CPES Cover Crop Trial Chilgrove – Year 2

S.Woodley Crop Services

CPES Portsmouth Water Cover Crop Trials:

Scope:
This field trial aims to demonstrate the feasibility of cover crop establishment on shallow chalk soils within Portsmouth Water's catchment zones, while highlighting the impact they have on over winter nitrate-N loses. The trial will also consider the impact that cover cropping has on the yield of the following spring cereal and its gross margins.

Control (bare stubble)

1. Broadcast into standing crop **Mix 1**
2. Broadcast into standing crop **Mix 2**
3. Traditionally Drilled **Mix 1**

Field Background:

- Chalk Loam soil
- Field is south facing in a valley bottom
- Variety: (Skyfall)
- Established using a Horsch Tine Drill
- 24m tramlines
- Cover Crop Established via:
    - Air Seeder on cultivator
    - Avadex applicator into standing crop.

Areas measured:

1. Soil Samples (p, K, Mg, pH & Organic Matter).
2. Soil Mineral Nitrogen.
3. Rainfall.
4. Porous Pots.
5. Quadrat Measurements.
6. Nitrate Leaching Loses

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Table 1: Proposed nutrient applications on the trial plots:

Control Over wintered stubble	**Plot 1:** Nitrogen Removal Cover Crop broadcast before harvest. Broadcast at **25 kg/ha**	**Plot 2:** Host farms choice of cover crop seed broadcast before harvest. **25kg/ha**	**Plot 3:** Nitrogen Removal Cover Crop Drilled into stubble at **25kg/ha**

Each plot is around 0.65ha

Nitrogen Removal (Mix 1):	**Farmers Seed (Mix 2):**
Black Oats 45% Forage Rye 30% Berseem Clover 15% Phacelia 10%	Phacelia 50% Vetch 50%

1. **Soil Samples (P, K, Mg, pH & Organic Matter):**

	Index				
Plot	**P**	**K**	**Mg**	**pH**	**OM**
Control	2	3	2	8	7.3
Treatment 1	3	3	2	7.7	7.9
Treatment 2	3	3	2	7.3	7.7
Treatment 3	3	3	2	8.3	7.8

Each plot was soil sampled to identify any limiting factors that may affect the success of the cover crop and following spring barley. The results above demonstrate a very even field in terms of P & K which will not affect the outcome of the trial.

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2. Soil Mineral Nitrogen Results:

Autumn 2020:

Available N kgN/ha 0-60cm			
Control	Treatment 1	Treatment 2	Treatment 3
17.7	20.9	23.5	23.9

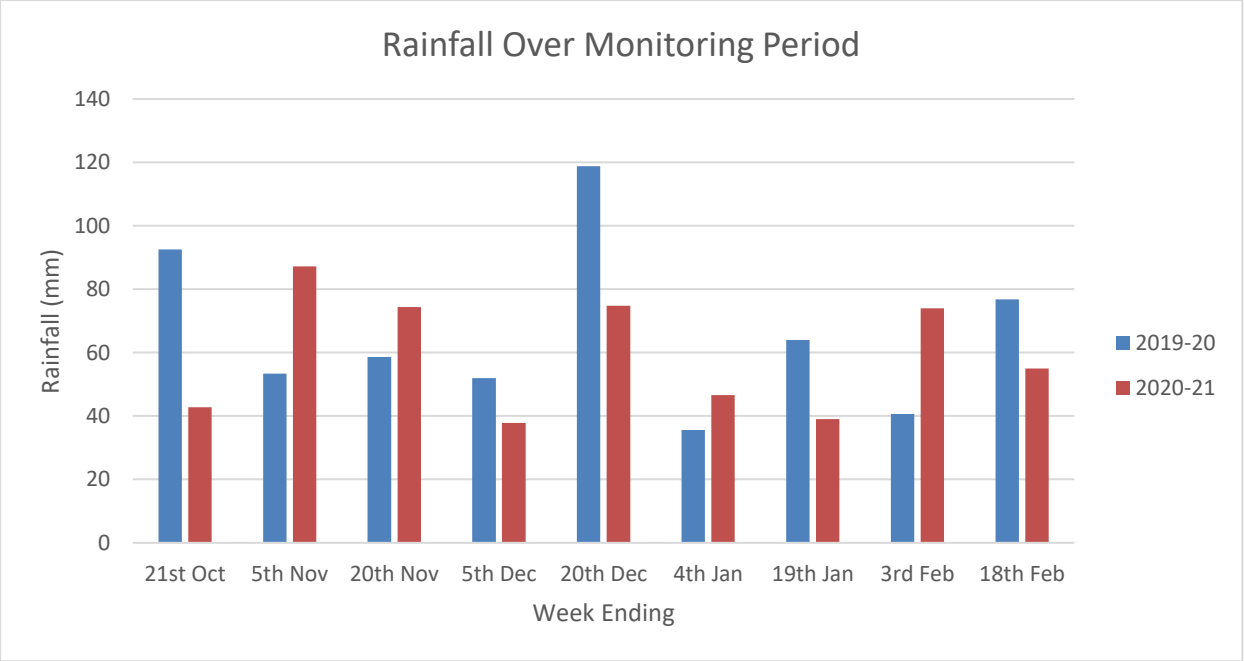
Spring 2021:

