The legacy effect of greenwaste compost application on crop performance in a long running UK field experiment (Poster Presentation)

D. Clarke*, N. Morris and E. Stockdale
NIAB, Morley, Wymondham, Norfolk. NR18 9DF, UK
*corresponding author: david.clarke@niab.com

Introduction

The New Farming Systems (NFS) soil amendments study is a long term study at Morley Farms, Norfolk, UK on an Ashley series (sandy loam) soil. The experiment is delivered through NIAB TAG, supported by The Morley Agricultural Foundation and the JC Mann Trust and guided by an independent steering committee. The aim of the experiment is to investigate the benefits and legacy effect of organic amendments on crop performance and soil physical, chemical and biological properties. This paper presents findings on the impact of four years (2008-2011) of 35t ha^{-1} greenwaste compost (referred hereafter as compost) application on wheat yields and soil organic matter (SOM). Wheat yields were higher for 7 out of the 10 years in plots receiving compost (*cf.* continuous wheat without compost), with a positive yield response still seen 6 years (2017) after the final compost application. Compost application has also given a recordable increase in SOM on these sandy loam soils.

Material and Methods

In autumn 2007 the amendment trial was established at Morley, Norfolk, consisting of 3 rotations with and without 35t ha^{-1} of compost (applied annually between 2008 and 2011) giving a fully factorial design made up of 6 treatments. The soil is a stagnogleyic argillic brown earth (Ashley Series) with sandy loam topsoil texture. The entire trial uses a disc and/or tine shallow non inversion (c.10-15cm) cultivation approach. Over winter, soil samples are taken and sent for laboratory analyses of SOM (0-10 and 10-20cm), available soil nutrients (P, K, Mg) (0-10cm) and soil mineral nitrogen (SMN) (0-60cm (post-harvest)). The laboratory testing practice for SOM switched during the study from wet oxidisation (2011-2013) to loss on ignition (2014-2016). Yield is measured using a Sampo plot combine with a minimum of one full cut per plot (2009 was hand harvested due to lodging). This paper presents the long-term results for yield (t ha^{-1}) and relative yield (%) for the continuous wheat rotation (mixture of spring and winter varieties) with and without compost. SOM data are presented as a % of dry matter and a relative % (*c.f* continuous wheat without compost).

Results and discussion

Across all years (omitting 2009 due to different harvesting method) the use of compost resulted in a significant mean yield increase of 6% (l.s.d 4.1%) in a continuous wheat rotation, with a positive yield response in seven out of the ten years (*Figure **1***). Yield responses of 11% and 10% in 2016 and 2017 respectively demonstrates a positive legacy effect which has lasted up to 6 years after the last compost application. In part, this is likely to be a response to increased soil nutrient content associated with amendment use. In 2016 extractable phosphorus, potassium and magnesium (0-10cm) were higher in the compost plots than those without compost. Increased levels of SOM have also been observed following the application of 4 years of 35 t ha^{-1} of compost (*Table 1*). Some caution must be taken when interpreting the SOM data due to the considerable variation across years i.e.

ranging from 2.3% to 5.2% in the compost treatment; this variation may be a result of sampling inconsistencies (e.g. different levels of residue in the sample), variations in trash distribution from cultivation, or variability resulting from laboratory analysis. SOM is important for sustaining soil fertility, improving structural resilience, improving aeration, increasing infiltration rates and allows the soil to store more water (Morris *et al*. 2010). In 4 out of the 5 years sampled SMN in plots with compost (*cf.* without compost) was less than 15 kgN/ha higher. All treatments receive optimum N fertilizer rates for yield (220kgN/ha for winter wheat) therefore this small increase in SMN is unlikely to affect yield considerably.

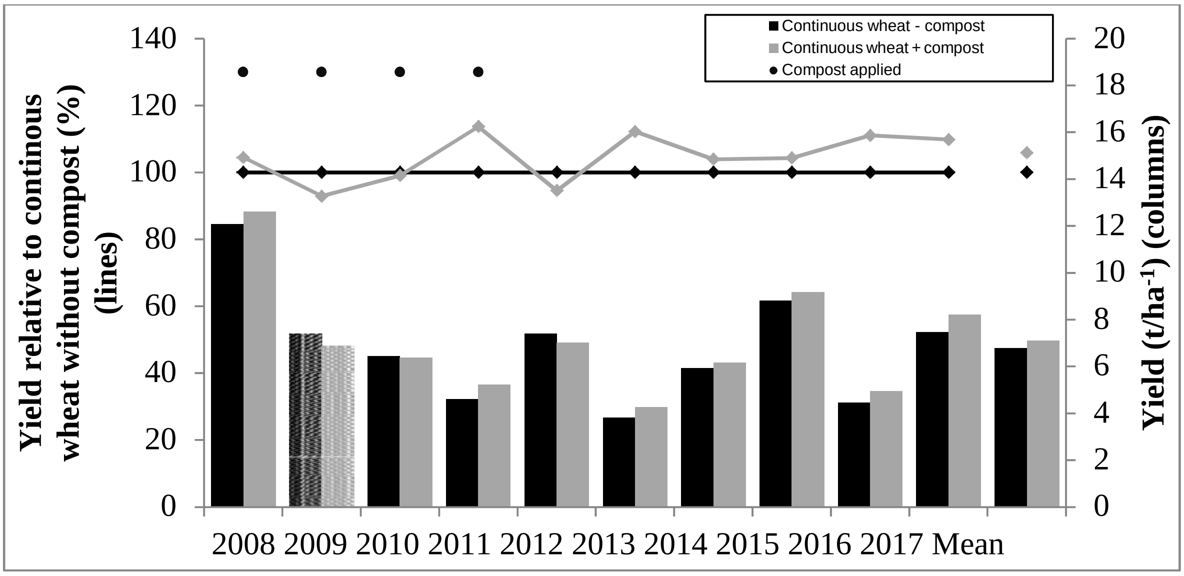

Figure 1. Yields (%) for the continuous wheat with compost relative to continuous wheat without compost (line and points) and yield (t/ha^{-1}) for the continuous wheat with and without compost treatment (columns). Compost was applied annually from 2008 until 2011. Mean excludes 2009 due to different harvesting method

Table 1 Soil Organic Matter (% of dry matter (0-10cm)) and relative increase compared with the use of compost in a continuous wheat rotation

	SOM % of dry matter (0-10cm)						
Treatment	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Mean**
Continuous wheat without compost	1.7	1.4	4.1	2.5	3.4	2.5	2.8
Continuous wheat with compost	2.3	2.8	5.2	2.9	4.8	3.2	3.8
Increase in SOM with compost application (%)	35	100	27	16	41	28	41

Conclusions

Findings suggest that repeated applications of 35t ha^{-1} compost can significantly improve yields in a continuous wheat rotation for at least 6 years after the final compost application. This yield response is likely a result of a combination of higher levels of available nutrients (phosphate, potassium and magnesium) and benefits from increased SOM.

The authors would like to acknowledge the support of The Morley Agricultural Foundation and the JC Mann trust for their support of the New Farming Systems Project.

References

Morris,N., Miller,P., .Orson,J. and Froud-Williams, R.(2010) The adoption of non-inversion tillage systems in the United Kingdom and the agronomic impact on soil, crops and the environment – A review.. *Soil and Tillage Research* **108**: *pp. 1-15.*