N Reduction Trial – Year Two Results

Project Aim:

In 2018, The Aquifer Partnership began working with S. Woodley Crop Services and Bevendean Farm to understand and measure the impact reduced nitrogen applications have on;

1) Nitrogen use efficiency
2) Nitrate leaching through the soil profile
3) Financial viability for the farm

Location of trial plots

A field over thin chalk and flint on Bevendean Farm (near Falmer) was selected and Zyatt (group 1 Wheat) was grown under five fertiliser programmes.

Monitoring

The crop has been monitored using:

- Spring and autumn Soil Mineral Nitrogen (SMN) sampling
- Yield and grain quality
- Crop tissue testing
- Aerial photography
- Localised weather station
- Porous pots (over winter 2020/21)

The crop was harvested on 4th August and the results of the second year of the trial are now in.

Year 2 field treatments:

Date of fertiliser application	Plot 1: Control Normal Fertiliser regime	Treatment 1: 5% reduction Reduced 3rd application	Treatment 2: 10% reduction Reduced 3rd application	Treatment 3: 15% reduction Reduced 2nd and 3rd application	Treatment 4: 20% reduction Reduced 2nd and 3rd application
3rd March 2020	160kg /ha Double Top 43 Kg N/ha + 48 Kg SO3/ha	160kg /ha Double Top 43 Kg N/ha + 48 Kg SO3/ha	160kg /ha Double Top 43 Kg N/ha + 48 Kg SO3/ha	160kg /ha Double Top 43 Kg N/ha + 48 Kg SO3/ha	160kg /ha Double Top 43 Kg N/ha + 48 Kg SO3/ha
23rd March 2020	160kg /ha Ammonium Nitrate 55 Kg N/ha	160kg /ha Ammonium Nitrate 55 Kg N/ha	160kg /ha Ammonium Nitrate 55 Kg N/ha	110kg /ha Ammonium Nitrate 38.5 Kg N/ha	100kg /ha Ammonium Nitrate 34.5 Kg N/ha
27th April 2020	150kg /ha of Ammonium Nitrate 51 Kg N/ha	120kg /ha of Ammonium Nitrate 41 Kg N/ha	90kg /ha of Ammonium Nitrate 31 Kg N/ha	110kg /ha of Ammonium Nitrate 38.5 Kg N/ha	100kg /ha of Ammonium Nitrate 34.5 Kg N/ha
1st May 2020	150kg /ha of Ammonium Nitrate 41 Kg N/ha	150kg /ha of Ammonium Nitrate 41 Kg N/ha	150kg /ha of Ammonium Nitrate 41 Kg N/ha	150kg /ha of Ammonium Nitrate 41 Kg N/ha	150kg /ha of Ammonium Nitrate 41 Kg N/ha
Total N applied (Kg N/ha)	190kg	180kg	171kg	161kg	152kg

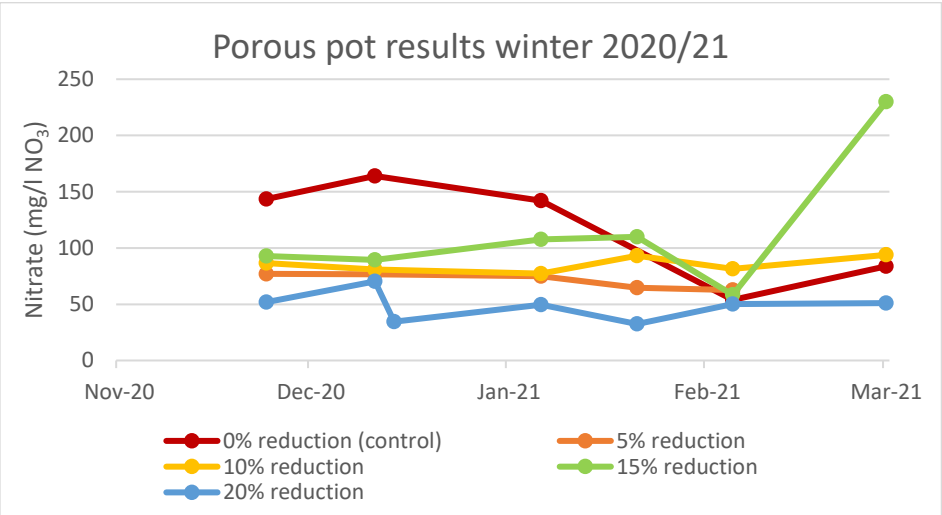
Year 2 Results:

Plot number	Control	1	2	3	4
Total N applied (kg N/ha)	190	180 (-5%)	171 (-10%)	161 (-15%)	152 (-20%)
Nitrogen use efficiency* (%)	56.8	57	53.2	40.3	61
Yield (t/ha)	10.8	10.3	9.1	6.5**	9.3
Protein Content (%)	9.99	NA***	9.85	9.47	9.42
Gross margin incl fert costs (£/ha)	£1,836	£1,715	£1,547	£1,003	£1,484
Post-harvest SMN (kg available N/ha)	27.2	26.6	43.1	26.9	44.7

**Nitrogen use efficiency = kg grain/ha divided by kg N applied/ha*
***Plot 3 was noted as having a patch of cleavers which may have skewed the results*
****The lab was unable to analyse this sample*

Key messages and next steps:

1) Nitrogen use efficiency (NUE) was on average lower in 2020 compared to 2019. The reduction in yield is the biggest contributor to this. The nitrogen use efficiency did not improve with the reduction in applied N fertiliser in 2020. The opposite result was found in 2019. Is the climate to blame? This would also explain the low proteins.
2) Nitrate leaching Spring 2020 saw higher than normal SMN levels, despite the wet winter. Levels recorded in August 2020 were lower than the spring result, suggesting there was less nitrogen in the soil after the crop of wheat than there was to begin with. The porous pot results below show nitrate leaching over the winter of 2020/21. The graph appears to show leaching was highest in the plot receiving the most N and lowest in the plot receiving a 20% reduction.
3) Yield differences were significant in 2020. Ignoring plot 3 (which suffered from weed issues) the average yield was 7% lower than 2019. The results in 2020 appear to show that when the amount of nitrogen applied decreased, both the grain proteins and yield also decreased (apart from plot 4). The results of 2019 did not support this trend.



4) Gross Margins were higher in 2020 due to the increased grain price.

The data from years one and two of the trial do not necessarily support any clear trends so more data is needed before any conclusions can be drawn.

The trial will continue this year and the full results of the three years will be available in spring 2022.

For more information contact Stephen Woodley (stephen@swoodleycropservices.co.uk 07745 138410) or Robin Kelly, Southern Water Catchment Officer (robin.kelly@southernwater.co.uk, 07795 640914).