Available N kgN/ha 0-60cm			
Control	Treatment 1	Treatment 2	Treatment 3
31.4	36.4	30.6	45.5

As was found last year, SMN (Soil Mineral Nitrogen) levels (0-60cm) have come out very low in the autumn of 2020. The previous crop of winter wheat gave a good performance, despite being coupled alongside the climatic conditions of summer 2020 (drought).

The levels after the cover crop and winter period have come out higher than they were in the autumn. Hard to fully explain this but given the high levels of organic matter in the soil and the historic use of green compost it is likely that the bacteria within the soil have actively converted organic nitrogen into readily available in organic nitrogen.

3. Rainfall:



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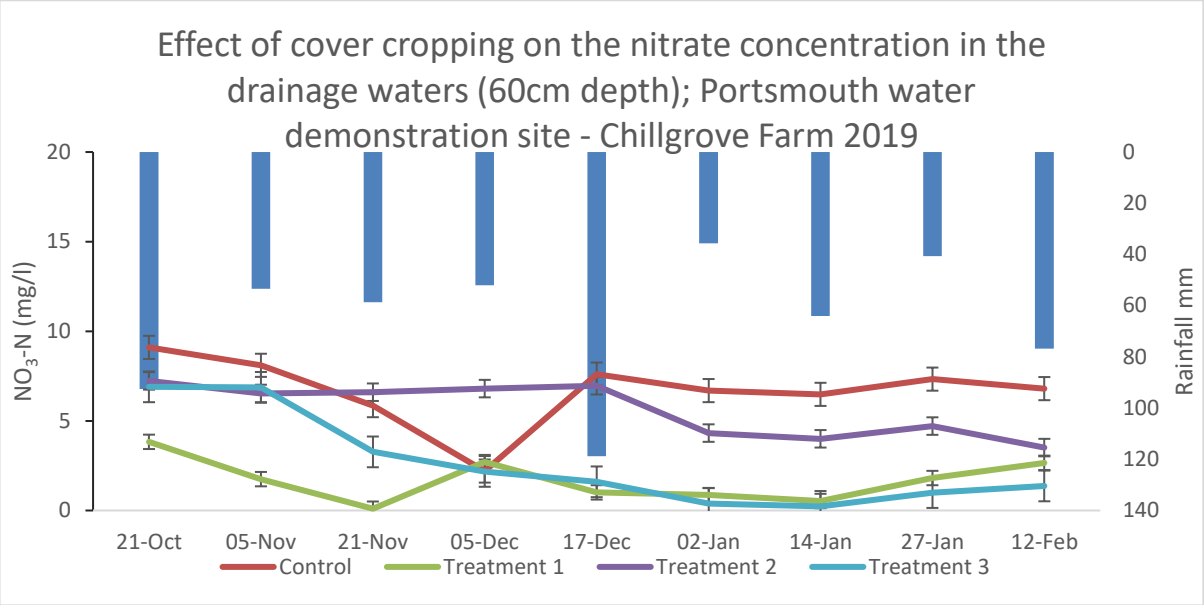
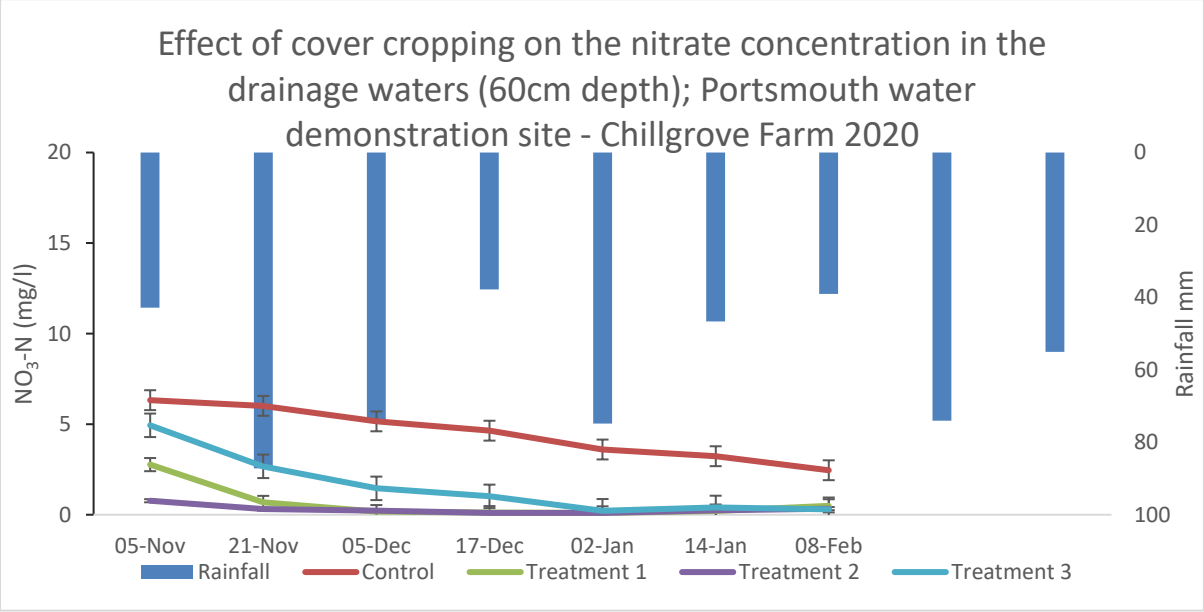
4. **Porous Pot Measurements 2019:**



