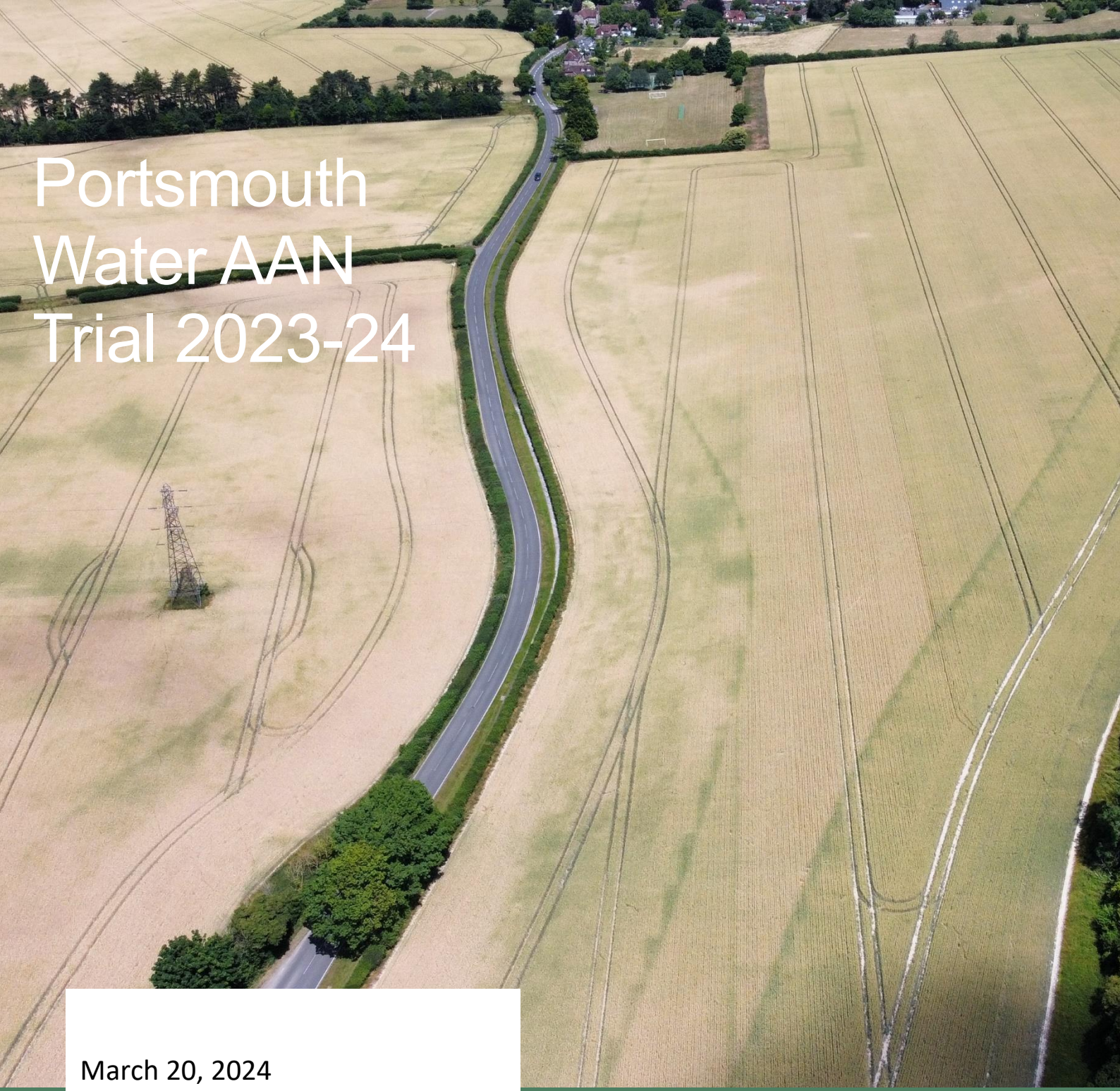

Portsmouth Water AAN Trial 2023-24

March 20, 2024

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Catchment Sensitive Farming
Working together for a healthy environment

Portsmouth Water

Introduction:

The planning of efficient nutrient applications and subsequently reducing the risk of nutrient leaching into the water and wider environment is a high priority for the East Hampshire and Western Streams catchment and Portsmouth Water. To reduce these inputs, this trial will aim to provide further evidence on the value of Additional Available Nitrogen (AAN) analysis. AAN testing is not widely encouraged by agronomists and therefore not commonly implemented into nutrient management planning as the exact science is yet to be established.

