



Agenda

1. Update on trial setup this year, treatment observations and how the crop is progressing - for each trial field.
2. Results from spring earthworm and soil assessments per trial field.
3. Soil pits - methods for assessing rooting/earthworm burrowing.
4. Harvest plans.
5. Future plans for group.

Deeper rooting field lab

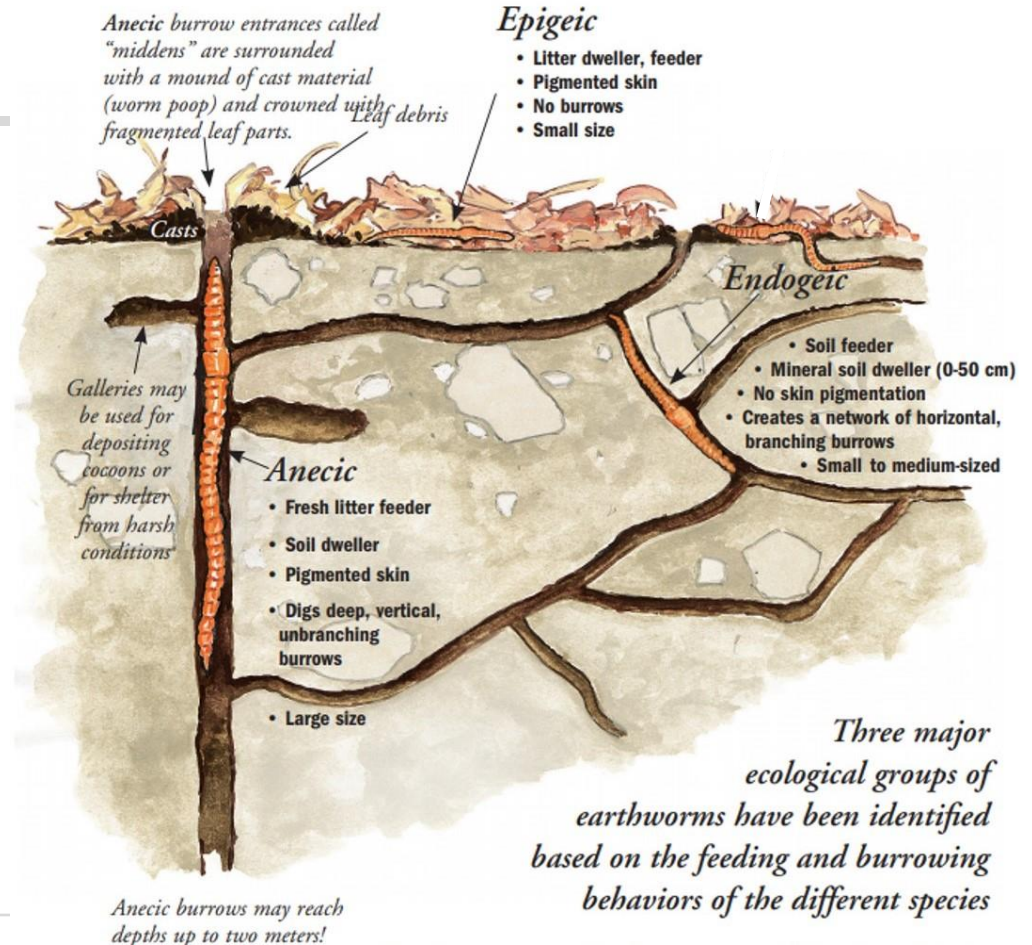
- Testing the impact of soil management on yield and rooting through encouraging deep burrowing earthworms
- Comparing manure and cultivation treatments and impacts on earthworms, crop rooting depth and yield



Field lab 2019: Growers: Rob Fox, Joe Pell, Rory Lay and Andrew Wilson, ADAS: Charlotte White, Anne Bhogal and Daniel Kindred

Deeper rooting field lab

- Testing the impact of soil management on yield and rooting through encouraging deep burrowing earthworms
- Comparing manure and cultivation treatments and impacts on earthworms, crop rooting depth and yield



Rory Lay: field trial



	Treatment
1	Strip till + FYM (farm standard)
2	Strip till (no FYM)
3	Deep cultivation (no FYM)
4	Deep cultivation + FYM

Crop: OSR

Basic soil type: Sandy clay loam

Joe Pell: two field trials

Basic soil type: Silty clay loam



P3: OSR



P22: Spring Barley

Rob Fox: field trial



Cultivation treatments:





