Nitrate leaching levels from the control plot where significantly higher throughout the winter period.

Porous Pot Measurements 2020:



Nitrate leaching levels on a whole are lower across the winter than the previous season. Consistency with over wintered stubble having the highest levels of leaching throughout the season.

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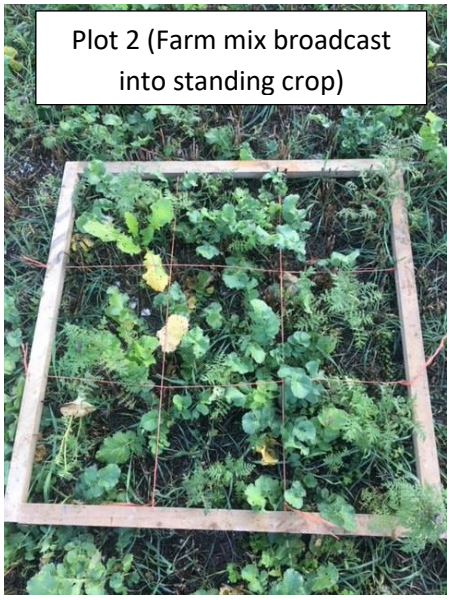
5. **Quadrat Measurements:**

Each plot was marked out in May to allow the identification of which plots were to have seed broadcast directly into the standing crop of wheat and which area was to be drilled. Throughout the season quadrat measurements were taken to assess the effectiveness of each plot. Unfortunaly the snow fall in February made is impossible to get accurate quadrat measurements at the end of the season.

