MEA

Measured by Experience

Summer Logbook 2011

Dr. Andrew Skinner, Engineering Director.

Tough Times

I went off to a seminar on soils and landscapes recently led by a group of well-respected academics and research scientists who wished to reshape the whole business of soils and water tables into a unified whole called 'the critical zone'. Well, they were on the money there. As simple wisdom states it, "for all of man's supposed accomplishments, his continued existence is completely dependent upon six inches of topsoil and the fact that it rains."

Private industry is a very difficult hunting ground, and one soon learns that if you're small, you'd better be clever

So I sat through the seminar waiting for new ideas, but was presented instead with list after list of all the old difficulties. Now, it's true that I'm getting grumpier with each passing year, but I'm increasingly irritated by folk who are happier with old problems under new banners rather than new solutions.

Private industry is a very difficult hunting ground, and one soon learns that if you're small, you'd better be clever, because nothing else cuts it. And not just 'head clever' – one has to be 'practically clever' to turn out gadgetry that evokes an "Oh, wow!" response in folk who pick up our instruments and just hanker to own them. Good technology is indeed indistinguishable from magic… without that, we don't eat. When you've learnt that hard lesson, it's a dreadfully painful business to realize that some of your suppliers haven't – that they are churning out the same bland old products or facsimiles thereof.

2010 was that sort of a year at MEA. Never before in the company's 27 year history have we had a better team of people, better management, better facilities and a better grip on our technology. Yet time and again we found ourselves dealing with crises not of our own making – sensors from the UK, USA and Switzerland failing badly in the field. When that happens, you need two things – cash in the bank and the determination to find a fix and pay for its implementation. At the end of the process, much of your hard-earned profits and the morale of your troops have been sapped in simply standing still. Yet this is what one has to do if one's business and brand are to be there tomorrow. Customers have a long memory if they have been treated badly in the past, even if their problems were not directly of MEA's making. Cracks have to be plastered over as they open.

As MEA approaches 30 years in business, this focus on the MEA brand has become increasingly important. Somewhere in the next decade MEA's ageing management will have to hand over to younger folk a working company that is well respected in the marketplace and where business keeps coming in through the door to feed them and their families. So MEA depends, as always, upon innovation – finding new solutions to old problems and adding value to them.

While 2010 delivered a bunch of old rubbish from a small handful of suppliers, it was notable also for something else – MEA came up with all sorts of new technologies that should see the light of day in the coming twelve months. Technology that will replace stuff that we currently have to import, and which is barely worth the candle…

As Confucius put it "The essence of knowledge is having it, to apply it."

EnviroPro

MEA has been field-testing the EnviroPro EP100C series of sub-surface probes for around a year. These buriable probes provide reliable soil moisture, salinity and temperature measurements in all soil types. Probes are available with 4 sensors, 8 sensors, 12 sensors, and 16 sensors. Multiple sensors per probe at 100mm intervals enables profiling at depths up to 1600mm, depending on the probe used. Soil moisture, salinity and temperature are available at every sensor depth. Soil moisture readings are temperature-compensated and can be salinity-compensated.

Soil moisture, salinity and temperature are available at every depth

In agriculture, moisture profiling at 100mm intervals allows you to track the movement of water through the root zone. Following the movement of nutrients through the root zone by tracking changes in salinity allows you to optimise fertiliser applications.

