the country. Development of appropriate and easy to operate software solutions remains the key for application at field scale. Apart from technical know-how and affordability, the lack of trained pilots is a major restraining factor in the growth of the UAV market in India. In India, where the farmers are mostly marginal and the land holdings are fragmented, spread of drone application may be hindered by its techno-economic feasibility. The drones enable difficult to access the remote areas such as terrace rice fields or fruit plantations in mountainous regions to be reached. Moreover, drone cannot be operated publicly without prior permission from the government till now due to safety issues. So, favourable regulations on the use of small drones for agriculture as well as access to platforms that can aggregate data from various sources to provide valuable insights would be greatly beneficial to farming communities.

Conclusion

The next agricultural revolution will be driven by data, which will help to increased livelihoods for communities involved in agriculture and increase agricultural productivity with minimum damage to the environment. Supporting ecosystems would facilitate the growth of many innovative start-ups providing agricultural intelligence using drones and other emerging technologies as a service to rural communities. Thus by the growth of a new breed of professionals and agricultural infomediaries as well as by combining various data sources and analytics the information gap among rural communities would be addressed.

References