- Direct drill
- 5 cm cultivation
- 15 cm cultivation
- 30 cm cultivation

Crop: spring beans

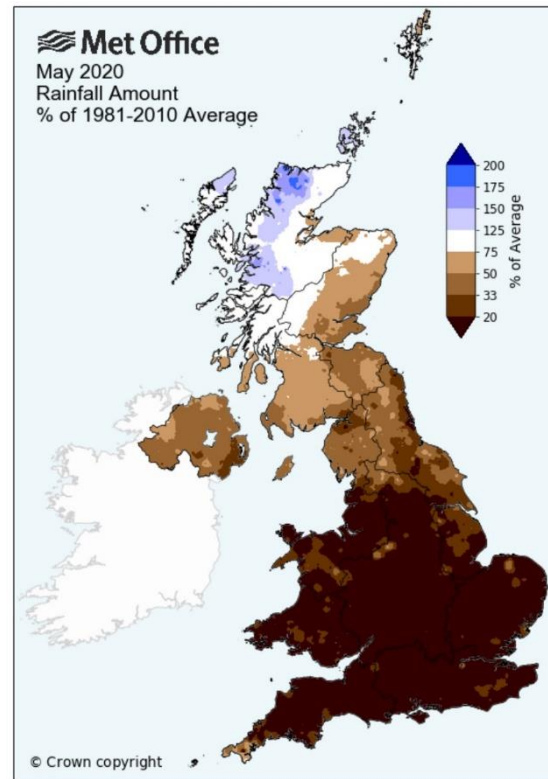
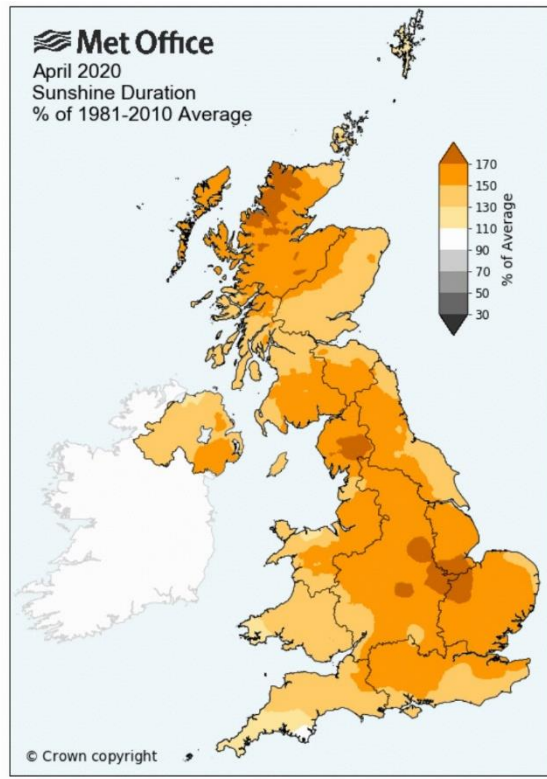
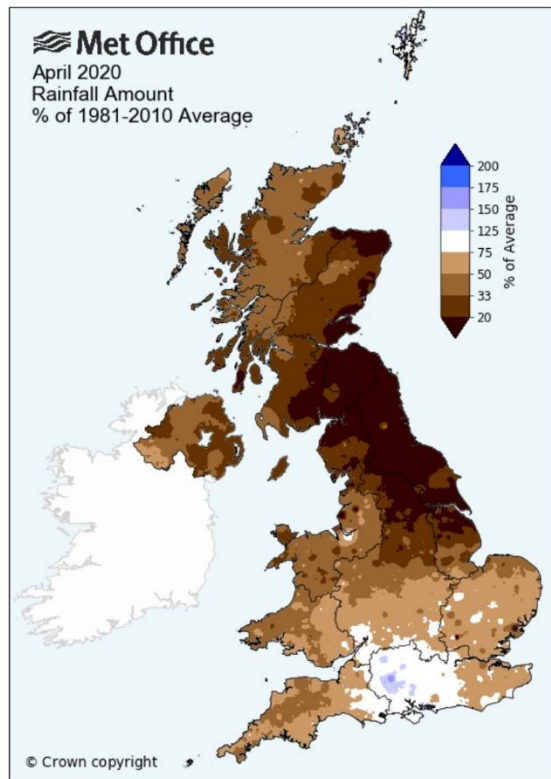
Basic soil type: heavy clay

Spring assessments 2020

- Earthworms:
 - Counts (total and number anecic, endogeic, epigeic and juvenile)
 - Midden counts
- VESS soil assessments
- Soil strength at depth
- Soil properties:
 - pH
 - Extractable P, K, Mg
 - SOM (Loss on ignition and CO₂-C burst)

Structure quality	Size and appearance of aggregates	Visible porosity and Roots	Appearance after break-up; various soils	Appearance after break-up; same soil different tillage	Distinguishing feature	Appearance and description of natural or reduced fragment of ~ 1.5 cm diameter
Sq1 Friable Aggregates readily crumble with fingers	Mostly < 6 mm after crumbling	Highly porous Roots throughout the soil			 Fine aggregates	 The action of breaking the block is enough to reveal them. Large aggregates are composed of smaller ones, held by roots.
Sq2 Intact Aggregates easy to break with one hand	A mixture of porous, rounded aggregates from 2mm - 7 cm. No clods present	Most aggregates are porous Roots throughout the soil			 High aggregate porosity	 Aggregates when obtained are rounded, very fragile, crumble very easily and are highly porous.
Sq3 Firm Most aggregates break with one hand	A mixture of porous aggregates from 2mm -10 cm; less than 30% are <1 cm. Some angular, non-porous aggregates (clods) may be present	Macropores and cracks present. Porosity and roots both within aggregates.			 Low aggregate porosity	 Aggregate fragments are fairly easy to obtain. They have few visible pores and are rounded. Roots usually grow through the aggregates.
Sq4 Compact Requires considerable effort to break aggregates with one hand	Mostly large > 10 cm and sub-angular non-porous; horizontal/platy also possible; less than 30% are <7 cm	Few macropores and cracks All roots are clustered in macropores and around aggregates			 Distinct macropores	 Aggregate fragments are easy to obtain when soil is wet, in cube shapes which are very sharp-edged and show cracks internally.
Sq5 Very compact Difficult to break up	Mostly large > 10 cm, very few < 7 cm, angular and non-porous	Very low porosity. Macropores may be present. May contain anaerobic zones. Few roots, if any, and restricted to cracks			 Grey-blue colour	 Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are visible usually.

