Whitewool Farm Undersown Maize Trial 2021

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Catchment Sensitive Farming
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Portsmouth Water

Introduction:

Undersown Maize, what's the fuss about?

The grown area of maize continues to expand each year in the Southeast of England. Agronomic benefits, contracted prices and a reduction in farm machinery / labor requirements has made it an attractive option for many. Within Portsmouth Waters catchments, there are several anerobic digestors operating. These digestors require large tonnages of maize to run and produce vast quantities of digestate to be spread back to land.

The growing season of maize is relatively short. It is drilled towards the end of April right through until the end of May, with harvesting commencing on the earliest varieties in late September to November. A dry autumn can allow following wheat crops to be planted after the maize is harvested. But a season like autumn 2018 results in fields being left as maze stubble.

The big difference between a field of maze stubble and a field of wheat stubble is the row spacing. Maize is commonly grown on 50cm row, leaving a large part of the field bare and vulnerable to both nutrient leaching and soil erosion.

The project:

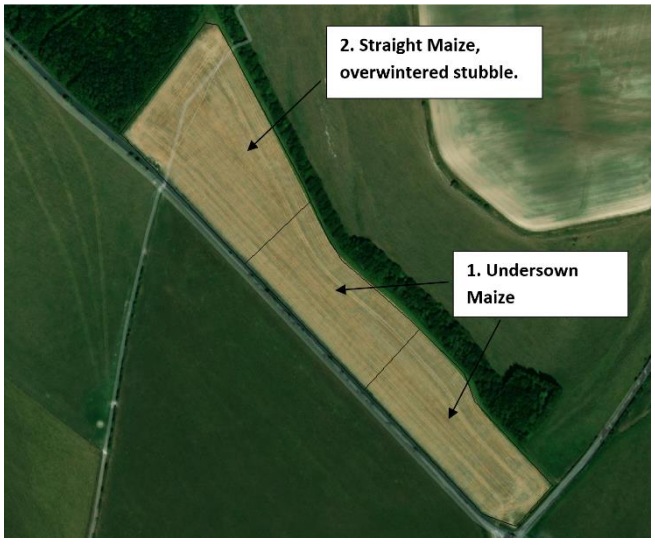
Portsmouth Water commissioned S. Woodley Crop Services to conduct an in-depth trial set to understand and measure the benefits under sowing maize can bring in terms of nutrient retention within the soil. Whitewool Farm kindly agreed to take part in the trial and offered a 4ha field, chalky loam soil. The field was drilled with on the 26th of April following an application of 41m3/ha on the 21st of April. This was followed by 125kgN/ha and a further 20l/ha of Effice-N-t 28 at the 12 leaf stage. Giving a total of 148kgN/ha)

The original plan was to have three replicates:

1. Maize Undersown with spring beans
2. Maize Undersown with Italian Rye Grass
3. Over wintered Maize Stubble
4.

Unfortunately, the spring beans failed, so the trial ended up as:

1. Maize Undersown with Italian Rye Grass
2. Over wintered Maize Stubble



Methodology:

Soil Sampling:
Soil mineral nitrogen sampling was carried out in April 2021 prior to any organic manure applications to set a baseline of nitrate levels within the soil. P, K, Mg and OM samples were also taken to understand the variability across the field. SMN samples where repeated after harvest and again in late Jan 2022.

Visual differences:
Site visits were made throughout the growing season to determine any differences in maize growth, weed burdens etc.

Yield Measurements:
Yield mapping was planned to determine the impact the under sowing had on the overall crop performance.

Earthworm Counts (per spit (30cm x 30cm x 30cm):
The presence of earthworms can be a good indicator of the overall state of the field. They thrive in organic matter rich soils providing natural aeration and aggregation of the soil profile. The burrowing they provide allows plant roots easy access to moisture and nutrients through the entire soi profile.
Earthworm counts provide an excellent sense check platform against the soil sampling results. If the OM measurement is extremely high but there are no earthworms in the field, then something is not adding up.

Drilling technique:

Penrose contractors where the drilling contractor of choice for this project. Their adapted drilling system and specialized tractor allowed inter row drilling with the minimum damage to the standing maize crop. The grass was drilled at a seed rate of 14kg/ha, being planted at the 6-leaf stage. At this stage, the maize has received all its herbicides and fertiliser applications and is past the vulnerable competition stage.

SMN (Soil Mineral Nitrogen) Results:

Field Reference	Undersown (Y/N)	April 2021 SMN (kgN/ha)	October 2021 SMN (kgN/ha)	January 2022 SMN kgN/ha)
Top Down 1 (Control)	N	25.2	129.1	67
Top Down 2	Y	55.2	90.1	76
Top Down 3	Y	39.5	98.3	86
	Average	39.97	105.83	76.33

Soil Results (P, K, Mg, pH):

SOIL ANALYSIS REPORT

Laboratory Sample Reference	Field Details			Index			mg/l (Available)		
	No.	Name or O.S. Reference with Cropping Details	Soil pH	P	K	Mg	P	K	Mg
520986/21	1	**TOP DOWN 1** *Into Forage Maize*	**7.6**	**6**	**3**	**2**	**103.2**	**249**	**59**
520987/21	2	**TOP DOWN 2** *Into Forage Maize*	**7.8**	**5**	**2+**	**2**	**84.6**	**222**	**56**
520988/21	3	**TOP DOWN 3** *Into Forage Maize*	**7.8**	**5**	**2+**	**2**	**82.2**	**185**	**52**

