



Cutting edge crop research

EXCITING developments in robotics, imaging and computing are being brought together to create the next generation of scientific tools which promises to revolutionise future crop research.

These tools will allow scientists to better study phenomics, which aims to understand how the genetic make up of an organism (its genotype) determines its appearance, function and performance (its phenotype).

A new facility, The High Resolution Plant Phenomics Centre, has been built in Canberra at CSIRO's Plant Industry Division and the Australian National University.

It is developing next generation research tools to probe plant function and performance under controlled conditions and in the field.

As part of the "phenomics revolution" CSIRO has built new technology platforms to provide comprehensive and continuous analysis of plant growth and performance.

They are being scaled for analysing single plants through to analysis of an entire ecosystem.

Phenonet

MOTIVATED by the need to measure environmental variations across an entire field, Phenonet provides real-time physical and environmental conditions including canopy temperature, soil moisture, incoming solar radiation and micrometeorology.



Phenonet (pictured above) consists of spatially distributed autonomous sensors (nodes) equipped with a range of sensors, a wireless communications device, a small computer (micro-controller) and an energy source (both battery and solar panel).

The collected data is transmitted over a mobile phone network to a server for real time viewing via the internet.

The data is correlated with each plant's genetic profile and performance.

This information can then be used to improve accuracy and speed of plant breeding.

Phenomobile

THE Phenomobile (pictured below) is designed to integrate a range of remote sensing technologies for phenomics field measurements at the plot scale.



Purpose built for CSIRO by Tatura Engineering, the buggy is designed to straddle a plot and collect measurements from three plots simultaneously, gathering data for canopy temperature, canopy volume/biomass and ground cover.

A stereo-imaging rig reconstructs a 3D image of the plot providing information about canopy volume, mean plant height, and density.

The Phenomobile, which was recently completed, is heading into the field later this year.

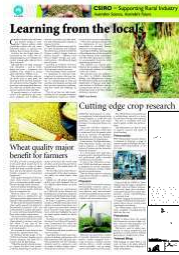
Phenotower

FROM 16 metres above the canopy the Phenotower (pictured right) collects infra-red thermography and colour imagery of a field plot.

This data is used for spatial comparison of canopy temperature, leaf greenness and groundcover between genotypes at a single point in time.

Tethered Blimp

FOR imaging an entire field at one



As an aerial imaging platform the blimp will carry both infrared and digital colour cameras operating in a height range of 30m to 80m above the field.

The infra-red thermography and colour images will identify the relative differences in canopy temperature indicating plant water use – an important trait to understand.

Cropatron

SET to be commissioned in 2012, the Cropatron will provide a “canopy-like” environment in which to examine crops.

This Field Crop Simulation module brings controlled environments directly to the field enabling scientists to examine the impact of climate change

on crops.

Two concepts are being explored in the Cropatron’s design.

The first includes a static facility with a high degree of environmental control, containment and highly instrumented to accurately measure the consequences of environmental perturbations on an organism’s physiology.

The second concept is a mobile design which would be placed over part of the crop in a field experiment.

■ **The funding for current and future phenotyping development within the High Resolution Plant Phenomics Centre is being provided through the Australian Federal Government’s National Collaborative Research Infrastructure Strategy (2009-2011) Education Investment Fund (2011-2013).**

