

Projects Feature



ICAC Projects: Using Innovation to Solve Cotton's Greatest Challenges

ICAC's Virtual Reality Cotton Training Programme and Soil & Plant Health app will change the world for growers and researchers across the globe

To reach its full potential, the global cotton industry will need to increase its use of innovative technologies – a major focus for ICAC in the coming years. Given the challenges of pest and disease resistance, the lack of available workers in many parts of the world, and securing a living wage for smallholder farmers in least-developed countries, technology will increasingly offer solutions that were never available before.

ICAC has positioned itself firmly at the forefront of this movement, developing innovative new solutions to problems that have challenged the industry for decades. The two major projects ICAC is working on now include the use of virtual reality (VR) for training, and a Soil and Plant Health app designed to help any grower in the field determine what problems they are facing and how to solve them – even if the farmer is illiterate.

Together, these two projects will open new doors and enable all cotton producers, researchers and scientists to access the most advanced technology available, no matter where they are.

What is Virtual Reality?

Virtual reality is the use of computer technology to create a simulated environment. Unlike traditional



user interfaces, VR places the user inside an experience. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds. By engaging as many senses as possible – hearing, touch, even smell – the computer is transformed into a gatekeeper to this artificial world.

Virtual reality's most immediately recognisable component is the head-mounted display (HMD). Human beings are visual creatures, and display technology is often the single biggest difference between immersive VR systems and traditional user interfaces.

With a multiplicity of emerging hardware and software options, the future of wearables is unfolding. Concepts such as Google Cardboard, Samsung GearVR



International Cotton Advisory Committee



and Oculus Rift are leading the way. Whatever your choice is, the simplicity of having a helmet-sized device that can work in a living-room, office, or factory floor has put HMDs on centre stage when it comes to VR technologies.

Benefits of VR Training

While cotton production practices vary widely based on geography and weather conditions, there is much that growers in one part of the world can learn from their counterparts, even if they're on the other side of the world.

That is the concept behind ICAC's VR Training Programme. If a problem in Africa is similar to a problem that's already been solved in India, the African growers don't know about it, and couldn't get there to see how to fix the problem even if they did know about it.

'Because the farmers can't go to see the solution, we are working on a way to bring the solution to them', said ICAC Executive Director Kai Hughes.

He added that before it can achieve a breakthrough in yields and increase input-use efficiency of water and nutrients in a place like Africa, countries need to seriously consider the development and evaluation of the following systems:

1. A new system of plant architecture;
2. New planting geometry;
3. Canopy management;
4. Soil health management; and
5. Ecological engineering for pest management.

'The big question is how to explain these complicated subjects to

smallholder farmers in the least-developed countries, who often have low literary skills', Hughes said. 'There have been numerous training programmes instituted over the last decade, as well as example farms, but all of them have failed to make any improvement in yields'.

VR can provide a great experience for farmers, who will be able to walk in a virtual cotton field during different times of the season to experience a variety of farm operations and production practices. Farmers will be able to understand the value of compact-short-statured plants, zero-monopodial type, short season (140-150 days), pest and disease management, fibre quality evaluation, and conservation-tillage practices that can help enhance yields and income.

VR can be used anywhere — in classrooms as well as the outdoors — to enhance student learning and engagement.

Training programmes on pest and disease management can be conducted any time of the year by walking farmers into fields that are

infested with insects and diseases to show them best eco-friendly management practices. VR could also help entrepreneurs walk into small-scale textile units, enabling them to understand and learn technologies that can help Africa convert cotton fibres into value-added products. VR also can be used as a training programme for key personnel from brands and retailers, allowing them to 'walk through' and understand each link in the cotton supply chain.

Reality Made Portable

VR can be used anywhere — in classrooms as well as the outdoors — to enhance student learning and engagement. VR can transform the way educational content is delivered; it works on the premise of creating a virtual world — real or imagined — and allows users to interact with it. Being immersed in what you're learning motivates you to fully understand it. It will require less cognitive load to process the information. Standalone headsets can be charged and don't need to be hooked up to a computer, making them ideal for training in remote areas.

'Of course, VR will never replace real field trips and travels, nor should it', Hughes said. 'But it does enable

people to have experiences that would otherwise be impossible'.

Why Focus on VR?

The objective of this project is to create series of short, professional-quality instructional videos, using the latest video-capture equipment. The short videos will then be edited in Adobe Premier Pro according to the course content. In short, we want to create something attractive, interesting and engaging — something that will be seen as best example in the cotton industry and the principals can be extended into other commodities.

Our goal is therefore to inform and educate farmers by showing them efficient cotton-growing methods through the use of stunning and extremely realistic 3D imagery. By showing farmers, key production personnel and decision makers more efficient and productive ways of producing cotton, we aim to increase yields and quality. We will capture examples of production from different countries and discuss the best practices.