The prospect of investigating the impact of using Additional Available Nitrogen (AAN) as a tool to inform nutrient management planning is one to be encouraged. There is a lack of knowledge on the ground in using AAN to inform nitrogen inputs and if applied to a nutrient management plan, does it have the potential to save costs in inputs, and thus reduce the amount of nitrogen being applied in the catchment?

The Trial:

The aim of this trial is to provide a case study for the benefits of taking AAN, alongside Soil Mineral Nitrogen (SMN) testing into consideration when nutrient management planning. The yield of the following cash crop will then be assessed to see if AAN is a viable and practical measure in nutrient planning.

One of the main concerns to growers regarding the AAN testing is the cost, Portsmouth Water and Natural England have agreed to cover the costs of the trial crop.

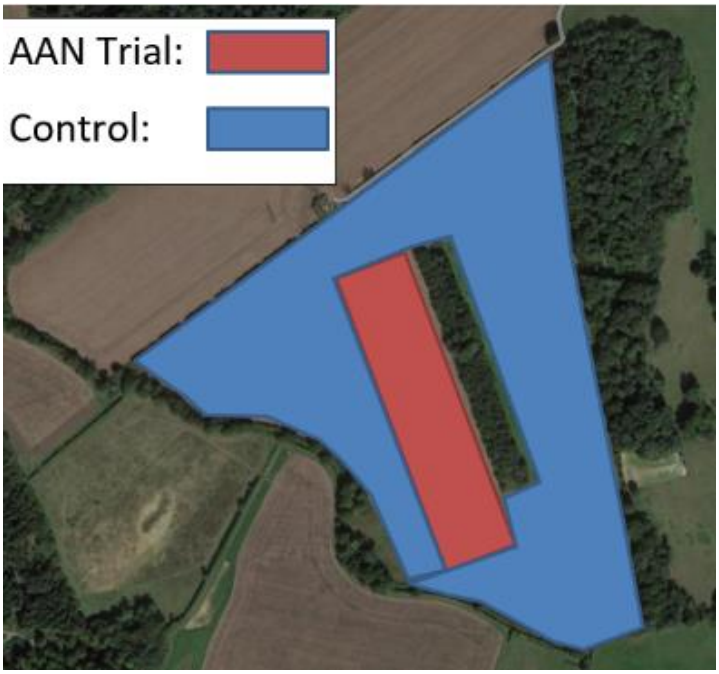


Table 1: Proposed nutrient applications on the trial plots:

AAN Trial **Total N: 190kgN/ha**	Normal Fertiliser Regime **Total N: 220kg N/ha**
SNS index 2 (using the 87kg/ha N in the soil from AAN sample)	SNS Index 0 (AAN SNS index 2) disregarded in the fertiliser program
70kgN/ha **200L / ha** of NS35 Liquid fertiliser early March.	70kgN/ha **200L / ha** of NS35 Liquid fertiliser early March.
50kgN/ha **140L / ha** of NS35 Liquid fertiliser April.	60kgN/ha **200L / ha** of NS35 Liquid fertiliser April.
70kgN/ha **200L / ha** of NS35 Liquid fertiliser Early May.	80kgN/ha **230L / ha** of NS35 Liquid fertiliser Early May.

Methodology:

Soil Sampling:

Soil mineral nitrogen sampling was carried out in February prior to any organic manure applications to set a baseline of nitrate levels within the soil. SMN samples were repeated after harvest and again in late February each year.

