

Management

BCG Farming Systems - 2000 Season

SUMMARY

The farming systems trial is in its first full year of operation and has collected base line information so that the effects of each farming system on soil characteristics, weed composition and disease burden can be assessed as the trial progresses. At the beginning of the trial soil disease levels were relatively low across the trial area. Weed composition in each paddock has been recorded and the major weeds identified were fat hen, wild oats, ryegrass and silver grass. Boron, chloride and exchangeable sodium concentrations across the trial are variable at depth but the majority of paddocks have toxic concentrations at 40cm. A soil microbial survey found the soil across the trial area has good levels of organic matter and an active microbial community.

The harvest yield results have shown variations between the farming systems at this early stage. Wheat yields varied from 2.2t/ha to 4.5t/ha. The main reason for the difference in wheat yield was due to fallowing. Field peas, canola, lentils and faba beans yielded less than 1t/ha and had very poor water use efficiency (less than 6kg/mm). As the trial progresses all these factors will continue to be monitored.

BACKGROUND

Farming systems in the southern Mallee and northern Wimmera are diverse and discussion is focused on which system is most sustainable in bio-physical considerations and economic return. The BCG Systems project has been established to clarify the issues of:

- (i) disease and weed seed-bank resulting from different farming systems,
- (ii) cultivation versus zero tillage,
- (iii) fallowing versus continuous cropping,
- (iv) role of livestock in sustainable profitability,
- (v) stability of rotations which include pulses versus those which are cereal based, and
- (vi) heavy grazing effect on soil structure and long term cropping productivity.

Four farm groups with individual champions are representing each of the main farming systems under study:

- (i) *Zero Tillage* - Alan Postlethwaite (continuous cropping, including a wide range of pulses in the rotation, stubble retention, no tillage, wide row sowing, banding fertiliser, no sheep)
- (ii) *Minimum Tillage* - Brad Martin, Brim Technology Group (continuous cropping, some tillage, burning stubble when required, pulses in the rotation, sheep when appropriate)
- (iii) *Fuel Burners* - Paul Barclay (conventional system including tillage, little or no stubble burning, low pulse intensity, fallowing for moisture)
- (iv) *Hungry Sheep* - Ian & Warrick McClelland (high intensity farming with livestock and cropping, no fallowing, tillage prior to cropping, pulses included in the rotation)

Thirty two plots (approx. 1 ha each) have been established, fenced and water for livestock is supplied. Each farming system is represented by five plots (for a total of 20 plots), the remaining 12 plots are taken up by a Standard Rotation, which is a replicated four year rotation of fallow, canola, wheat and field peas. The Standard Rotation was established to measure spatial variability across the site.

METHODS

The thirty-two system plots are managed according to the direction of each of the champions. Measurements of soil characteristics, deep soil N, soil water, weed seeds in the soil, soil disease levels (using the DNA test), soil organic matter and biological activity were all taken prior to sowing in 2000. In crop assessments of growth, weeds and crop diseases were also undertaken during the season. All inputs were recorded and gross margins were calculated.

The crops grown in each system were:

- (i) Zero Tillage - canola, wheat, barley, fababeans and lentils (20% each)
- (ii) Minimum tillage - wheat (40%), barley (20%), lentils (20%) and medic fallow (20%)

- (iii) Fuel Burners - field peas (20%), wheat (40%) and fallow (40%)
- (iv) Hungry Sheep - wheat (60%), lentils (20%) and medic pasture (20%)

RESULTS

(i) rainfall

The 2000 growing season rainfall was 256mm, which was average for the season. Late in the season the crops not on fallow were severely stressed for moisture.

(ii) soil characteristics

Disease levels prior to sowing:

Soil samples were analysed using the DNA testing procedures: Take-all was detected in low to moderate levels in seven plots all of which were in a cereal in 1999. *Pratylenchus neglectus* was detected in moderate levels in five plots (all of which were wheat in 1999). Eelworm, rhizoctonia and *P. thornei* was either not found or only present in very low levels.

Weed seed in the soil prior to sowing: The major weeds detected were fat hen, wild oats, ryegrass, medic and silver grass.

Soil boron, chloride and sodicity: Toxic levels of boron, chloride and sodicity were found across the site at depths ranging from 30 to 60cm.

Soil organic Carbon and soil microbial activity: Organic Carbon in the topsoil (0-5cm) ranged from 0.9 to 1.3%. The microflora identified were:

- microbes able to solubilize bound phosphate in alkaline conditions.
- microbes able to fix nitrogen.
- bacteria and fungi able to decompose crop residues in the soil environment.
- microbes able to oxidise ammonium and nitrite forms of nitrogen.

Across the site the soil had good levels of organic matter and an active microbial community.

(iii) in crop measurements

Cereal diseases: Eelworm, Take-all and *Pratylenchus neglectus* was detected on the roots of wheat and barley sown in 2000. The extent of damage ranged from very low to moderate. The level of infection was not related to the DNA test result undertaken prior to sowing. There was no visible sign of soil disease in the crops during the season.

Pulse and oil seed diseases: *Altenaria* was the only disease identified in canola in 2000. The fababeans had low levels of infection of ascochyta and chocolate spot and were treated with a fungicide.

Weeds in crop: The major weeds present during the growing season were mustard, wild oats, ryegrass, medic and skeleton weed. The plots were sprayed with the appropriate herbicide.

The Fuel Burners and Hungry Sheep systems had the lowest number of weeds present (ryegrass and wild oats at less than 2 plants/m²). The Reduced Till and Zero Till systems had a higher weed population with up to 8 wild oat plants/m².

(iv) harvest results

Wheat yields ranged from 2.2 t/ha of Frame on faba bean stubble in the Zero till plots to 4 t/ha of Silverstar on fallow in the Fuel Burners. Barley in the Reduced Tillage and Zero Tillage systems was affected by boron toxicity during the dry period in early October, and yielded poorly at 2 t/ha at feed quality (due to high protein). Field peas, canola, lentils and faba beans all suffered from the dry conditions and yielded less than 1 t/ha.

The gross margin returns for the 2000 season were:

	Average gross margin \$/ha
Zero Tillage	59
Reduced Tillage	161
Fuel Burners	199
Hungry Sheep	284

INTERPRETATION

As expected, in a dry season, the wheat crops grown on fallow performed very well (up 4.0 t/ha) whilst the wheat on stubble yielded 2.0 t/ha. The lentils sown in May in the Zero Tillage and Reduced Tillage systems were of poor quality due to a large rainfall event during seed set in early November, whilst the lentils sown in the Hungry Sheep system were sown in June and survived the wet period in November and were of good quality. Barley was affected by boron toxicity and yielded poorly and was only feed quality.

The results of the weed survey, soil disease levels, microbial activity and soil organic matter were base line data only and will be used to see what changes occur under each system over time.

This was only the first year for the Systems Trial and the information should be seen in that light. It will take a number of years for the different systems to settle in.

The BCG Farming Systems trial would not be possible without the valued sponsorship of Grain Growers Association Ltd., CASE, Cyclone,Hardi and DNRE.