Managing stubble and nutrition to increase soil carbon

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Key findings

- The addition of extra nutrients did not increase yield, therefore it is expected that more nitrogen, phosphorus and sulphur remained in soil to breakdown stubble.
- Tillage practices (removed, worked or standing) also have no effect on grain yield or quality in both years of trials.

Why do the trial?

Soil organic matter comes from the decay of plant material (eg. stubble) and animal waste and is made up of a number of different fractions which are more or less available in soil. Only the charcoal and humus fraction are regarded as permanent (slow to breakdown) in soil. The main reason for a grower to increase their soil humus level is to keep more carbon (C) stored when moving into an emerging carbon economy.

Research has shown that when trying to increase soil humus levels it not only about increasing soil C, but also other nutrients such as nitrogen (N), phosphorus (P) and sulphur (S). The problem is plant material such as stubble is primarily C with much smaller amounts of N, P and S. The aim of this trial was to add normal and higher amounts of nutrients (N, P and S) to different stubble managements (standing, worked and removed) to see if soil humus level would be increased.

How was it done?

Plot size	2.7 m x 12 m	**Crop type**	Fathom barley
Seeding date	7th June 2013	**Fertiliser**	Normal nutrition DAP (18:20) + Zn 2% @ 60 kg/ha High nutrition DAP (18:20) + Zn 2% @ 85 kg/ha, SOA (21:0:24) @ 4.5 kg/ha and urea (46:0) @ 11 kg/ha

Methods

The trial was a randomised complete block design with three stubble managements (standing, worked and removed), two fertiliser rates (normal and high) and four replicates.

The trial was established at Hart in 2012 and the same treatments were overlayed in 2013. Stubble load at the beginning of 2013 was 1.5 t/ha.

Results

In both 2012 and 2013 there was no difference in grain yield, protein, test weight and screenings for stubble management or nutrition analysed as an interaction or alone (Table 1 and 2).

Since there was no grain yield or protein increase for the high nutrient treatments the additional nutrients must have remained in the soil as they were not exported with the crop. The exact fate of these nutrients is unknown however, they potentially contributed to the formation of soil humus. Future analysis of soil humus content before and after two years of trials will reveal if this hypothesis is correct.

From an agronomic point of view there was no yield benefit in adding more N, P and S. If the soil tests results reveal an increase in soil humus there would be a benefit of adding extra nutrients under a C trading scheme.

Table 1. Grain yield, protein, test weight and screening levels for wheat grown in oat stubble at Hart in 2012.

Stubble	Nutrition	Grain yield t/ha	Protein %	Test weight kg/hL	Screenings %
Removed	High	2.05	11.9	78.5	3.6
	Normal	1.83	11.5	76.8	5.2
Standing	High	1.77	12.3	75.0	6.2
	Normal	1.69	11.6	76.3	5.7
Worked	High	1.76	12.1	75.9	7.0
	Normal	1.87	11.7	75.5	6.2
	LSD (P≤0.05)	ns	ns	ns	ns

Table 2. Grain yield, protein, test weight and screening levels for Fathom barley grown in wheat stubble at Hart in 2013.

Stubble	Nutrition	Yield t/ha	Protein %	Test weight kg/hL	Screenings %
Removed	High	5.89	12.9	63.9	6.3
	Normal	5.95	12.8	64.5	5.6
Standing	High	6.00	13.3	64.6	4.8
	Normal	5.82	12.4	65.5	4.2
Worked	High	5.88	12.9	64.6	6.4
	Normal	5.86	12.7	64.4	5.6
	LSD (P≤0.05)	ns	ns	ns	ns