Porous Pot Results Oct – Jan:

Date of sample	Average Nitrate (mg/l)	Date of sample	Average Nitrate (mg/l)	Date of sample	Average Nitrate (mg/l)
10/11/2021	9.10	10/11/2021	1.48	10/11/2021	13.00
19/11/2021	5.88	19/11/2021	3.7	19/11/2021	16.46
03/12/2021	0.1	03/12/2021	4.33	03/12/2021	16.08
17/12/2021	2.52	17/12/2021	2.73	17/12/2021	17.8
12/01/2022	0.13	12/01/2022	4.33	12/01/2022	22.15
18/01/2022	0.9	18/01/2022	2.8	18/01/2022	20.33
01/02/2022	0.83	01/02/2022	1.96	01/02/2022	17.7
09/02/2022	0.87	09/02/2022	0.1	09/02/2022	23.56

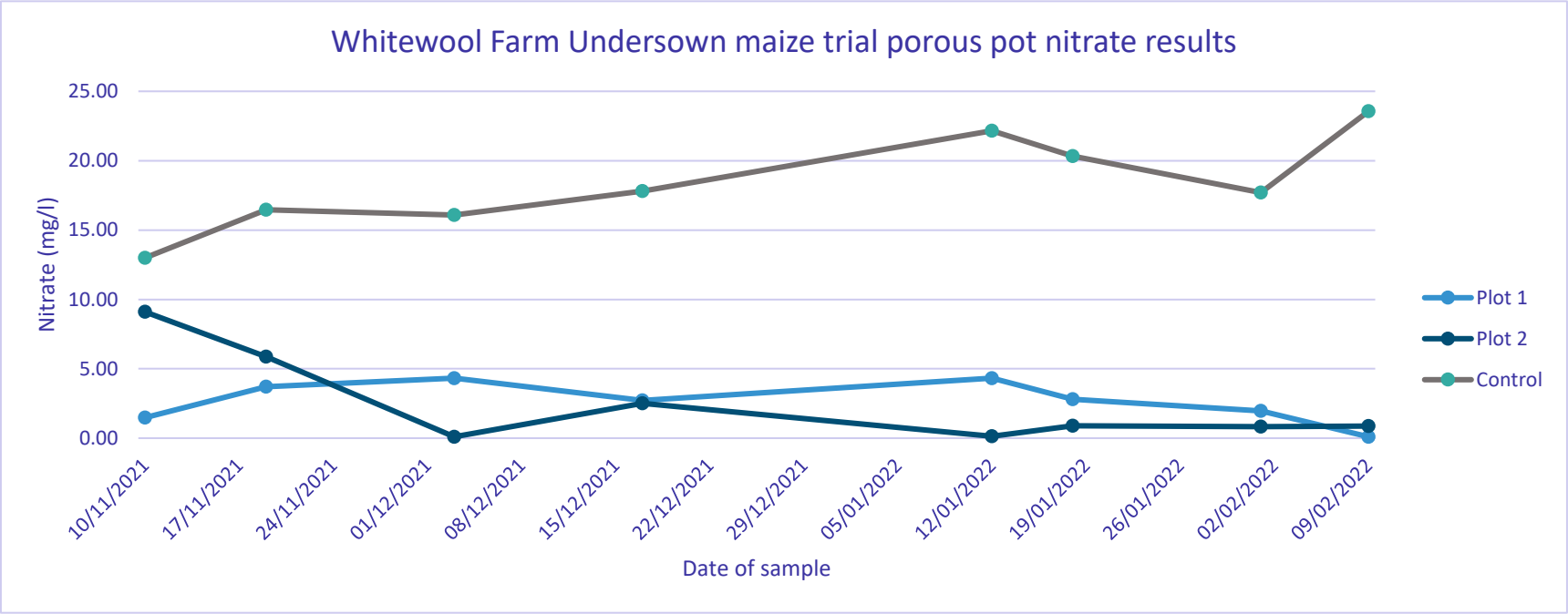


Figure 1. Porous pot results 2021-2022

Quadrat Measurements:

Oct 2021

Jan 2021

Conclusions:

The results from this trial clearly demonstrate the positive impact that under sowing maize can have on nitrate retention.
2021 was a good maize and grass growing season, with sporadic rains falling throughout the growing season. The under sown grass was drilled in ideal conditions (6 leaf stage) in the middle of June, quickly followed by a shower of rain.
The soil mineral nitrogen results clearly show the difference between residual nitrogen in the soil after harvest and again after the winter period. Levels after harvest on average are 35kgN/ha higher on the bare stubble indicating the maize inability to use all the nitrogen that was available and the grass's performance in utilizing some of this excess.
Following the winter period, SMN levels in the soil where higher in the two plots drilled with grass. Grass is excellent at mitigating the effects of heavy rainfall and reducing the levels of leaching through the soil profile. There was a difference of around 15kgN/ha in the soil after winter. This N will be available to any following spring crop.
The results found from the SMN sampling are supported by the results obtained from the porous pot study. Porous pots are installed to a depth of 60cm and capture water passing through the soil profile. This water is then analyzed for nitrate content and provides us with a direct measurement of nitrate leaching into the soil. Figure 1 demonstrates the difference between the three plots. As you can see the two plots drilled with grass outperformed the control (bare stubble) on average 10 times lower than the control plot.

2022 Trial:

Planning is currently underway to repeat the trial at Whitewool Farm in 2022.

Any questions then please contact Stephen Woodley (stephen@swoodleycropservices.co.uk)