November 2020:

Plot 3 (drilled N removal mix)

Plot 2 (Farm mix broadcast into standing crop)



Plot 1 (N removal mix broadcast into standing crop)

Control (Bare Stubble)

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January 2021:

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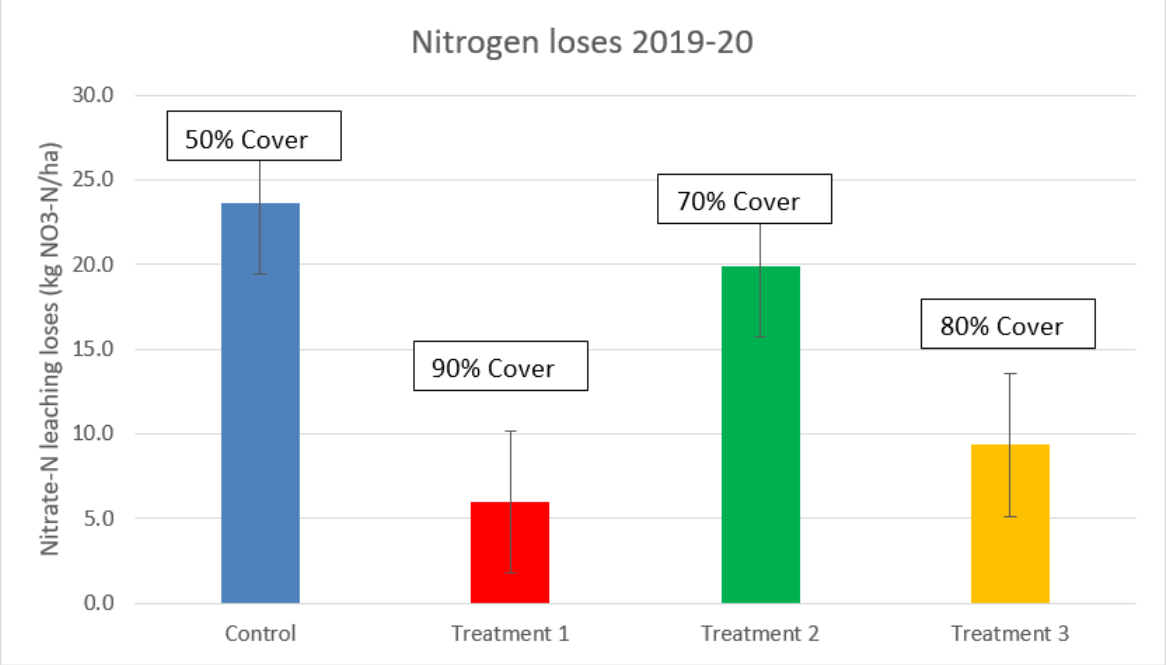
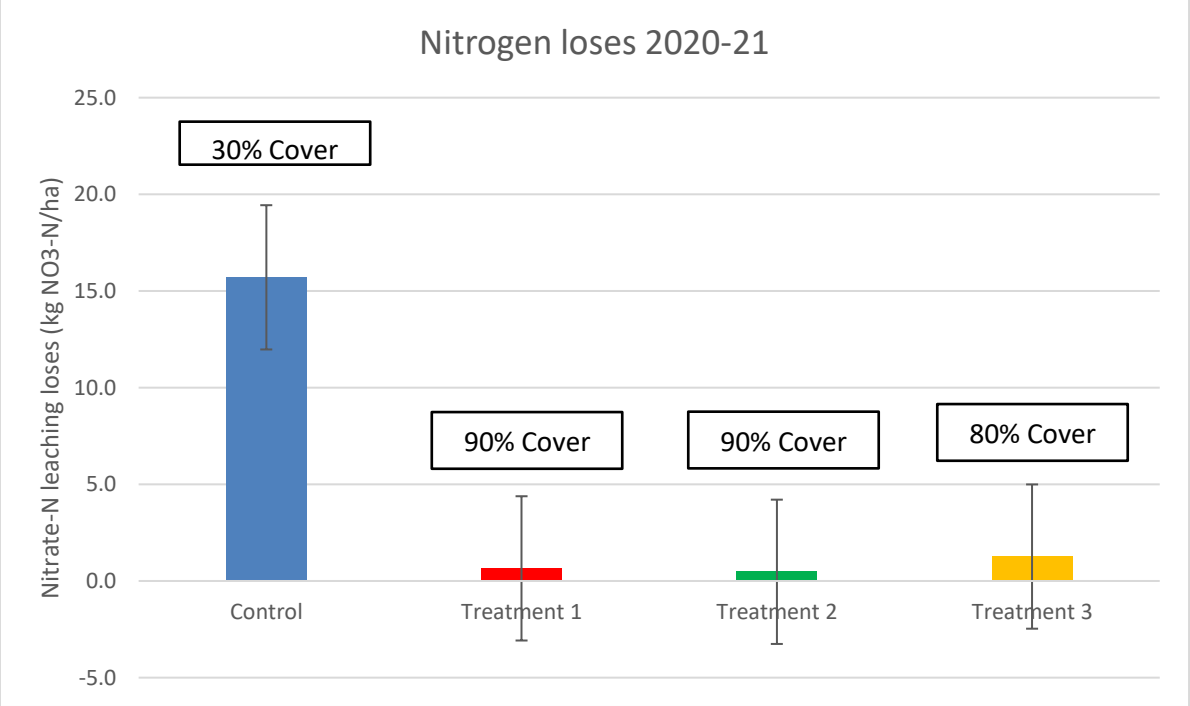
Nitrate Leaching Loses:



Graph 1. Nitrate leaching loses October 2019 – February 2020 (592mm rainfall, 250+ EWR / drainage)



Graph 2. Nitrate leaching loses October 2020 – February 2021

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Spring Bean Yields:

Unfortunately, the planned crop of spring barley following the cover crop trials was abandoned last minute in favour for a crop of spring beans. This decision was solely down to the potential gross margin from spring beans vs spring barley.

Combined with the lack of yield mapping from the combine, the only data provided is the average yield of 5.6t/ha. A very good yield for a crop of spring beans.

It does however remove the possibility of comparing harvest figures from the 2019-20 season to the 2020-21 season.

Cost / Benefit Analysis:

A cost assessment has been produced to compare each treatment in terms of the variable and operational costs. The farm solely relies on contractors for all field operations, so costs are likely to be higher compared with operations being carried out in house.

Nitrogen Removal (Mix 1):	**Farmers Seed (Mix 2):**
Black Oats 45% Forage Rye 30% Berseem Clover 15% Phacelia 10%	Phacelia 50% Vetch 50%

Treatment	**Over Wintered Stubble**	**Nitrogen Removal Mix (broadcast)**	**Farmers Seed Mix (broadcast)**	**Nitrogen Removal Mix (drilled)**
Yield (t/Ha)	5.6	5.6	5.6	5.6
Price (£/t)	210	210	210	210
OUTPUT (£/Ha)	1176	1176	1176	1176
Cover crop seed (£/ha)		45	30	45
Fertiliser – N, P & K	0	0	0	0
Sprays	154	154	154	154
Total variable costs	154	199	184	199
GROSS MARGIN (£/Ha)	**1022**	**977**	**992**	**977**
FIELD OPERATIONAL COSTS (£/ha)				
Broadcast / Drill covers		17.44	17.44	52.5
Field Operations	275	275	275	275
Total Operational Costs (£/ha)	275	292	292	327.5
NET MARGIN (£/Ha)	**747**	**685**	**700**	**649.5**

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Conclusions

It was clear from the start the benefit of broadcasting cover crop seed directly into a standing crop. Establishment and early growth were superior to the conventionally drilled plot. The quadrat photos taken in October demonstrate the differences with a 10% improvement in cover.

Similarly, to last year, all three plots with a form of cover significantly outperformed the plot left as over wintered stubble, highlighting the real benefit that cove crops can have in reducing nitrate leaching but also the overall environmental benefit.

The difference in levels of foliage is also clearly visible in the results from the over wintered porous pots. Ranked in worst to best performance:

- Control (bare stubble)
- Drilled N Reduction Mix
- Broadcast N Reduction Mix
- Broadcast Farmer Mix.

This outcome demonstrates that the more diverse the mix, does not necessarily mean the nitrate retention level increase. Establishment methods and timings are the more critical component.

Unfortunately, the last-minute change in cropping plan and lack of yield monitoring makes the comparison of costs over the two seasons impossible. However, the reduced margin from planting cover crops has been consistent over both seasons. The additional SMN in the spring is not enough to cut back nitrogen inputs significantly and in the case of following with a legume, it doesn't make any difference.