Spring assessments 2020



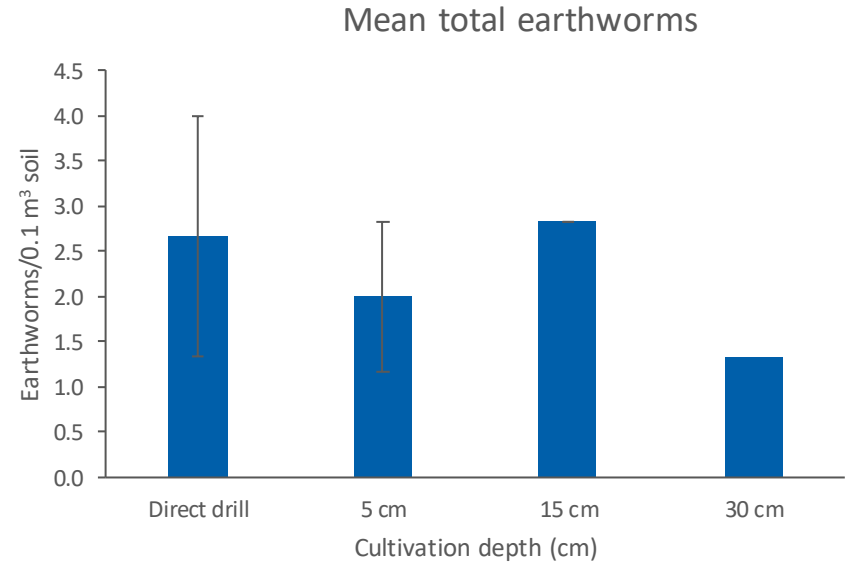
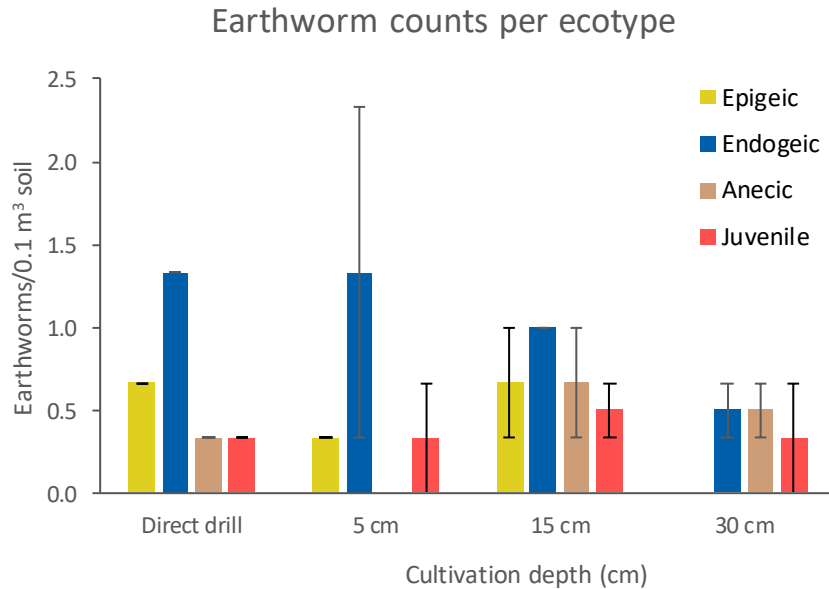
Dry April: Only of 40% average UK rainfall

Sunniest April on record

Sunniest May on record

Driest May in England (17% average rainfall)

Rob Fox – earthworms



Replicate sampling pits each of 0.1 m³ soil (20 x 20 x 25 cm soil blocks)