Visual Differences:

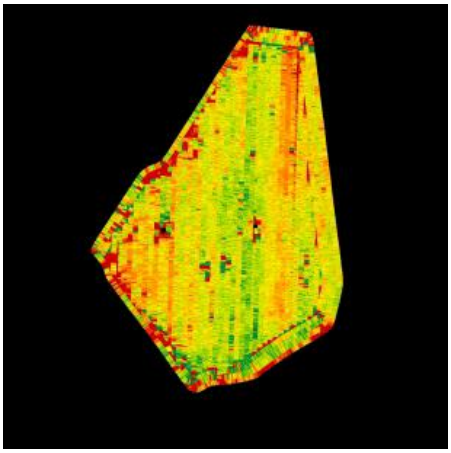
Site visits were made throughout the growing season to determine any differences in wheat growth.

Tissue Samples:

Tissue samples were taken each month March-June to measure any potential nutrition deficiencies in the plants.

Yield and Grain Analysis:

Yield data gathered at the point of harvest and grain analysed for protein content.



Porous Pots:

Ten porous pots were installed in each treatment, giving a total of twenty porous pots across the trial. Porous pots were sampled once every two weeks from the beginning of November through to the end of February. The water samples gathered from the porous pots were analysed as fresh samples for nitrate levels (mg/l) which provided an excellent indication of the potential nitrate leaching through the soil profile.

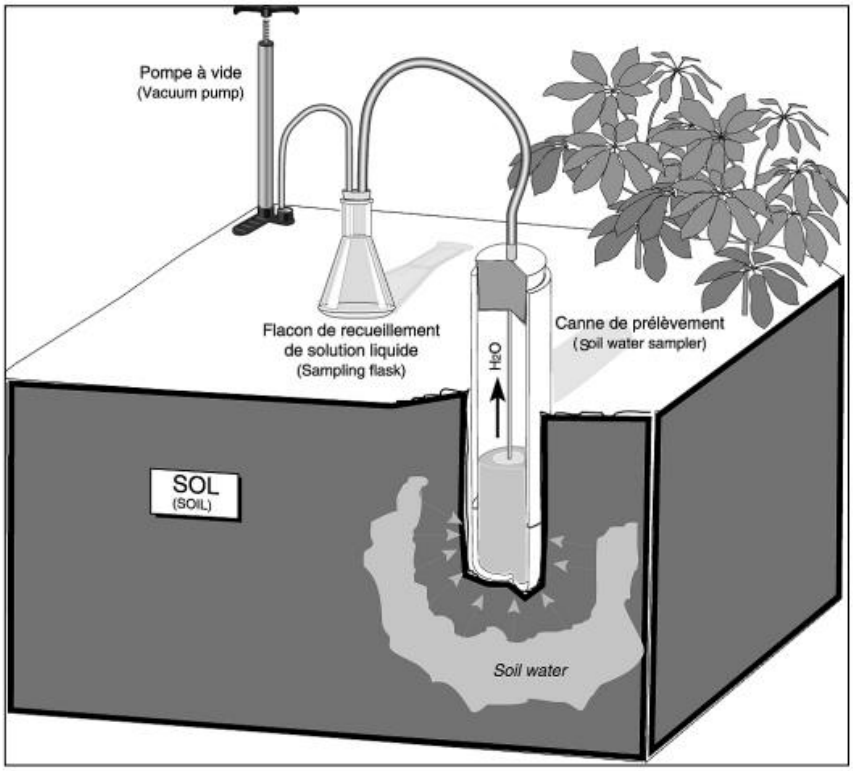


Table 2: SMN (Soil Mineral Nitrogen) Results 2023-2024:

Field Reference	Feb 2023 SMN kgN/ha	August 2023 SMN (kgN/ha)	Feb 2024 SMN kgN/ha)
AAN Trial	27.8	59	93
Control	25.5	63	91
Average	**26.65**	**61**	**92**

The results from the SMN sampling show that the nitrogen content in the soil is very similar between the trial and the control throughout the season, despite the additional 30kg/ha added to the control.

