Compost in windrows before field application (Nick Corp)

Organic matter application to enhance soil health (United Kingdom)

DESCRIPTION

The addition of organic matter, such as compost, to soils on farms can enhance soil health with benefits for soil organisms, soil structure, carbon sequestration and plant production.

Application of organic matter to soils, in the form of compost, helps enhance soil organisms and structure for improvements in overall soil health. This technology has been applied to 36 hectares of a 300 hectare organic arable farm that practices a rotation of 2 years grass ley, followed by a winter cereal and then two spring cereals with cover crops in the period between the two spring crops. The technology has been trialed in the south of England (Berkshire) where the average annual rainfall is around 690 mm and the soil is mostly gravel, silt and clay soil with low organic matter – making it challenging to cultivate.

The practice has been to import certified green waste compost to apply to fields on a rotational basis before the winter crop, as it requires more nitrogen than the spring crops. The application was planned for this period in the rotation as spring spreading can damage the soil through compaction after the winter crop has been harvested.

The sources of green waste varied, with 900 tonnes of composted PAS 100 certified green waste from a local waste company, and 500 tonnes of green waste from a local camomile producer, both in 2019/2020. The compost was stored in windrow heaps for 6 months on the grass leys turning once during this time. For the application, a contractor then used a spreader before soil cultivation for the winter crop. This technology is ongoing.

The primary aim of the application of organic matter is to improve soil fertility and the soil's health. This in turn results in better crops.

Challenges to overcome with this technology are issues with compaction from spreading activities and the cost of compost purchase and haulage. Compaction can be alleviated through autumn spreading, yet costs can be prohibitive. So, far the benefits of the technology application are limited as it will take a long time achieve the full impacts of increasing soil organic matter, especially in the soil type that is present on the farm, yet the hope is it will have a large impact in the future.

LOCATION

Location: Reading, Berkshire, United Kingdom

No. of Technology sites analysed: single site

Geo-reference of selected sites
- -1.17672, 51.37333

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: No

Date of implementation: 2019

Type of introduction
- ✓ through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions

Compost in windrows before field application (Nick Corp)

Field of rye with compost application (Nick Corp)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose
- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact

Land use
Land use mixed within the same land unit: No

Cropland
- Annual cropping: cereals - oats, cereals - rye, cereals - wheat (spring), cereals - wheat (winter), fodder crops - grasses

Number of growing seasons per year: 1
Is intercropping practiced? No
Is crop rotation practiced? Yes

Water supply
- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

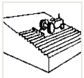
Purpose related to land degradation
- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed


physical soil deterioration - Pc: compaction

biological degradation - Bl: loss of soil life

SLM group
- integrated soil fertility management

SLM measures


agronomic measures - A2: Organic matter/ soil fertility

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated: per Technology area (size and area unit: 36 hectares)
- Currency used for cost calculation: £GBP
- Exchange rate (to USD): 1 USD = 0.85 £GBP
- Average wage cost of hired labour per day: £150

Most important factors affecting the costs
The cost of contractor haulage and spreading, which is partly driven by current fuel costs.

Establishment activities
1. Procurement of compost (Timing/ frequency: Spring)
2. Application of compost (27.4t/ha) (Timing/ frequency: Autumn)

Establishment inputs and costs (per 36 hectares)

Specify input	Unit	Quantity	Costs per Unit (£GBP)	Total costs per input (£GBP)	% of costs borne by land users
Fertilizers and biocides					
Compost purchase, haulage and spreading (£11 per tonne)	ha	36.0	303.0	10908.0	100.0
Total costs for establishment of the Technology				**10'908.0**	
Total costs for establishment of the Technology in USD				*12'832.94*	

Maintenance activities
n.a.

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 693.0

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [x] moderate (6-10%)
- [x] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [x] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: both ground and surface water

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [x] Yes
- [ ] No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [x] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [x] leased
- [ ] individual

- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [x] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [x] individual, not titled
- [ ] individual, titled

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

		1	2	3	
health	poor			✓	good
education	poor			✓	good
technical assistance	poor			✓	good
employment (e.g. off-farm)	poor			✓	good
markets	poor			✓	good
energy	poor			✓	good
roads and transport	poor			✓	good
drinking water and sanitation	poor			✓	good
financial services	poor			✓	good

IMPACTS

Socio-economic impacts

		1	2	3	4	5	6	7		Comment
Crop production	decreased				✓				increased	Yield remains the same, yet this could be offset by any loss linked with organic conversion. Difficult to quantify at this time.
crop quality	decreased				✓				increased	Quality remains the same, yet this could be offset by any change linked with organic conversion. Difficult to quantify at this time.
expenses on agricultural inputs	increased		✓						decreased	More expensive technology than conventional fertilisers

Socio-cultural impacts

Ecological impacts

		1	2	3	4	5	6	7		Comment
excess water drainage	reduced					✓			improved	Improved soil water infiltration evident
soil moisture	decreased					✓			increased	Slightly improved moisture capacity of soil evident and will improve long-term
soil crusting/ sealing	increased					✓			reduced	Slightly reduced soil crusting evident and will improve long-term
soil compaction	increased					✓			reduced	Slightly reduced soil compaction with more soil air space evident and will improve long-term
nutrient cycling/ recharge	decreased						✓		increased	Improvements in available soil nutrients
soil organic matter/ below ground C	decreased					✓			increased	
emission of carbon and greenhouse gases	increased				✓				decreased	Increased potential for carbon sequestration with addition of carbon rich green waste

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

		1	2	3	4	5	6	7	
Short-term returns	very negative					✓			very positive
Long-term returns	very negative							✓	very positive

Benefits compared with maintenance costs

		1	2	3	4	5	6	7	
Short-term returns	very negative							✓	very positive
Long-term returns	very negative							✓	very positive

CLIMATE CHANGE

Gradual climate change

		1	2	3	4	5		
annual temperature increase	not well at all				✓		very well	
annual rainfall increase	not well at all				✓		very well	
seasonal rainfall increase	not well at all						very well	Season: winter Answer: not known

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ✓ single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- 0-10%
- 11-50%
- 51-90%
- ✓ 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

To which changing conditions?

- climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Good fertiliser option for organic system
- Improvements in soil health will benefit farm for many years

Strengths: compiler's or other key resource person's view

- Sustainable method of soil health improvements and crop fertilisation

Weaknesses/ disadvantages/ risks: land user's view → how to overcome

- Relatively expensive to implement → The farm is organically certified so costs offset from higher organic food prices as this technology fits within certification. Additional farm subsidy to support technology would also be beneficial in the future if policy changes.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome

- Expense to implement → Recognition through farm subsidy
- Have to take a long-term approach, this is not a quick fix → Set a long-term sustainability and soil health plan for repeated application management

REFERENCES

Compiler
Alan Radbourne

Reviewer
Rima Mekdaschi Studer
William Critchley

Date of documentation: July 1, 2021

Last update: Aug. 16, 2021

Resource persons
Karen Fisher - land user
Nicholas Corp - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5968/

Linked SLM data
n.a.

Documentation was faciliated by
Institution

- Soil Association (Soil Association) - United Kingdom
- UK Centre for Ecology & Hydrology (CEH) - United Kingdom

Project

- European Interreg project FABulous Farmers