Sometimes breaking old habits is difficult, and the old way of doing things is not always the best. It



may be difficult to break the mould and convince people to change their ways by just showing them pictures from a book or a photo.

By using the latest 3D VR technologies available, we will be able to capture the interest of the audience in a more powerful way than ever before. They will be able to explore farms as if they were physically there, enabling them to look around, observe, and investigate plants closely. Seeing is believing.

How, Where and When

Filming in a cotton field is currently in progress. The video will be used by ICAC staff to conduct training sessions in ICAC Member countries. These sessions will not attract a fee and will be provided as part of a programme of value addition activities to ICAC Members. Non-ICAC members will be required to pay a training fee. In addition, the training video can be 'rented out' to ICAC partners. Sponsors will be able to utilise the training video for exclusive use by their staff only.

The launch the concept of virtual reality training in agriculture, and particularly cotton, at the launch of World Cotton Day on 7 October 2019 at the WTO in Geneva.

World Cotton Day is an ICAC initiative which will take place in October every year – the month of Mahatma Gandhi's birthday.

ICAC has engaged key partners and received approval from the Director Generals of the WTO, UNCTAD, ITC and FAO to pursue this initiative and have the day officially recognised by the United Nations within the next two years.

Therefore, the launch on the 7 October 2019 will be under the auspices of the WTO, and the following year, our UN partners will sponsor the adoption of World Cotton Day at the UN (only a UN body can propose and sponsor such a day).

Adding value for Members is critical to the success of the ICAC moving forward.

'Going forward, VR training forms part of a value-addition programme for ICAC Members, thus helping to retain membership of ICAC and encourage new members', Hughes concluded. 'Average assessment fees for African nations are \$30,000 to \$40,000 depending on the amount of production.

'We expect that the cost of training for non-ICAC Members will be \$10,000 per week – exclusive of costs. Adding value for Members is critical to the success of the ICAC moving forward, and VR training is a great example of how ICAC is providing it', he said.

Soil and Plant Health App Delivers Customised Solutions

Similar to the VR training, ICAC's Soil & Plant Health app is designed to bring information to the people who need it most – wherever they are, in whatever language they speak.

The concept originated during a meeting of ICAC's Expert Panel on Social, Environmental and Economic Performance of Cotton (SEEP). One member – Dr. Kater Hake of Cotton Incorporated – told his colleagues that he believed soil health is cotton's biggest concern, globally, and that any movement toward sustainability must first address that issue.

Dr. Keshav Kranthi, head of ICAC's Technical Information Section, credited Dr. Hake as the driving force behind the app concept and agreed that soil health is one of the most pressing cotton challenges that cotton faces.

'If the soil is good, the industry can move toward other steps on sustainability', he said. 'But if the soil health is poor, virtually nothing is going to work. Addressing the health of the soil is the first step toward a sustainable cotton industry'.

While the members of SEEP agreed with the concept, what could be done about soil health? Farmers face different situations in every field, and what if the grower doesn't speak English? How could ICAC address the endless variations in cotton production and growers?

As with the VR training, technology was the only possible solution, so SEEP members decided to launch a pilot program in India. That's not to say there aren't problems with soil health elsewhere, including Asia and Africa. But the sheer number of cotton growers in India (more than 9 million individuals) and the diversity of cotton challenges they face made it the ideal testing ground. Also, as Dr. Kranthi pointed out, things learned in India could be easily applied in other countries.

'We determined that if we could do a good job in India, it would be a foundation on which we could build the app further', Dr. Kranthi



said. 'About 80% to 85% of the content is common to all regions'.

The main objective of the Soil & Plant Health app is to help small-holder and illiterate cotton farmers address the immediate problems in their fields and share site-specific practices that rely on global expertise but are optimised for local conditions.

Initial funding for the project came from Cotton Incorporated, with the intent of releasing a demo version in spring 2019 to attract new investors. As discussions about the app continued, it was decided that to ensure maximum effectiveness, components addressing plant diseases and pests should be incorporated as well — which is how the Soil Health

app became the Soil and Plant Health app. Dr. Sandhya Kranthi, Head of the Crop Protection Division at India's Central Institute for Cotton Research, was chosen to be the technical consultant. Project stakeholders agreed that the tool should incorporate an entomology component that will be developed by Dr. Sandhya.