Table 3: Tissue Sample Results 2023:

Sample	Average N Content in plant	Average N Content in plant	Average N Content in plant	Combined Average
	N:S Ratio % **03/05/2022**	N:S Ratio % **25/05/2022**	N:S Ratio % **14/06/2022**	N:S Ratio %
Control 1	2.3	1.69	1.07	1.68
Control 2	2.87	1.65	1.1	1.87
Trial 1	2.16	1.73	1.26	1.71
Trial 2	2	1.5	0.97	1.49

With the additional Nitrogen added, the results of the tissue sampling should have been higher in the control. However, that is not supported with the data gathered throughout the season, with no statistical differences between the results. The results above show that the plant has the equal opportunity to growing successfully.

Table 4: Grain and yield analysis results 2023:

Field Reference	Protein (%)	haG	Kg/hl	Moisture (%)	Gluten	Yield t/ha
AAN Trial	9.85	105	71	16.27	15.18	9.74
Control	10.39	140	71	15.83	16.65	9.1

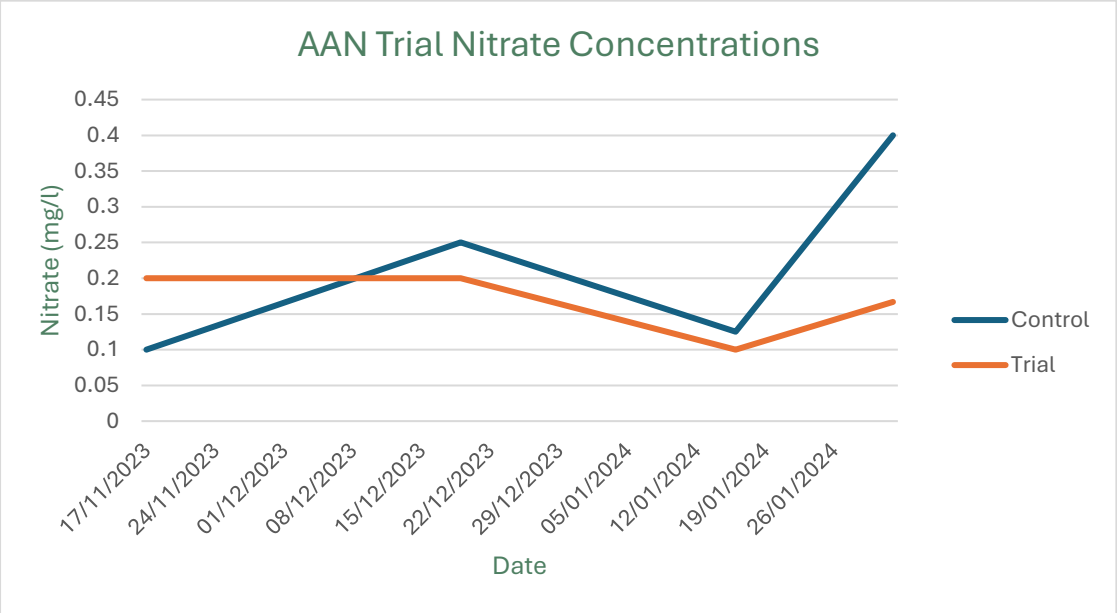
The grain analysis results show that the protein has yielded just under half a percent higher for the control with the kg/hl being the same due to an increased moisture content in the trial area. The protein yield has been significantly benefited by the additional 30kg/ha of nitrogen. This Typhoon wheat is being grown for feed; therefore, farm will not receive any additional income from this higher protein figure.

In terms of yield, there is a 0.64t/ha difference between the trial area and the rest of the field average. Although this does not sound like much of a difference, in real terms this equates to over £70/ha more revenue.