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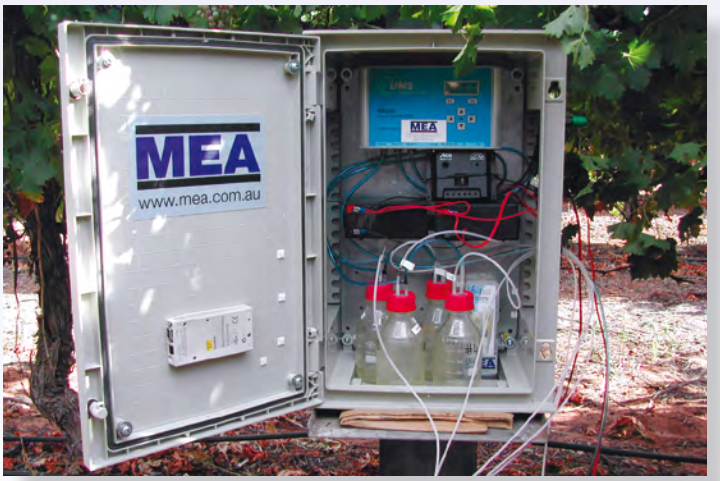
MEA Solar Calibration Facility

For many years now, MEA has had far-too-slow a turnaround on the re-calibration of solar sensors, as they have needed to be returned to the manufacturer in one of Australia's cloudier cities. Now MEA has established a sunny and high-quality calibration facility on the roof of our factory to speed up the re-calibration process, resulting in faster turn-around.

Soil Salinity Sensor Trials

MEA has been working away quietly now for over 3 years on the problem of measuring salinity build-up in soils, a medium-term threat to all irrigation areas faced with declining winter rainfall. Plants increase soil salinity by extracting fresh water from brackish irrigation water during transpiration, leaving salts behind to accumulate in the soil. The use of already-saline water on perennial crops necessitates the addition of a 'leaching fraction' to the amount of irrigation water applied; this extra water is designed to flush toxic salts out below the crop root-zone. Such root-zone leaching has the unintended consequence of putting pressure on local aquifers, leading to mobilization of groundwater towards the river at the lowest point in the landscape. This adds further salt to the river water, which is in turn recycled further downstream onto other crops and other aquifers. Monitoring the build-up of salt in soils under irrigated agriculture has, however, been far more complicated than the measurement of salt in the irrigation water itself.



MEA, with a little help from our friends in Yalumba and CSIRO, has been field-testing a variety of soil salinity sampling systems at Yalumba's Oxford Landing Vineyard near Waikerie in the South Australian Riverland. These systems include the WET sensor (Water-Electrical conductivity-Temperature) from Delta-T, an automated vacuum extraction system from UMS in Germany, and FullStop wetting front detectors (WFDs) developed by CSIRO and automated by MEA with specially-designed sensors that are located in the throat of the WFDs.

For a complete picture of these trials and results, contact Andrew Skinner at MEA for a re-print of his paper, Skinner, A.J. and Lambert, M.F. (2011). `An automatic soil salinity sensor based on a wetting front detector.' IEEE Sensors Journal, Vol. 11, Issue 1, p245-254, January 2011. In summary though, the MEA four-electrode salinity sensor in the WFDs is the most useful of all these sensors, as it captures a record of the soil salinity as it is mobilized by the wetting front associated with an irrigation or large rainfall event, and requires no manual intervention or large energy source to operate. There is still a long road ahead, however, before MEA commercialises these sensors.

LiDAR Wind Monitoring Systems from MEA

The Australian wind energy industry has matured over this past decade, with many wind farms now installed at sites marked for many years only by a single MEA tower festooned with anemometers and wind direction sensors.

Because of the sheer effort and cost to install a meteorological mast up to 100m tall, other methods have been sought to stretch that information about wind flows over the surrounding complex terrain. Computer modelling in particular has sought to address the paucity of data available across the huge acreages around the central monitoring mast where the many wind turbines making up a sizeable wind farm will be sited. Yet doubts about the accuracy of these models remain, and new measurement tools are being sought to bridge that gap.

Lasers measure wind speed, direction and turbulence at 5 different heights between 10m and 200m

MEA has tackled this gap in our wind measurement systems by negotiating with the Scottish company Natural Power, through their UK manufacturer ZephIR, to bring a LiDAR unit to Australia. LiDAR uses focusable lasers to measure wind speed, direction and turbulence at 5 different heights between 10m and 200m, all from an instrument 2m high located at ground level. The great advantage of LiDAR is its portability – it can be moved around a potential wind farm site to fill in the gaps and uncertainties left by the models. Call MEA for more information.

