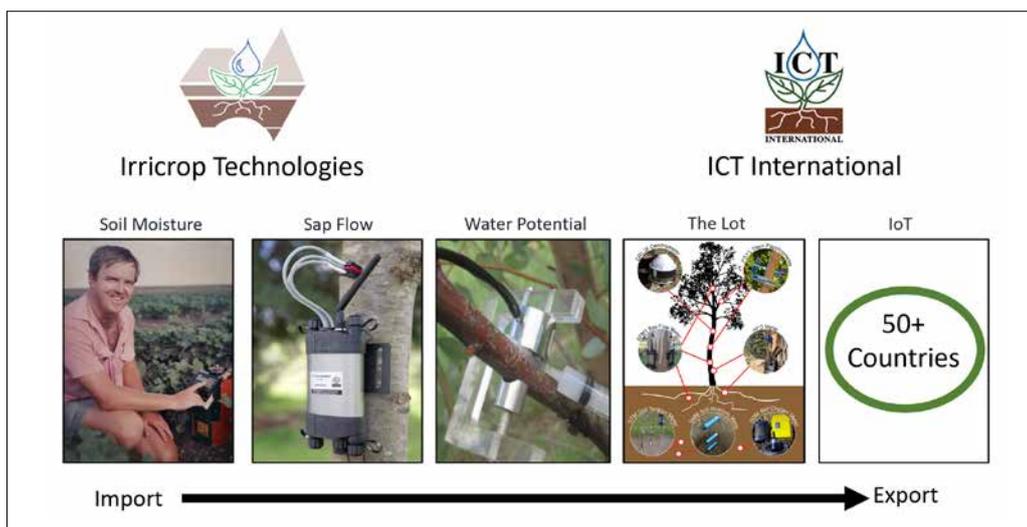


ICT International and SMART Farming

ICT International provide scientifically and commercially validated decision-making tools for soil, plant and environmental monitoring.

ICT International provide sensing solutions to improve plant water use efficiency for commercial agriculture and agricultural research. In the early 1980's Peter Cull commercialised his PhD research (1975-78) in soil moisture measurement and irrigation scheduling, providing products and advisory services to the agricultural industry (especially cotton). In the 2000's ICT International started to develop and manufacture sensors that quantify plant water use and stress. ICT International now exports to over 50 countries annually.



Timeline:

Irricrop Technologies & Neutron Probe Services: Enabling Better Water Management

1979: *Dr Peter Cull finished his PhD "Irrigation Scheduling of Cotton by Computer". Enabled by his findings, Peter encouraged farmers to adopt better water management practices. Supplying farmers the tools, training and guidance as a complete service allowed the adoption of these practices. These tools included the Neutron Probe (for soil moisture measurement) and software developed for irrigation scheduling (the PROBE).*

1980-1993: *Peter consults across 24,000ha of cotton, specialising in irrigation scheduling and insect management. During this time, Peter continues to introduce new technologies to farmers.*

1984-1990: *Developing tools and technologies to measure whole farm water use, Peter continues to drive the adoption of new technologies. These include infrared thermometry, portable leaf porometers and dendrometers.*

Peter undertook detailed studies examining the cause and effects of soil compaction by farm machinery. These were undertaken as the Australian cotton industry adopted new soil management best practices for wet clay (vertisol) soils after rain or irrigation.

1990-2000: *Using remote imagery captured by video cameras attached to fixed wing aircraft, Peter quantified spatial variability of cotton crops. Images were processed overnight using an Intel 486 PC. However, remote sensing was found to be of limited use for real-time decision making.*



ICT International and SMART Farming

Sensors deployed in the soil and (especially) on the plant were found to be of much greater use for quantitative real-time cotton crop management decision making.

1990s-2000: The search began for the technology that would enable direct measurement of Plant Water Use and Plant Water Stress in a Plug and Play solution.



ICT International: Measuring Plant Water Use and Plant Water Stress

2006: ICT International start the development of wireless sensors using **2.4GHz proprietary network technology.**

The first sensors to have 2.4GHz capability were the Sap Flow Meter (SFM1) and the Stem Psychrometer (PSY1); these continue to be the ICT International flagship sensors. Adoption of the SFM1 and PSY1 by the scientific and commercial community continues to increase. These sensors were developed in close collaboration with the scientists behind the measurement principles.

2013: **University of New England, Armidale build the UNE SMART Farm (now the SMART Farm Innovation Centre).**

ICT International collaborated with UNE to build a meshed network of store-and-forward 2.4GHz sensors. The UNE SMART Farm provided opportunities to develop knowledge with researchers surrounding the use and effectiveness of wireless sensor networks in agriculture.

2017: With an increasing understanding of the limitations of 2.4 GHz, ICT International move to Internet of Things (IoT) solutions. Focusing on the biophysical process being measured and the sensor technology, the R&D programme develops a software agnostic solution for the distributed sensor network.

2018: **NBNCo Avocado Monitoring Project**

ICT International deploy their first LoRaWAN network and sensors. Installed in an Avocado orchard, the objective was to reduce rates of fruit drop (abscission) and yield loss by improved irrigation scheduling. This demonstrated that LoRaWAN enabled monitoring that was not possible with 2.4GHz due to the restricted signal range when 2.4GHz was used within an extensive tree canopy.

2019: ICT International collaborated to roll out LoRaWAN networks across the NSW Department of Primary Industry's research stations.

2020: **New South Wales Department of Primary Industry's Farms of the Future project**

To showcase IoT sensing solutions, ICT International installed a range of tools for agricultural decision making and aquaculture compliance in NSW. Solutions were deployed for livestock & irrigated cropping operations and monitoring estuarine water quality for oyster farming. These highlighted the possible applications of IoT for decision making and compliance.



2021: **ICT International release the 3rd edition of the IoT Catalogue**

An ongoing programme of continuous development enables ICT International to continuously work with leading researchers and customers globally. The result of this is the latest 95 page IoT Catalogue, containing a wide range of case studies and applications. Showcasing over 80 IoT products, the catalogue is available in 7 languages from the ICT International website.