TARGET: Zero Hunger
Episode 6

Drones, data, food security: getting new perspectives on agriculture

[Sandra] Hello and welcome to Target: Zero Hunger – a podcast that explores the food challenges and solutions of our time, brought to you by the UN's Food and Agricultural Organization. I'm your host, Sandra Ferrari.

[Field tape of Philippines crew launching the big drone in the field]

[Sandra] What you're hearing is the sound of a group of researchers launching a very expensive drone over a field in the Philippines, one of the world's most at-risk countries for tropical storms and other disasters.

[Theme music IN]

[Sandra] In this episode, we'll explore what drone technology has to offer for agriculture.

We'll hear more about how drones are assisting the government in planning future agricultural interventions that make the farming sector stronger and better prepared for natural disasters.

We will also talk to a researcher at Kansas State University, in the United States, who is running a project that uses drones to detect pests in commercial wheat fields to prevent and control major outbreaks.

[Theme music OUT]

[Sandra] These days, drones hardly need any explanation anymore. But for the record: these unmanned aerial vehicles or UAVs are a type of "flying robot" that can be controlled remotely. They come in all shapes and sizes – some so small they fit in palm of your hand and others…well… like a two seater plane.

Their early use for military purposes gave them a bad rep for a while, but increasingly, researchers, aid organizations, governments and private companies are exploring the many ways drones can be used for good - from tracking rhino poachers, to search and rescue and delivering medicine to remote areas. But also, for smarter food production.

[News footage of Hurricane Haiyan report]

[Sandra] Over the past decade, earthquakes, typhoons and floods have claimed thousands of human live in the Philippines and periodically left parts of the lands infrastructure and economy in tatters. Unfortunately, such disasters impact heavily on farms and food systems. In fact, in 2013, Typhoon Haiyan alone devastated 600 000 hectares of farmland and caused over $700 million in damage to the agriculture sector.

As the country continues to increasingly experience the impacts of climate change, the Government of the Philippines and FAO have launched a drone initiative in order to use the technology for disaster risk reduction in the agriculture sector.

[Field tape of Philippines crew – discussing mission plans]

[Sandra] Under a pilot phase, some 25 FAO and government technical experts are ready to be deployed across the archipelago to support drone missions whose first goal is to assess where farmlands are most at risk from natural disasters and quickly assess damages after they strike.

[Drone taking off]

[Sandra] Because they can cover up to 600 hectares a day, the drones can significantly speed up the process of risk analysis. But to make sure they are effective, every mission requires thorough organization, and technical experts have to go through a series of crucial steps before sending the two drones to the sky.

[FAO Philippines – Office discussion]

[Office Chatter]

Jaimie: They were hit badly by El Nino.

Zaida: I had a short chat with Farmer John during the ocular and he said their harvest was reduced to half.

[Sandra] Jaime Reyes and Zaida Manglicmot work for the Department of Agriculture in the Philippines and are part of this group of technical experts. The two of them were recently trained - over the course of three weeks - how to fly the drones.

Rizza: Can I just double check how many hectares are we targeting to for our flights tomorrow?

[Sandra] Rizza Espenido is a Technical and Operations Assistant at FAO. She is also a phantom drone specialist and one of the so-called “Spotters” of the Drone Operations Team. This means she tracks the course of the drone and assists the controller in case of emergency. Like Jaime and Zaida, she has learned a range of remote aerial assessment methods.

[Field tape of Philippines crew – Setting drone for flight]

[Sandra] The drones are equipped with navigation and photogrammetric equipment – basically, a camera that takes very detailed aerial photos from different angles that allows the team to later generate detailed and data-rich maps and images.

In addition to crop assessments, the data generated from drone flights can also help the government plan where to initiate infrastructure projects that can benefit local famers, like irrigation or storage facilities. The technology also makes it easier for authorities to monitor the environment and assess how coastal and forest areas are doing.