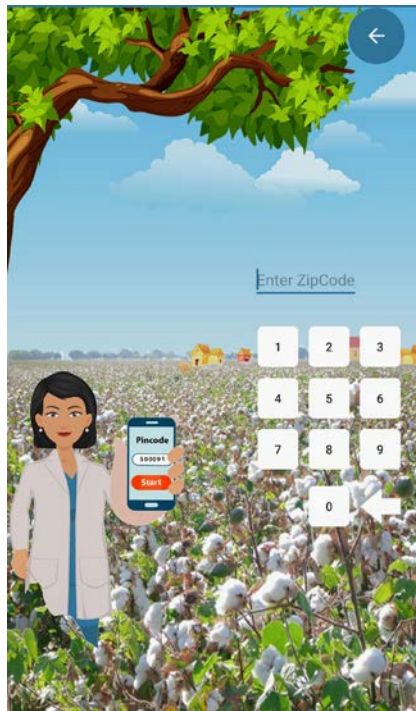
Indian collaborators and organisations will help to field-test the app's beta version, which will include best practices and processes in the following areas: salinity, drought, infiltration, compaction, tillage, surface residue, organic amendments, cover crops, soil microbiome, carbon balance, temperature stability, fertiliser loss, nutrients and pests.



Illiteracy Is No Barrier

The major innovation, compared to other products currently available in the market, is that ICAC is going to produce a talking app. In India alone, content needs to be available in four languages and dialects (in addition to English), so trying to translate all of the necessary content into every conceivable language is untenable – not to mention that even if that could be done, it still wouldn't address the problem of illiteracy.

To make the content accessible to an illiterate user, an animated female character was created to welcome the user in his or her local language when the app was launched for the first time.



But wait ... how does the app know what language to choose? It uses the phone's Global Positioning System (GPS) to determine where the farmers are when they launch the app and automatically select the local language. 'Even if the app initially chooses the wrong dialect, Indians are accustomed to hearing other dialects on TV and in movies, so they will understand well enough how to manually change it to their desired language', Dr. Kranthi said.

But the use of GPS does much more than give the user a head start on the language. The app draws on extensive regional knowledge of soil types, so as soon as the app knows where the farmer is, it already has a solid understanding of the characteristics of the local soil. Essentially, it is pre-loaded with reams of data about soil conditions all over the world so it can provide a 'head start' for the user.

And the magic of GPS does even more than that! When the app is launched, it asks the farmer to input the date the crop was sown and then accesses temperature and precipitation results from 'the 60' – a commonly used industry term referring to weather conditions from the preceding 60 days – with an emphasis on the number of heat units accumulated during that period.

It doesn't even need to ask the farmer if the soil is wet or dry because it already knows, based on recent weather conditions.

With that location-specific information, the app is able to show the user what the cotton plant should look like on that specific day. It literally displays a photo of what the plant should look like at that stage in its growth, given the weather it's experienced in the prior weeks and months.

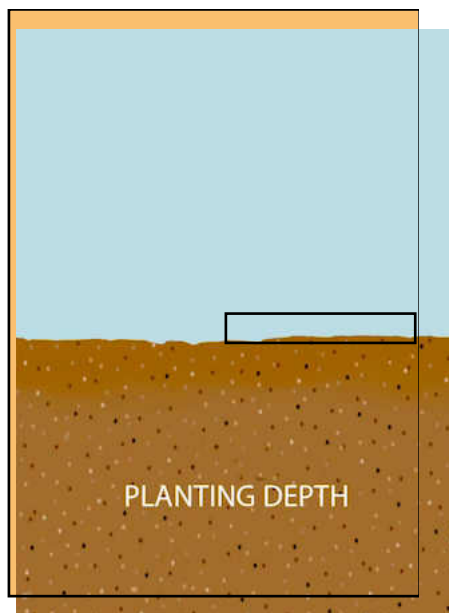
It can even tell the grower approximately how many bolls the plant should have by that time!

If the user is not in the field when the app first launches, the user can simply enter a zip code that will be used to draw the soil and weather information in that area. The app also helps connect individual farmers in an area, enabling them to share information and sending alerts to the community if a common problem has been detected and what the probable solution is.

The disease and pest information is handled in a similar way: by using localised knowledge. When the user indicates the potential presence of a disease, the app will show images, one by one, until the photo matches what the farmer sees in his field, and then the troubleshooting process begins. The same process applies to insect

pests, displaying various images displayed until the grower finds a match.

There are more than 85 animations of various pests (as well as beneficial insects), diseases and diagnostics. You can view two of them here:



Animation 1

Going forward, Dr. Kranthi and his colleagues hope to make the app even more powerful through the use of artificial intelligence (AI). It will enable farmers in the field to upload data and photos, which will increase the precision and effectiveness of the advice provided.

'Eventually, we hope that the user will be able to click on a photo that matches what they see and get a very specific diagnosis for their

The app is pre-loaded with reams of data about soil conditions from regions of the world, so it can provide a 'head start' for the user.



Animation 2

problem', Dr. Kranthi said. 'The app might actually be able to take all of the GPS data, analyse the uploaded photo and say, "You have a nitrogen deficiency"'.

While created as an ideal solution for isolated and illiterate farmers in least-developed countries, the app has an added benefit for literate ones, with the ability to print PDFs containing the app's recommendations and final diagnosis.