Soil Moisture Monitoring Under Broad Acre Crops

Soil moisture monitoring under irrigated crops makes all sorts of sense as a management tool, but there has always appeared to be little incentive to monitor moisture levels below rain-fed cereal crops - it either rains or it doesn't…

Yet recent scientific work on soil moisture levels below broad-acre agriculture has shown that estimates of the stored soil moisture provided by buried sensors can be useful too. Specifically, permanently-installed probes below the seeding depth, with temporary probes in the tillage zone during the growing season, are useful for watching both the rate of infiltration of rainfall and soil moisture extraction profiles driven by crop transpiration.

Knowledge of soil moisture content can be useful for determining whether or not a crop has enough moisture reserves to maximise yield. If this sub-surface water is just not present, application of expensive nitrogen fertilisers will only exacerbate crop failure by speeding up moisture withdrawal and 'cooking the crop'.

Free online weather data is available from MEA stations adjacent to many of the state's large grain growing regions. This can provide background information on rainfall and evapotranspiration rates, and can supplement local soil moisture data. To access free on-line weather data from MEA weather station networks, refer to our web-site at http://www.mea.com.au/products/weatherevap-aws

Hot Cows

If you're leading the 'cow-on-concrete' life of beef cattle kept in feed-lots and fed on grains (not grass), then you'll probably be pretty uncomfortable during hot still sunny days when the radiant heat load raises body temperature well above that of the surrounding air.

Measurement of the Heat Load Index for livestock can be calculated on an MEA weather station especially fitted with a Black Globe Temperature Sensor. This blackened copper sphere has a thermistor temperature sensor at its centre, and provides an output via an algorithm used by the feedlot industry to measure solar stress on their cattle.

'Deep Desert' Weather Station Networks

Almost twenty years ago now, MEA instrumented many of the diesel power stations throughout the townships in remote areas of South Australia, monitoring fuel consumption and the energy generated. To get this data back to Adelaide, we used telephone landline modems at 1200 baud; this required us to string copper cables across rooftops and under bushes to reach the power station and the data logging box.

When MEA recently won a tender to supply a half dozen of the same remote townships with weather stations, something more up-to-date was needed for the business of getting data shipped back to desktops in the 'big smoke'. Our reliable Next-G cellular phone network clearly didn't cut the mustard, so we opened up the business of satellite modems once more to see what had changed in the last decade. Did the old conundrums of high price and high energy consumption still apply?

We found that we could make use of the Thuraya satellite parked above Singapore to 'see down' into the outback. This satellite incorporates a GPS system; when the broad beam from the satellite sweeps over the area, the receiver on the MEA weather station wakes up and transmits its location. The satellite then sends down a more highly-focused higher-power beam to collect the data from that exact spot.

One of the bright folk on the MEA R&D team modified our familiar Packet Data Terminal (PDT) to beam data up regularly to the Internet via this satellite, thus avoiding the high costs of dial-in calls. Long-term testing showed that we could run the whole weather station – including the satellite communications – on a relatively small 20W solar panel. And finally, behind the scenes, we received great support from the modem supplier – always a good sign of a quality product.

A New Sensor for the Solar Power Industry

Andrew travelled to Delft in the Netherlands in the late summer of 2010 to visit a small company named Huxseflux who specialise in the manufacture of solar sensors. Now we all know Andrew just loves this stuff – talking to the small brotherhood of instrument makers around the world who get excited about sensors for environmental measurements.

The first solar radiation sensor to meet or exceed the ISO-9060 performance mandate specific to solar energy testing

One of the main technical discussions between Andrew and Kees van den Bos centred on the emerging solar power market and instruments suitable for solar energy surveying, the equivalent of the wind energy surveying measurements that got MEA underway back in the mid 1980's.

