Advanced Cropping Systems with Controlled Traffic. A Nuffield Scholar's Experience

Mark Branson, B.AppSc (Agric) NSch – Farmer

BACKGROUND INFORMATION:

Property: 1200 Ha Owned at Stockport and Giles Corner, Lower North of S.A.
Rainfall: 425 to 500mm, Predominately winter rainfall.
Paddock Sizes: From 20ha to 70ha.
Crops Grown: (80%). Durum and Bread Wheats, Malting and Feed Barleys, Canola, Faba Beans, and Field Peas.
Sheep (20%).
Self-replacing merino flock, Hazeldene bloodline, Old ewes put over Poll Dorset Ram – 1st cross lambs.

CONTROLLED TRAFFIC – MATCHING OPERATING WIDTHS

- Started on my farm by matching tractor tracks with boomspray to spray Fungicides on Beans in 1997 when I started tramlining.
- Used DGPS guidance first in 2002 when purchasing a KEE ZYNX controller to an Omnilite 132 5Hz DGPS receiver.
- With the purchase of a new airseeder I matched all in crop machinery to track on 2.2m wheel spacings, with the airseeder 1/3 the width of the boomspray and urea boom.

KEE TRIMBLE – RTK AUTOSTEER ON JD 8200 TRACTOR

- +/- 2cm Repeatable Accuracy.
- Base Station on the tallest most central hill on the farm. Powered by Solar Panels and Deep Cell Batteries.
- DGPS Receiver (Duel Frequency).
- Bigfoot – 3 Gyros, 3 Accelerometers that keep the YAW, ROLL, and PITCH adjustments in order. Guaranteed to keep you straight on uneven rolling ground.
- Uses 2 VHS radios to communicate between the base station and the tractor.
- Accurate to 10km, but VHS signal travels 35km.

AUTOSTEER IN CONTROLLED TRAFFIC – THE OPPORTUNITIES

Canopy Management

- Later N Applications
- Later Fungicides
- Use of Growth Regulators

Night Spraying

- Ability to sow and spray when wet.
- Complimentary to Precision Agriculture
- Easier driving – Less fatigue

CONTROLLED TRAFFIC - THE BENEFITS

- Improved soil health through reducing compaction.
- Decreasing crop inputs by 5 to 8%.
- Decreasing diesel usage by up to 25%
- Increasing crop yields by 5 to 15%
- Grain quality increases by having better soil structure

NUFFIELD SCHOLARSHIP

"Using Precision and Conservation Agriculture to Improve Farm Profits and the Environment"

Last year Mark completed a Nuffield Scholarship spending 18 weeks travelling the world looking at where Australia fits into world agriculture, Precision agriculture, High input farming, and Conservation agriculture involving No-till and Controlled traffic. This scholarship was sponsored by GRDC. The countries travelled included New Zealand, USA, Canada, UK, Belgium, Scotland and France.

WHAT DID I LEARN?

- Agriculture land throughout the world is extremely variable.
- Environmental issues caused by agriculture need addressing.
- We need to become farmers of Carbon.

Carbon -

- Increases water holding capacity and use efficiency.
- Decreases soil erosion.
- Increases infiltration, which reduces runoff.
- Decreases soil compaction.
- Increases soil tilth and structures.
- Decreases fertilizer inputs.
- Increases nutrient cycling and storage.
- Increases absorption of pesticides.
- Increased capacity to handle manure and other wastes.

Solution: No-till, growing high carbon crops, and stubble retention.

We need to remove compaction from our soils.

Compaction -

- Decreases yields by 5% to 15% depending on soil type.
- Decreases water infiltration
- Decreases nutrient uptake by the roots.
- Decreases carbon cycling in the soil.
- Increases soil erosion.
- Increases the chance for nutrient loss from the land.
- Increases the chance of waterlogging.

Solution: Controlled traffic.