No earthworm middens found

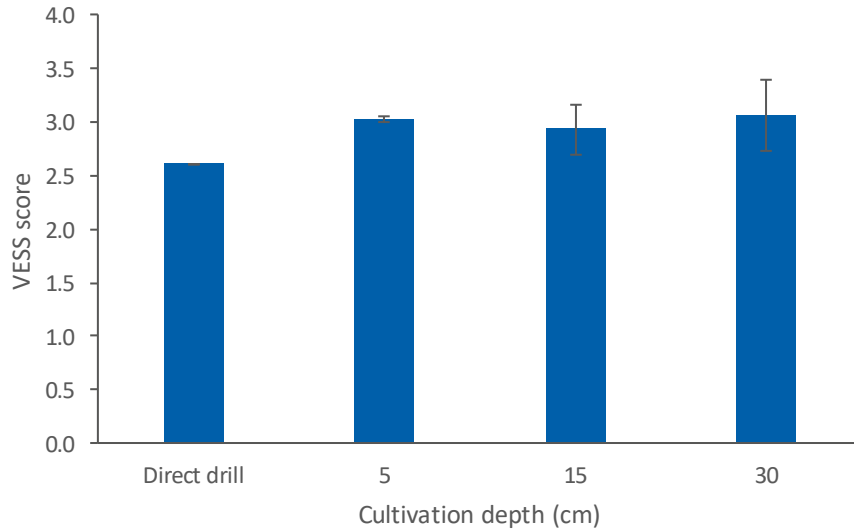
No significant difference in total earthworm numbers or between ecotypes

Cultivation treatments (n=2), Direct drill (n=1)

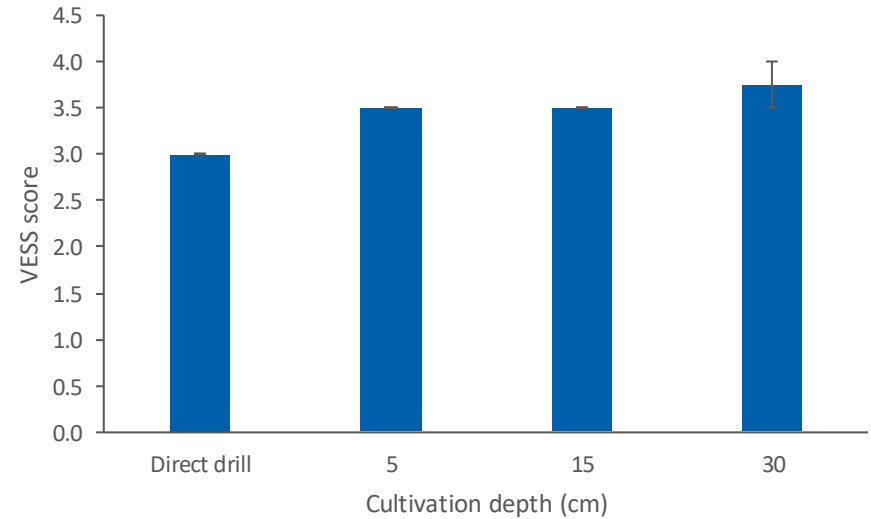
Error bars are ±1 standard deviation

Rob Fox – soil properties

Topsoil VESS: average block score



Topsoil VESS: average limiting layer score

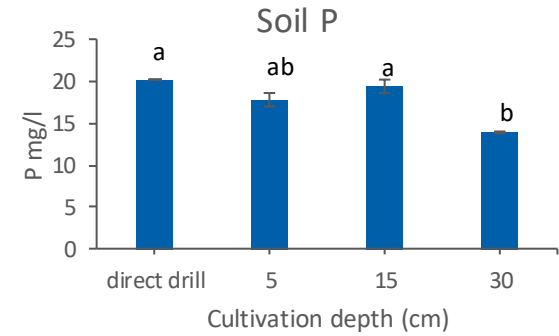
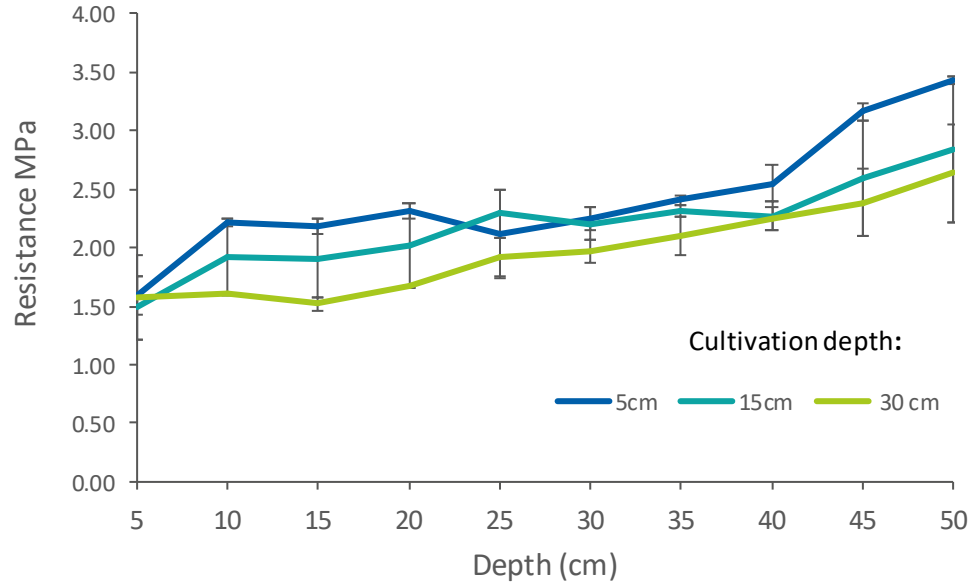