One of the problems in this area is that the higher-quality Secondary Standard global solar radiation sensors suitable for solar renewable systems performance and solar energy resource validation are 'over-the-top' in price for these applications, while requiring excessive maintenance and characterization to fully meet their specifications under field conditions.

Hukseflux (www.hukseflux.com) have recently released the SR12 First Class solar radiation sensor for just such solar energy test applications; this sensor meets or exceeds the ISO-9060 Standard performance mandate for a First Class pyranometer specific to "solar energy test applications". It is available in Australia through MEA.

Rainbow Software

MEA sells a powerful image analysis system from Delta-T in the UK with the odd name of 'WinDIAS 3'. The full system allows the rapid analysis of leaves by automatically measuring leaf area and a number of other leaf features such as perimeter, length and width. The traditional use of the WinDIAS 3 software is for calculating the percentage of diseased leaf area, making it ideal for plant pathology, agronomy, plant physiology and forestry.

However, with a bit of lateral thinking the software can be put to all manner of uses; all you need is a digital image and some imagination. Examples include: -

1. Work out the area of leaf that has been eaten by insects.

2. Work out the % of fat on a piece of bacon or the % of orange and black on a butterfly.

However, with a bit of lateral thinking the software can be put to all manner of uses; all you need is a digital image and some imagination

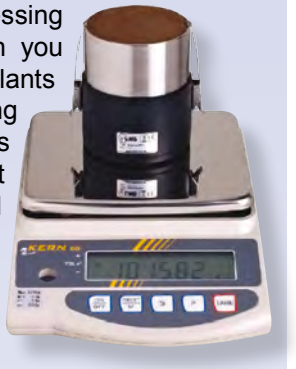
3. Work out areas/uniformity of insect eggs and perform a count on clusters.

4. Calculate the area of insect instars as they grow.

And who in MEA understands all this complicated stuff? Our own Sonja, of course!

Characterising Soil Moisture Release Curves

If you don't know what a 'soil moisture release curve' (SMRC) is, then you're probably not in the soils business and might care to skip on the next story.



But if you have spent your life messing about growing things in soil, then you would know that different soils treat plants differently when it comes to giving up their stored soil moisture. This is characterised by the classic plot of soil moisture content versus soil moisture tension, which essentially tells you how hard plant roots have to work to extract various amounts of water from a particular soil.

If you don't have a soils lab – and very few of us do – then there is now a simple way of figuring this out, using a Hyprop© apparatus (UMS, Germany) to determine pF-curves and the unsaturated hydraulic conductivity of soil samples from standard 250 ml soil sampling rings. Again, call Sonja at MEA for more information.

On the Road Again

Over the next 6 months, MEA's hard-working marketing team, agents and resellers will be 'all over the place' at exhibitions and field days across the country, showing off MEA's and our supplier's innovative products.

Some of the dates, places and names are as follows: -

11 February - Precision Agriculture Expo in Swan Hill, Vic - Tanya, Sonja and MEA Agent Jeff Mitchell from Vine Science.

18 to 20 February - Seymour Alternative Farming Expo in Seymour, Vic, MEA Agent Tim Brown from MSAS Enterprises.

16 to 17 March - Australian Nut Conference in Sydney - Sonja.

18 to 19 March - South East Field Days in Lucindale, SA - Tanya and MEA Reseller Tim Powell from Advantage Ag.

14 to 16 April - AusVeg in Brisbane - Tanya.

02 to 04 May - Clean Energy Council in Melbourne - Tanya and Andrew.

05 to 06 May - National Vege Expo in Werribee, Vic - Tanya and Sonja.

13 to 15 May - Fruit Growers Tasmania in Hobart - Sonja and MEA Agent Geoff Dell from ServeAg.

03 August - National Apple and Pear and Cherry Conference in Adelaide - Sonja.

We are always keen to get out and meet with the people who will benefit most from the use of our gear, so if you are organising an exhibition or field day and think that MEA would be 'right' for your event, give us a call and talk to Tanya.