CONTROLLED TRAFFIC AROUND THE WORLD

In the UK the are into tramlining instead of CT. They use 4 wheel steer sprayers in their system, both self-propelled and trailers to reduce crop damage on the corners.

At Silsoe Research Centre I saw a tillage machine, which uses a camera set-up to visually cultivate between green wheat rows and saw potential in this technology to use in CT systems in inner row spraying or other inner row weed control. This was called the ROBOCROP Vision Guidance System.

I saw a RTK CT system at Clay Mitchells farm in Iowa, USA where he strip crops Corn and Soybeans using the sun's angle to give his Corn a 20% yield advantage. He also runs a self-propelled sprayer, which uses auto section cut-off on 35 sections at RTK accuracy.
In North America I saw many types of crop dividers on sprayers, which are used in spraying summer crops.

In the USA I saw very good contract sprayer systems.

PRECISION AGRICULTURE IS A REALITY

Phosphorus: If adequate, place in the soil at replacement rates derived from the previous years yield maps.

Nitrogen: Use management zones to determine yield expectations within the paddock, and in season sensors to variable rate according to how the canopy is looking at the time of application.

Nitrogen Budgeting: A major problem in working out how much is coming from the soil through mineralization.

Solution.
- Plant Root Simulation Probes (PRS ®)
- NVDI scanning N-Rich strips and farmer paddock practice to allow the plants to tell the N recommendation.

Profits can fall short if any nutrient is short.

REMOTE SENSING

Aerial Imagery: Multi and Hyper spectral cameras measuring and mapping different bands of information taken from aircraft.

Satellite: EADS Astrium's Farmstar from France.
- Measures: Chlorophyll and Leaf Area Index (LAI).
- Agronomic Models: Plant population, Biomass, N status of the crop.
- Recommendation Maps: Tiller density, Lodging risk, N application maps.
  A powerful remote sensing and agronomy package.

GROUND N SENSORS:

Yarra N Sensor – Old
- Measures biomass and Chlorophyll.
- Uses ambient light as it's light source.
- It is used for post N, Fungicides, Plant Growth Regulators, and Defoliants.

- It increases the harvestability of the crop through evening up maturity.
- Profits in Germany = A$90/ha.
- Estimated profits in Australia (using Yarra's model) = A$28/ha.

Yarra N Sensor – New 2006 model.

- Uses its own light source.
- Uses a windows interface.
- Uses wireless instead of cables.

Greenseeker ® - Measures NVDI.

Model RT100

- Used to work out a standard N rate for a paddock or zone.
- Need to put down a N rich strip to compare standard paddock N, and a area where N is not limiting.
- Need to work out algorithms for Australia, work being done in WA and NSW.
- Excellent agronomic work has been done out of Oklahoma State University.

Model RT200

- 6 Greenseeker sensors on a boom used to average NVDI across boom.
- Uses its own light source.
- Has good agronomics in Oklahoma, USA.
- Virginia, USA and Canada have research projects looking into developing algorithms for their growing areas.

Crop Circle ® - Measures NVDI and other crop reflectance indexes.

- Has its own patented light source, both NIR and Visible, mimicking natural light.
- 3 models – Yellow/NIR, Orange/NIR, Red/NIR.
- Single sensor at the moment.
- Are developing an on-the-go N rate package (release 2007) and 8 sensor, GPS offset, mapping system at the moment.

Other Precision Ag. Sensors.

- On the go pH sensors for liming, - Verris, - Aust. Centre for P.A.
- On the go protein sensor for N budgeting, - Zeltex AccuHarvest sensor.
- Electronic Conductivity sensors for soil mapping, - EM38, - Verris, - GEOCARTA.

CONCLUSION

The Nuffield Scholarship was a wonderful experience that will stay with me forever.

Australia is a world leader in controlled traffic work and adoption but there is still work to be done in making the soil benefits better defined, and in steering implements in undulating country to inner row sow.