No significant difference between average block scores or limiting layer scores

Cultivation treatments (n =2), Direct drill (n=1)
Error bars are ±1 standard deviation

Rob Fox – soil properties

Penetrometer resistance



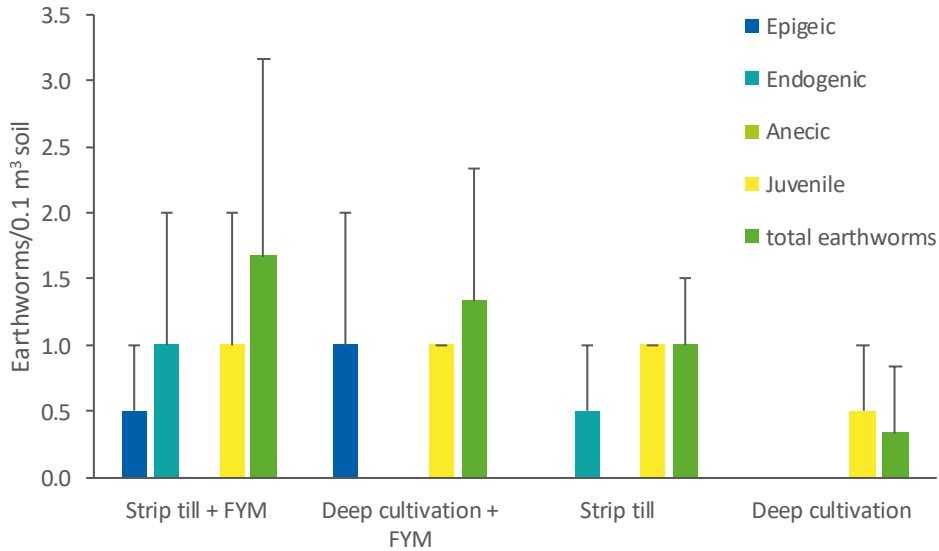
	direct drill	5 cm	15 cm	30 cm
pH	8.0	7.4	7.4	7.7
P mg/l	20.2	17.8	19.4	13.9
K mg/l	205	208	164	162
Mg mg/l	810	623	688	785
SOM % LOI	4.8	4.5	4.2	4.5
CO ₂ -C mg/kg	79	107	90.5	83.5
PMN mg/kg	59.4	50.6	25.8	52.7

