Headline: Smart farming yields solutions

Byline: China Daily/Asia News Network

Published Date: 06:04 PM June 21, 2018

Section: technology

Word Count: 8594

Content:

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HONG KONG — As heavy snow swept across China early this year, local media in Central China's Hubei province reported that farmers used unmanned aerial vehicles, or drones, to spray de-icing agent, saving over 500 snow-covered vegetable greenhouses from collapse.

In the midst of climate change, technology is enhancing the resilience of the agriculture sector to weather and climate extremes, helping it face the challenges of producing more food to feed the world's growing population.

"Farming, being highly dependent on rainfall, soil health and temperature, is most vulnerable to change in climate," said Raj Paroda, former director-general of the Indian Council of Agricultural Research and a senior adviser of the Asia-Pacific Association of Agricultural Research Institutions (APAARI).

More than 2.2 billion people in Asia rely on agriculture to make a living, according to data from the Asian Development Bank. The region accounts for 90 percent of the world's rice production.

Although climate change will improve thermal conditions for agricultural production in some areas, its negative effects on food security and overall agricultural development are more profound, including declining crop quality and yield, decreasing arable land quality, rising prices of water and fertilizers, and more crop pests and diseases.

"The projected climate change is likely to reduce agricultural production by 7 to 10 percent in the next decade (by 2030) and beyond, if no adaptation and mitigation measures are initiated seriously," said Paroda, adding that climatic variability affects most of the biological, physical and chemical processes that drive productivity of agricultural systems, including horticulture, livestock and fisheries.

"Agriculture is not only the cause but also the solution to climate change related problems," said Paroda.

He said agriculture is contributing a significant share of the greenhouse gas emissions that are causing climate change — 17 percent directly through agricultural activities and an additional 7 to 14 percent through land use changes.

Due to China's large population, the country's per capita arable land and fresh water resources are much lower than the global average, according to Lam Hon-ming, professor of the School of Life Sciences at the Chinese University of Hong Kong (CUHK). Lam is also the director of the State Key

Laboratory of Agrobiotechnology, a CUHK partner laboratory.

“First-grade arable lands in China occupy less than half of the total arable lands,” said Lam. “To boost and maintain crop yield, China has used a lot of fertilizers and chemicals in the field, posing a challenge to sustainable agriculture.”

The country’s total population is expected to reach 1.5 billion by 2030, and such an increase requires an extra 100 billion kilograms of grain to meet demand, according to the State Grain Administration.

Suitable strategies

Yet climate-related disasters account for the loss of 50 billion kg of grain in China every year, and climate change could further trigger uncertainties in the country’s natural environment, according to the China Meteorological Administration.

A US$313 million project, funded by the Chinese government and the World Bank, is helping several hundred thousand rural households in six Chinese provinces adopt Climate Smart Agriculture (CSA) to strengthen their resilience to climate change. As a result, yields of crops like rice and maize have all increased with better irrigation systems and improved soil conditions through technology.

In addition, farmers now enjoy more policy incentives as the country stresses modern agriculture. Financial support and training will be provided to develop a new generation of professional farmers and encourage the growth of a more diverse agriculture business, according to the State Council, China’s Cabinet.

Progress has been evident.

China saw zero growth in chemical fertilizer and pesticide use in 2017. A total of 800,000 hectares of farmland have been covered by pilot programs to rotate crops or to leave the land fallow for ecological conservation and sustainable production, with a target to reach 2 million hectares this year, according to Xinhua.

Shenzhen-based DJI, the world’s largest commercial drone maker, launched its first farm-specific drone, the MG series, in 2015 to meet the country’s demand for plant protection.

And other products such as its Phantom series high-end consumer drone have been used for agricultural science experiments, mapping and data analysis, said Xie Tiandi, DJI’s director of communications.

Nearly 10,000 drones had been put into operation in China’s agriculture sector as of September 2017, according to a report by online agriculture magazine Enongzi.

In a test by DJI, an MG-1P agricultural drone could spray about 90 mu (6 hectares) per hour, 90 times faster than a human.

Compared with ground spraying done manually, using agricultural drones for plant protection can save on pesticides and water usage, by 50 percent and 90 percent, respectively, Xie said. Separating humans and pesticides also greatly improves safety for farmers and workers.

Xie said technology companies can play an important role by providing products and services that are both cutting-edge and affordable for the industry.

For example, the MG series has reduced the unit price of a plant protection drone from more than 100,000 yuan (US$15,640) to as low as 29,999 yuan, which is much cheaper than many agricultural automation devices, said Xie.

DJI, through its Unmanned Aerial Systems Training Center, offers training courses for plant protection. The company has also supported training provided by professional service teams for plant protection and even local agricultural materials stations.

“Geospatial technologies like drones, satellite remote sensing and artificial intelligence (AI) play an important role not only in China but everywhere,” said Paroda from APAARI.

Key advances

“China is much ahead in most of these (geo-spatial and AI technologies)…other countries need to learn from these initiatives,” said Paroda, suggesting that a regional platform for CSA could be formed to help other Asian developing nations to move forward at a faster pace.

But imparting technological advances to aging farmers in Asia can be challenging.

“There is a huge gap between existing technologies and the farmers that can apply them,” said Vanessa Teo, founder and CEO of the Brunei-based startup Agrome IQ, which provides agricultural business intelligence and data analytics.

The company aims to support farmers through the decision-making process to plan for an efficient and profitable farm.

“To ensure food security for 9 billion people by 2050, farms will need to be more resilient to climate uncertainty, and data will play a huge role in the process of farm optimization,” said Teo.

Currently, Agrome IQ’s platform collects specific data such as soil, genetics and weather, then provides information to support the farm management process.

“With our platform, farmers will have a step-by-step guide on how to grow their crop instead of relying on general information from a variety of sources, and also we provide a tracking system … to ensure the resources are efficiently allocated to the farm,” said Teo.

The company also offers educational technology programs to cultivate innovation-based future farmers. The curriculum has been integrated into international schools and agricultural vocational training schools in Brunei, and Teo hopes to expand the platform to other member states in the Association of Southeast Asian Nations, as well as the Chinese mainland and Hong Kong.

As the Asian region has a high concentration of smallholder farmers, Paroda said it is important to ensure they can have access to new knowledge and technologies.

“Science, technology and engineering will continue to play a major role,” said Lam at CUHK. “Science will help to pinpoint the problem and predict the consequences.”