[Field tape of Philippines crew – Drone landing]

[Sandra] The drone data collected by the Department of Agriculture and FAO also play a major role in advising farmers and fisher-folk. With reliable information on new pests and diseases, for

instance, or on areas where land has been damaged and crops are not growing properly farmers can take better decisions on where to put their resources and protect their livelihoods.

Rizza, Jaimie, Zaida and the other people on the team hope that the initiative will be extended to other local government units across the Philippines. And FAO, too, is looking into ways to use this technology in other regions for a variety of monitoring purposes.

One of those areas where drones could come in handy is controlling pests in crop fields.

To find out more about this use of drones, I talked to Brian McCornack, an associate professor of entomology at Kansas State University in the United States, who recently came to FAO in Rome to present his work. He and his team recently launched a three-year project together with Australia's Queensland University of Technology. The project reflects a growing interest in both countries to find out in what ways emerging technologies like drones can be used to make detecting plant-based threats more efficient.

I reached Brian at his office at Kansas State to about the kinds of pests and diseases he's tracking and the benefits of using drones to do it.

A note to listeners, Brian refers to drones as UAS – short for unmanned aerial systems. Here's Brian.

[Brian McCornack Itw OUT]

[Brian Clip1] Primarily the system that we work in is wheat, and we're targeting cereal aphids – primarily Russian wheat aphid and green bug. We're also looking at other pests like Hessian fly. Two of these which happen to be an invasive species for Australia, which is another reason why we are working with Australian colleagues with this particular grant. It's to understand the data that we're collecting here, in a landscape where those pests actually reside and how we detect those using unmanned aircraft systems. We've expanded this a little bit more outside of wheat, mainly because the primary objective of that grant is to truly understand the utility and/or limitations of UAS technology to remotely sense pests. And to do that – or at least what we're learning – when you change to a new system, you go from wheat to sorghum you start to deal with more complicated issues. Where the fruit and bodies change. Where the pests feed the signatures we look for in images are going to change in correspondence to what insects there are and what kind of damage they're causing.

[Sandra] Brian and his team work with a small drone called Inspire, which only weighs a few kilos. The device has eight blades and is equipped with a camera, sensors and a GPS transceiver. It's battery-powered and can fly for about 30 to 40 minutes with a drone operator controlling it from the ground. The high resolution system Brian's team uses can generate images with pixels that are so precise that if they were to walk into the field to find that spot, they can get within a couple of centimetres of the area that that pixel is referring to.

[Brian Clip 2] I think one of the more immediate values that we can get from the technology is simply changing our perspective. I'll give you an example of this. We were contacted by a grower in north central Kansas who was having a problem with some hessian fly in his wheat fields, and he was working with his insurance company to identify whether or not he needed to put it to pasture, whether they should till it or replant - getting them to figure out what their options were. So we took him off air and took advantage of this and got some areal imaging for a presentation I was going to give later, but we went out and we started sampling. And where we were sampling we weren't necessarily seeing the issues that they thought they were seeing. And we were kind of having a hard time in making this decision on what to do next. And so our plan of action was to come

back in a week and reassess the situation. And during that we were doing some overflight with our Inspire – which has a really good camera – and we were taking some video of it. We came back we were seeing a lot more than what we weren't necessarily seeing in the field that was literally 15 feet away from us.

[Sandra] So drones allow researchers and farmers to zoom out, so to speak, and get a bird's eye view of an area of farmland that can help them assess the full scope of the situation on the ground. But Brian and his team are interested in using the drones for more than just an eye in the sky to providing a more well-rounded perspective of a problem area – he's also exploring ways to equip drones with robotic capabilities to collect insect samples or set traps.

[Brian Clip 3] Maybe we actually need to collect a leaf, to see if there are rust spores on it or to see if there's an aphid on the bottom side of the leaf. So part of the project is looking at the potential for, what we widgets, so little devices to add to a UAS to take off or add to a UAS as needed to remotely collect the sample. Over all the project is more about how do we optimize the practices that we currently use to detect invasive species?