Cultivation treatments (n=2)
Error bars are ±1 standard deviation

Rory Lay – earthworms

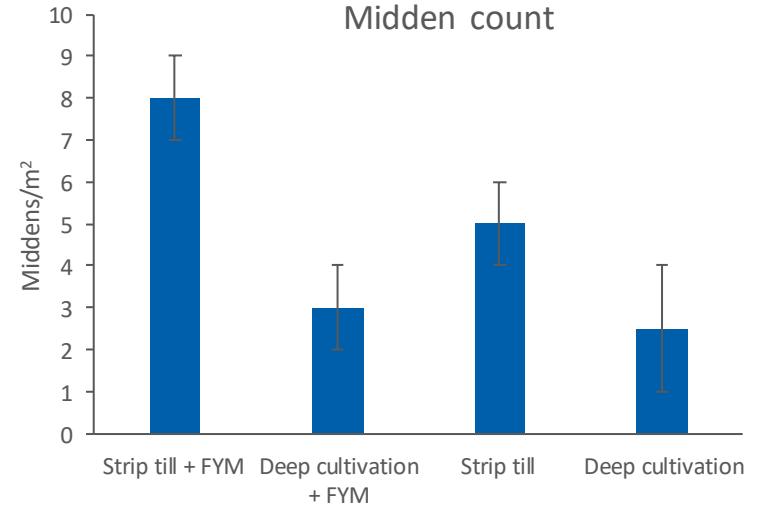


Earthworm counts per ecotype

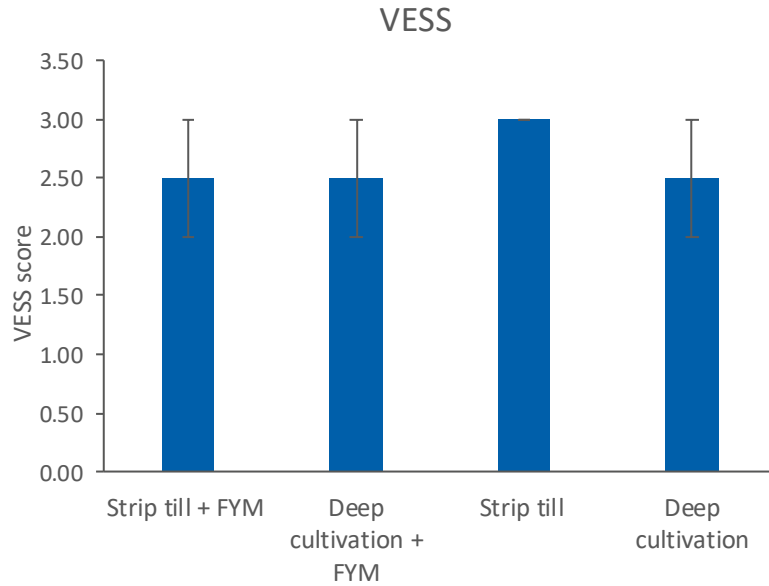


Replication per treatment (n =2)
Error bars are ± 1 standard deviation

Midden count



Rory Lay – soil properties

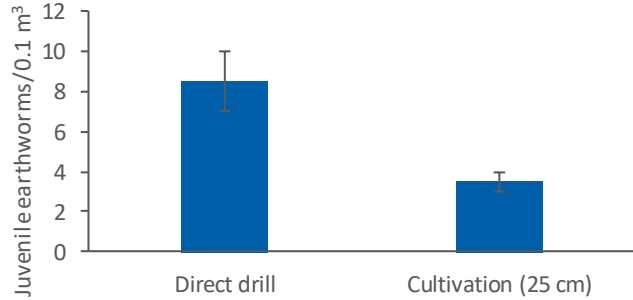


Measure	Strip till + FYM	Deep cultivation + FYM	Strip till no FYM	Deep cultivation no FYM
pH	6.7	6.7	6.8	6.8
P mg/l	34.2 (3)	24.0 (2)	31.6 (3)	33.6 (3)
K mg/l	149 (2-)	142 (2-)	170 (2-)	141 (2-)
Mg mg/l	111 (3)	110 (3)	88 (2)	94.7 (2)
SOM % LOI	8.9	8.5	8.1	8.3
CO2-C mg/kg	102	99	105	111

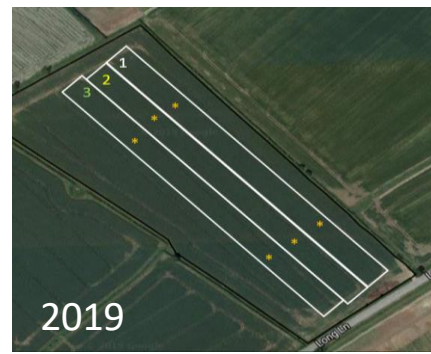
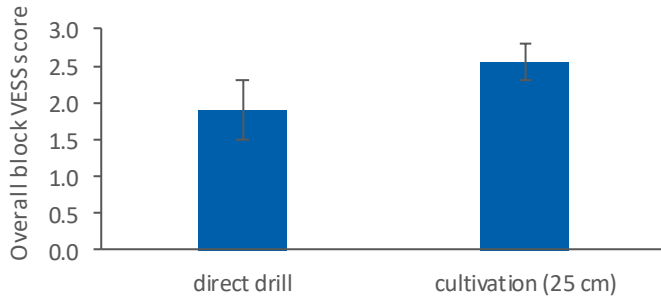
Replication per treatment (n=2)
 Error bars are ± 1 standard deviation

Joe Pell – P22

Juvenile earthworms



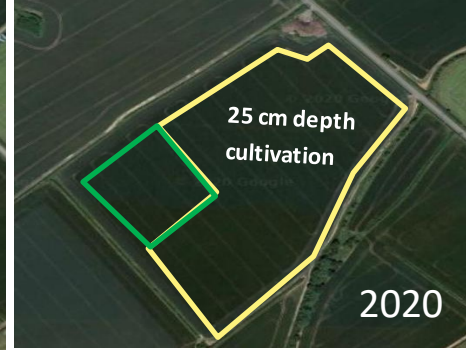
Vess scores



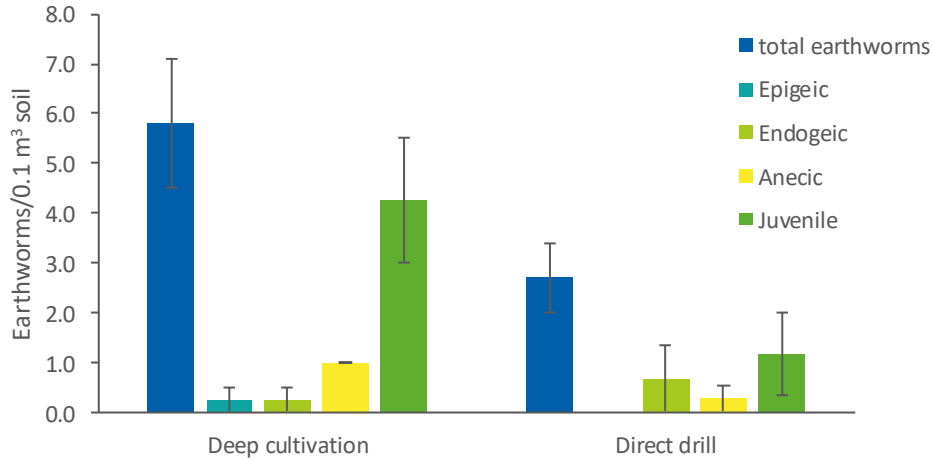
Treatments 2019: (1) Deep cultivation , (2) Direct drill, (3) Shallow cultivation