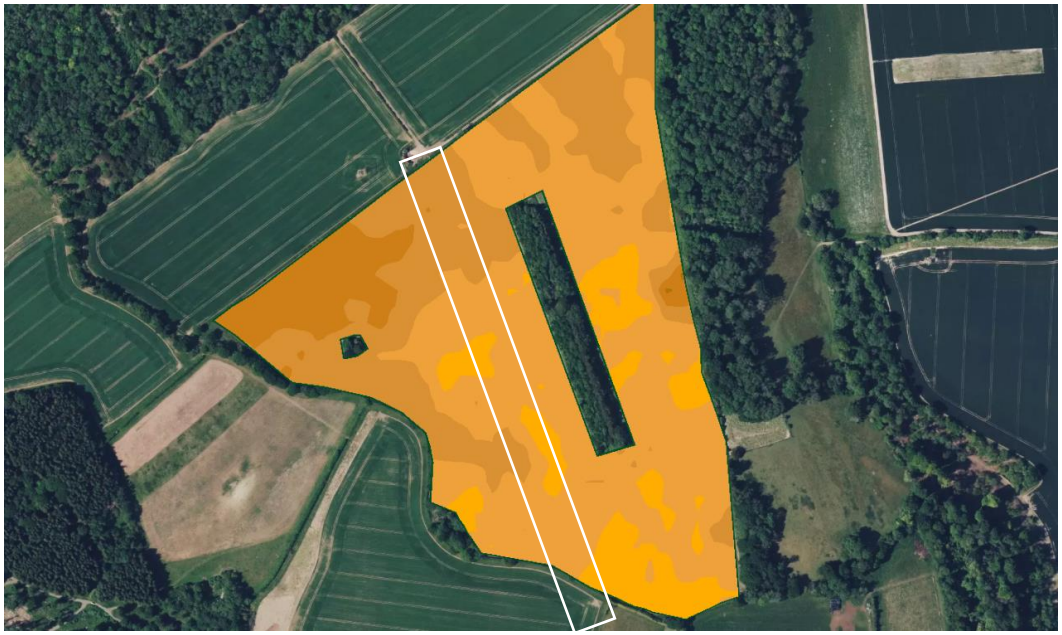
Table 5: Porous Pot Results Nov 2023 – Feb 2024:

Control		Trial	
Date of Sample	Nitrate (mg/L)	Date of Sample	Nitrate (mg/L)
17/11/2023	**0.1**	17/11/2023	**0.2**
19/12/2023	**0.25**	19/12/2023	**0.2**
16/01/2024	**0.125**	16/01/2024	**0.1**
01/02/2024	**0.4**	01/02/2024	**0.16**

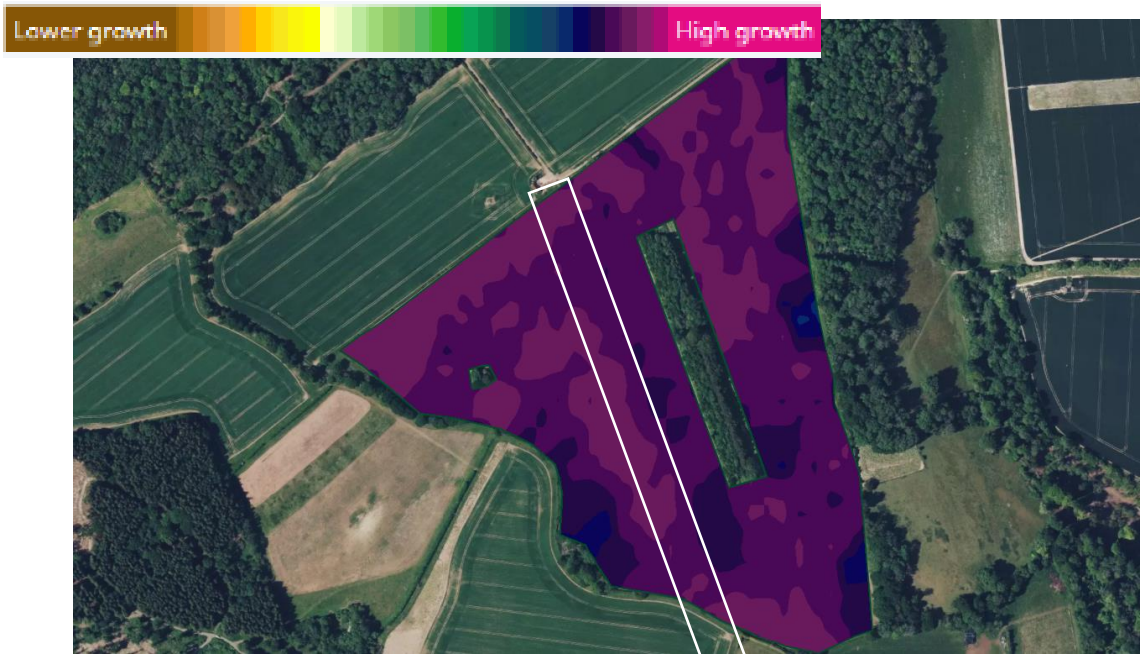
Figure 1. Graph showing porous pot results 2022-2023