[Sandra] So drone technology is interesting for the ease of it and collecting data, etc. but it's also a costly technology. I asked Brian if he thinks it's worth investing in?

[Brian Clip 4] For the system that we fly, it has a pretty decent payload on it so we can carry quite a few sensors, it's got a flight time of anywhere between 30-40 minutes depending on what we're carrying on it. A fixed wing however could cover a much larger area and have a flight time of up to 45 minutes, but the technology itself might only be about two or three thousand dollars. Considering how much acreage you could be covering and how much manageable land you could be covering, the cost is not much. Where you're really going to be getting into the cost is really the person who is flying it. I think that will only change as the technology of UAS gets better and the regulations relax a bit. Some of that might actually deal more with the safety requirements of the UAS. As that improves, I think it's going to be even more cost effective. For us, our average farm size might be around a thousand to two thousand acres, the cost of that technology might only be two to three dollars an acre to fly.

[Sandra] So what does Brian think is the main value of the project he's working on and how does it benefits the future use of drones?

[Brian Clip 5] So, I think the greatest value of some of the research we are doing is providing that baseline data. Some guidance on the types of pests that best relate to signatures that really can be detectable with the technology we have. I think the coolest part of all of this is that we're working with bio AG engineers who are the ones that are developing the sensors. You know, as the sensor technology gets better and hopefully cheaper – because that's really one of the limiting factors –we talked about the price of the UAS, but really the limitations are the sensor technology. I mean the fly – hyper spectral cams – which gives you more and a lot more flexibility and indexes which might be something predictable for a pest might run around $80 000 for one camera. Four or five years' time, if there's a significant amount of demand, that price can be reduced quite a bit. All of a sudden there's a lot more utility in the technology. So I think some of the deliverables that are in the grant, is showing how to optimize the technology that we currently have; realizing there might be some limitations in the sensor technology for a given pest. But the bottom line is simply changing perspective actually adds quite a bit to what you might be sampling on the field. So even if you ground truth it, you know that the pest is there. If you spend another 20 minutes flying over that area you now have some imaging to stitch together to kind of going along with your ground truth data again provides a stronger zero or presence of a particular pest in an areaI think that's more of

that immediate value that this particular project can provide is figuring out how to use that perspective data to inform a management decision.

[Sandra] Cost is not the obstacle per se, according to Brian. But there are still some challenges to take into account when we look at ways to use this technology more widely. One of them being – who's going to analyse all this data?

[Brian Clip 6] You know, as much as we can fly and get the data, what do we do with the data? It's not a trivial task ahead of us. For example that flight I talked about earlier above that small area. Might have taken up to 40-50 gigs worth of images. That's something that we're not going to be able to upload to the cloud and get analysed we might need some software that's with us to do that. But at the end of the day if we're covering thousands of hectares of land-where's that data going to go? And who's going to be able to look at it and understand and interpret the data and make a management decision out of it.

Drones have had a lot of buzz in the media for the last 2-3 years, and we're really pushing is to make sure that our stakeholders and growers and consultants really understand what the current limitations of the technology are and where we're headed. And part of that is about using these technologies to maximize yields. At least in terms of agriculture.

[Brian McCornack Itw OUT]

That was Brian McCornack, Associate Professor of entomology at Kansas State University.

[Theme music IN]

As the evolution of drone technology continues– application for their use in agricultural sectors can only be expected to improve.

From the monitoring of disaster areas and disease outbreaks to the assessment of lands threatening to become potential drought areas… drones are proving to be useful tools for ensuring food security… for their efficiency, but also for the wealth of data they can collect.

As Brian pointed out, however, there are still some lingering questions of what to do with all of that information.

In next week's podcast, we'll continue to take a closer look at some of the nuts and bolts behind how FAO is assisting countries leverage other technologies, like remote sensing, to support food security.

This episode has been produced by Kim-Jenna Jurriaans, Anais Hotin and myself.

If you have any questions or feedback for us please write to FAO-audio@fao.org. I am Sandra Ferrari. Thanks for listening.

[Theme music OUT]

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