Measure	Direct drill	Cultivation (25 cm depth)
pH	6.7	6.9
P mg/l	20 (2)	22.0 (2)
K mg/l	308 (3)	273 (3)
Mg mg/l	218 (4)	242 (4)
SOM % LOI	9.7	9.6
CO2-C mg/kg	102	109

Joe Pell – earthworms (P3)



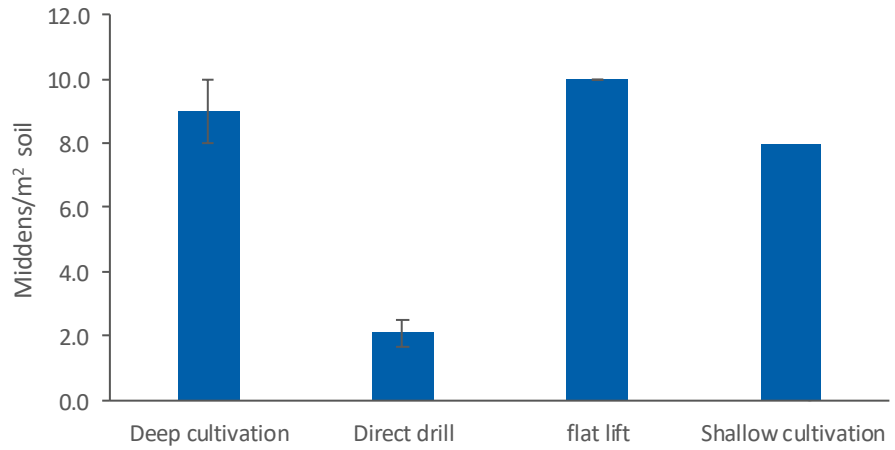
Earthworm counts per ecotype



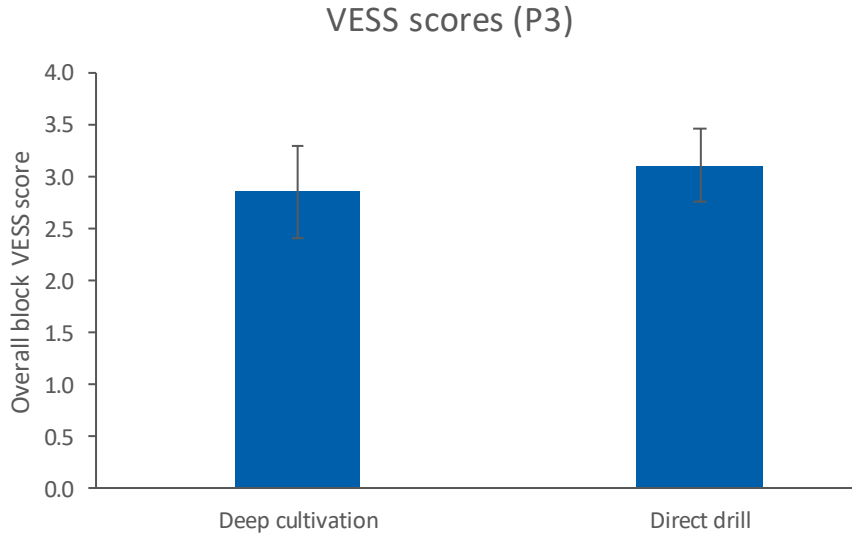
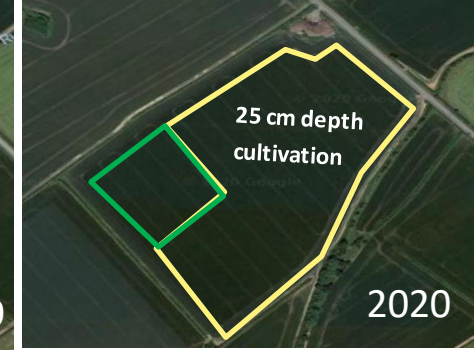
2019 Treatments: Deep cultivation, Direct drill, Flat lift, Shallow cultivation

Replication per treatment (n =2), shallow cultivation (n=1)
 Error bars are ±1 standard deviation

Midden Counts



Joe Pell – soil properties (P3)