Apart from a spike in the last round of data collection, the results from the porous pot data in both the trial and the control are very similar. These readings are all low and under 1mg/l. This suggests that the Nitrogen being added to the field is being used efficiently by the crop and the subsequent cover crop. The difference is not significant enough to make a big difference to the overall concentration of nitrate getting into the aquifer.



Satellite image captured on 02/03/2023, showing the variability in growth rates across the trial field. White rectangle indicates the AAN Trial area. The rest of the field serves as a control. There is no clear difference in this image between the trial and the control, indicating that at this point, the trial and control and showing a similar growth rate. The variability is likely the result of differences in the makeup of the soil.



Satellite image captured on 26/05/2023, showing the variable growth rates across the trial field. White rectangle indicates the AAN Trial area. The rest of the field serves as a control. From the image, there is no clear difference between the trial and the control as there are patches throughout the field that have the same growth. The trial is also next to a wooded dell that will cast shade during the first part of the morning. This could explain some of the darker shading (higher growth) compared to other parts of the field.

Results Summary 2023:

Plot number	Trial	Control
Treatment	AAN result	Farm standard
Total N applied (kg N/ha)	190	220
Nitrogen use efficiency* (%)	47	44
Yield (t/ha)	9.1	9.74
Protein Content (%)	9.85	10.39
Gross margin incl fert costs** (£/ha)	£1,462	£1,532
Difference between spring & autumn SMN results (kg available N/ha)	31.2	37.5

Nitrogen use efficiency = kg grain/ha divided by kg N applied/ha

****** Based on grain price of £200/t and market fertiliser price of £650/t***

Note that the cost of an AAN sampling and analysis package is £180 per field.

Conclusions:

Over the past year we have been able to put to the test AAN analysis as an alternative to a standard SMN sampling approach. This trial site was one of two analysed in 2022-23. Despite this is the second year of this project, it is year one at West Marden Farms and is to be taken with caution due to the lack of replicates. However, there has been some useful information that has come out of so far.

On paper, reducing the nitrogen levels by 30kg/ha has an expected damaging effect on the crops yield and quality, particularly the protein levels within the grain. Nitrogen levels recorded from the tissue samples showed no significant difference in the trial compared to the rest of the field (table 3). This trend follows in the SMN and porous pot results. This suggests that the additional nitrogen added to the rest of the field has not had a significant greening or leaching effect. However, when looking at the grain and yield analysis it is clear there was a significant effect on protein.

Yield data from the trial indicates a reduction of 0.64t/ha compared to the field standard. Unlike last year's trial, the grain price was poor, but the fertiliser price was at an all-time high resulting in lower-than-normal gross margins. That being said, the field control was around £70/ha better than the AAN trial, and that's before the additional cost of AAN analytical methods are taken into account.

The trial did not witness a statistically significant lower level of nitrate being picked up in the porous pots or post-harvest SMN results.

The 2022-23 season did not support the use of AAN analysis at West Marden Farms.

This trial is being conducted in a different field for the 2023-24 cropping season.

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