4.3 Increasing farmer knowledge and skills in stubble management systems in south west Victoria - Dunkeld, Vic

CARING FOR OUR COUNTRY

Take home messages:

- No yield differences were observed between the incorporated stubble and the standing stubble plots despite differences being recorded in plant growth during the year.
- The dry spring conditions had an impact on grain yields with no significant difference observed between treatments

Location:
Dunkeld Research Site.

Funding:
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Researchers:

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- Craig Henson – Kelly & Henson, Dunkeld
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Background/Aim:
This project assists farmers in adopting improved stubble management practices by comparing the performance of two stubble systems – full incorporation and a no-till approach – to demonstrate the impacts of each system on soil health, water penetration and crop performance.

Stubble management is an ongoing bone of contention in the High Rainfall Zone with grain growers looking for cost efficient methods of dealing with stubble without having to resort to burning. Many growers have converted to stubble retention systems while others are shallowly incorporating the crop residue into the soil soon after harvest. Soil organic carbon levels are slow to improve under both systems and concern has been raised that soil health must be improved more rapidly if yields are to continue to improve.

Recent research by Dr Clive Kirkby from CSIRO Canberra has shown that it should be possible to increase the proportion of carbon rich stubble converted into more stable humus by the addition of extra nutrients prior to incorporation shortly after harvest. These nutrients are required by the soil's microbes to convert the crop residue into humus. Dr Kirkby's work has shown that humus is made up of a set ratio of carbon, nitrogen, phosphorus and sulphur. The hypothesis is that since Australian soils are naturally low in nitrogen, phosphorus and sulphur, this deficiency must be corrected if the maximum amount of carbon in the stubble is to be converted to humus.

This project is in the first year of investigating this hypothesis and comparing it with other stubble management systems and in particular examining the impact these systems have on the soil humus levels over a period of three to five years.

Rainfall:

Avg. Annual:	612.2mm Hamilton Airport 1991-2008
Avg. G.S.R.:	474.0mm Hamilton Airport 1991-2008
2008 Total:	453.2mm Dunkeld Research Site
2008 G.S.R.:	April – November = 298.1mm[1] (Dunkeld Research Site)

[1] Yield Potential: 1/3 of Dec (72mm), Jan (45.2mm) & Feb (11.4mm) with monthly totals above 20mm + 1/2 March (15.6mm) rainfall when total above 20mm + ((April – November rainfall) – 90mm*) x 20kg/mm/ha. In total December-March adjusted rainfall to stored soil water = 39.1mm, plus April-November = 298.1mm, minus evaporation factor* =>247.2mm. Therefore, for Dunkeld, the water limited yield should be 4.94t/ha, or 247.2mm x 20kg/mm/ha.

Cultivar: Bolac Wheat

Sowing rate: 100 kg/ha

Sowing date: 6th June 2008

Fertiliser:
MAP @ 100 kg/ha. Topdressed with 100 kg/ha of Urea

Treatments:
1. Common Practice (Control) – This year the control was standing stubble
2. Standing stubble
3. Standing stubble with additional nutrients applied after harvest
4. Incorporation soon after harvest
5. Incorporation with additional nutrients applied after harvest.

Yield potential: as per French-Schultz 4.94 t/ha

Plot size:
Dimensions, 12m wide x 286m long x 2 replicates with every third plot a control.

Paddock history:
2006: Pasture, 2007: Canola

Soil type: Medium clay

Soil nutrients:
pH (1:5 water) = 5.3
Organic Carbon (%) = 3.16
Phosphorus (P) = 41
Potassium (K) = 165
Sulphur (S) = 25.6

Above: Incorporating stubble

Above: Mountain backdrop

Above: Martin Peters and Mark Steele measuring soil moisture

Results and discussion:
Following the 2007 harvest, there was about 5 tonnes/hectare of canola stubble left in the paddock. It was determined that to break this down to humus it was necessary to add 60 kg/ha of nitrogen, 14 kg/ha of phosphorus and 10 kg/ha of sulphur.

This equated to 130 kg/ha of urea and 160 kg/ha of single super. (This actually provided 17.6 kg/ha of sulphur.)

The nutrients were applied to treatments 3 and 5 on February 21, 2008 and in the case of treatment 5 were incorporated on the same day with a He-Va Disc Roller.

At sowing on June 6, 2008 the canola stubble had broken down to about 560 kg/ha of dry matter under the standing stubble treatments and down to 140 kg/ha of dry matter where it was incorporated. There was no major difference between the breakdown of stubble where additional nutrients were or were not added.

Table 2: Agronomic results from 2008

Treatments	Emergence (plants/m²)	Tillers (stems/m²)	Head Counts (heads/m²)	Yield (t/ha)
Control (Common Practice)	160	731	527	4.17
Standing Stubble	160	712	548	4.06
Standing stubble with additional nutrients	152	773	564	4.26
Incorporation	155	803	646	4.53
Incorporation with additional nutrients	148	927	674	4.20
Least significant difference (LSD)	**30 not significant**	**30**	**91**	**0.53 not significant**
CV %	**9.5**	**1.9**	**7.6**	**6.1**

Emergence figures appeared to be low for all treatments but the Bolac Wheat compensated for that with all plots having acceptable tiller numbers. Significant differences were observed between tiller numbers, with the incorporated treatments having higher numbers than the standing stubble plots. Additional nutrients applied after harvest also produced significant increase in tiller numbers. The dry conditions during spring resulted in a reasonably high tiller mortality rate with the incorporated plots having higher head numbers just prior to harvest. However, this did not carry over to grain yield as there was no significant difference recorded between the yields of the different treatments.

The stubble load from the 2008 harvest was 8.5 t/ha and this was incorporated on February 4, 2009 with an additional 130 kg/ha of urea and 230 kg/ha of single super. This equates to 60 kg/ha of nitrogen, 20 kg/ha of phosphorus and 25 kg/ha of sulphur. It is envisaged that these nutrients will be needed by the microbes to convert the carbon in the stubble into humus. Soil samples have been taken and more will be taken just prior to sowing the 2009 crop to determine any changes in the soils organic carbon pool. As well, stubble loads prior to sowing will also be determined.

Summary:
At this stage after one year of work it is too early to make any recommendations regarding the differences between incorporation and retaining standing stubble plus the addition of extra nutrients after sowing. This trial will be ongoing for a number of years with comprehensive soil testing undertaken each year. In addition, weekly soil moisture measurements commenced late in the 2008 season. These measurements are being undertaken to determine the water use of crops grown under the different systems. Cost of adoption is not covered in this report and needs to be investigated over time, prior to investment in any new stubble management system.