2019 Treatments: Deep cultivation, Direct drill, Flat lift, Shallow cultivation

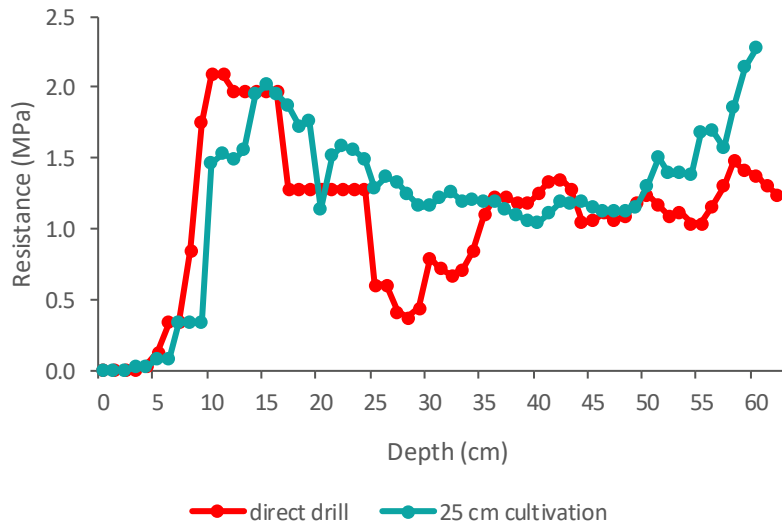
Measure	Direct drill	Flat lift	Shallow lift	Deep cultivation
pH	6.7	6.8	6.7	6.8
P mg/l	21.1	16.6	15.4	17.4
K mg/l	466	389	405	430
Mg mg/l	269	259	300	300
SOM % LOI	9.2	9.5	8.9	9.4
CO2-C mg/kg	123.0	125.5	123.0	127.0

Error bars are ± 1 standard deviation

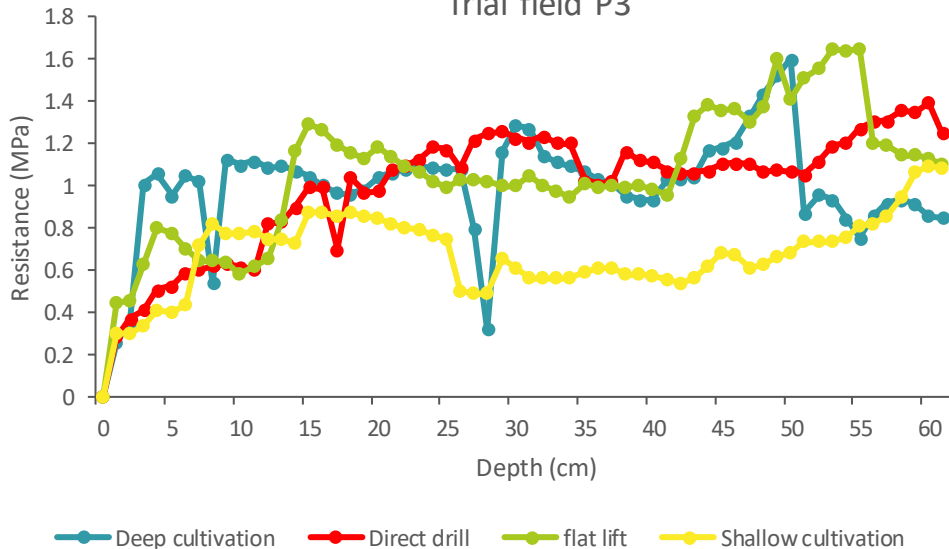


Joe Pell – soil strength

Trial field P22



Trial field P3



Soil Pits: assessing rooting and burrowing



Soil Pits

- Soil pit to 1 m depth (per tramline/ on treatment boundary)
- Photo to document the soil pit
- Photo of the roots at depth (two tape measures at right angles to show depth and scale)



Harvesting

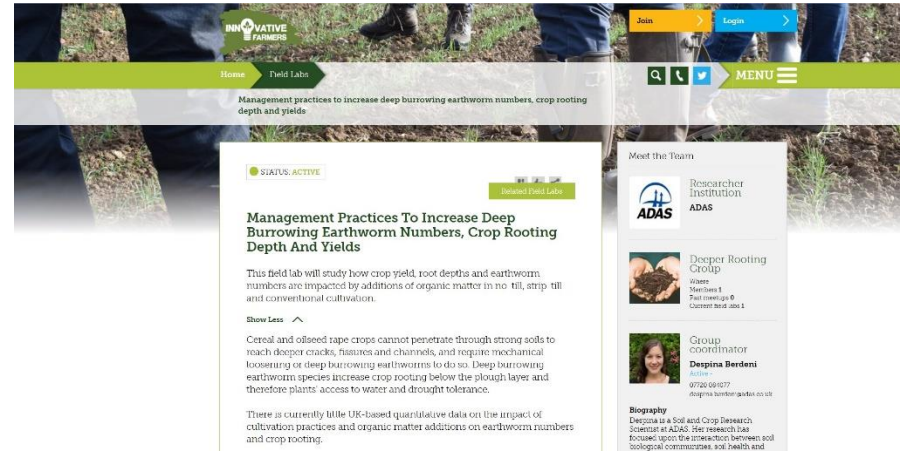
Harvested with a yield mapping combine:

- **Calibrate** the combine and ensure the yield mapping function is working correctly.
- Keep **harvest direct** closely in line with the tramlines (headlands can be cut separately)
- Harvest **full header widths** wherever possible.
- Harvest **within one treatment** area where possible, i.e. avoid having the header spanning two treatment areas.
- Harvest the whole field with the **same combine** and on the **same day**.



Future plans for the group

- Soil pits: assessing rooting depth and burrowing
- Harvest - yield data collection and analysis per treatment
- Cultivation treatments for next year?



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