



Broadbalk is an agricultural field experiment at Rothamsted Research in Harpenden. It was set up by Sir John Lawes and Sir Joseph Henry Gilbert in 1843 to compare the effect of different fertiliser treatments on wheat yield.

While some changes have been introduced over time, the Broadbalk experiment is still running today making it one of the oldest, continuous agricultural experiments in the world.

This activity gets students plotting graphs and interrogating real wheat yield data from Broadbalk. It looks at the effect of different fertiliser treatments and farming practices and encourages students to think about why long-term data is important.



Wheat Yield

The amount of wheat grain harvested. It is measured in Tonnes per Hectare (t/ha).

Activity

1. Split the students into two groups. Give one group the Continuous Wheat Data and the other group the Rotational Wheat Data.
2. Students should study the data and plot a bar graph showing the wheat yield in each year for each treatment.
3. To help compare treatments students should calculate the average wheat yield for each treatment and plot those results too.
4. Bring both groups together to share and discuss their findings.

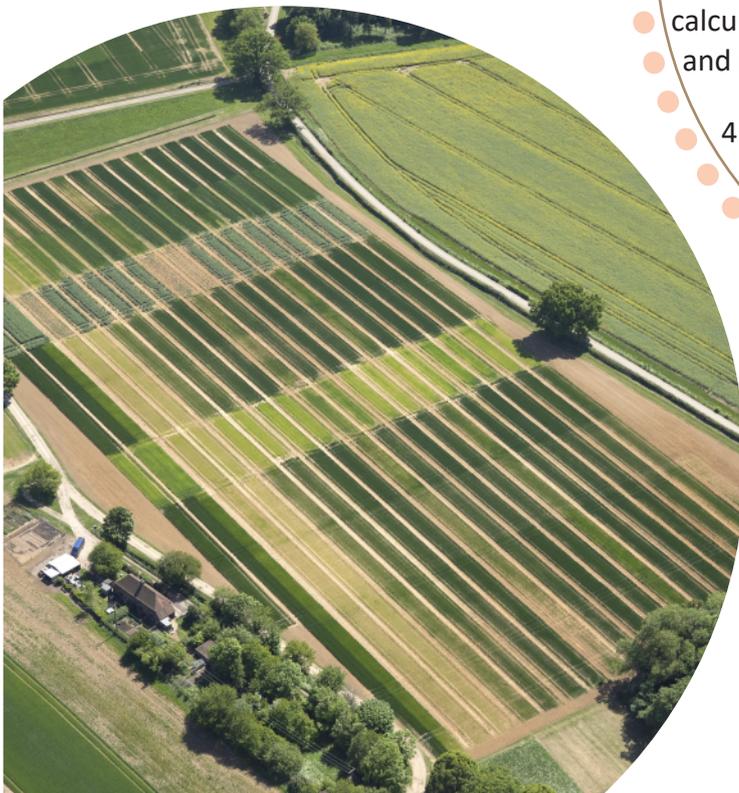
The accompanying slide deck may help to drive discussions.

Continuous Wheat

Wheat is grown every year.

Rotational Wheat

Wheat is grown for three years then a different crop is grown for one or two years.



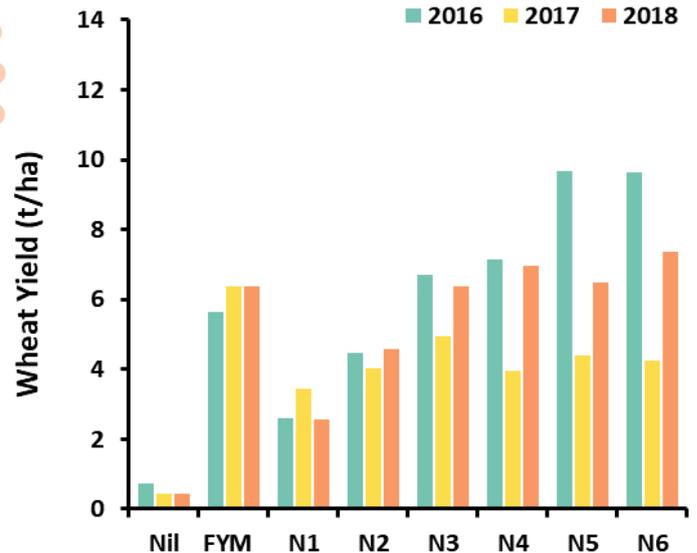
Data

N1 to N6 are inorganic fertilisers that contain increasing levels of Nitrogen (N) and equal levels of Potassium (K), Phosphorus (P) and Magnesium (Mg).

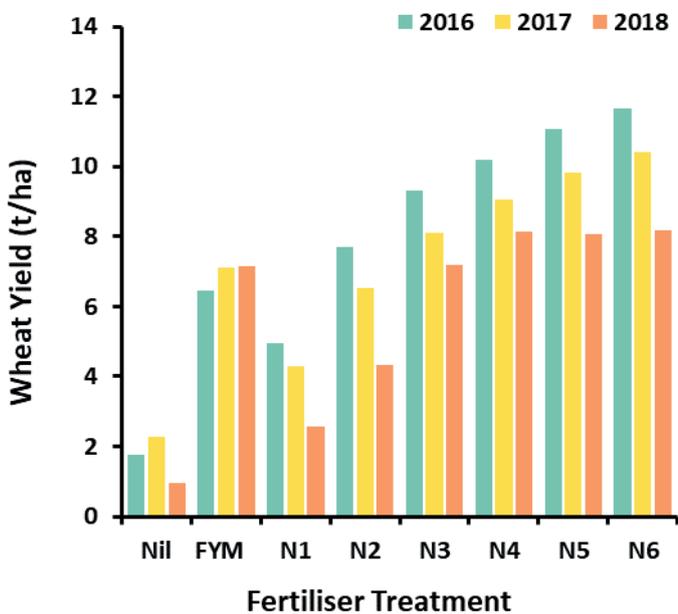
Farm Yard Manure (FYM) is an organic fertiliser, meaning that by using it farmers are not adding chemicals to their fields.

However, it can be hard for farmers to get enough FYM for all of their fields.

Continuous Wheat



Rotational Wheat



Fertiliser Treatment

Discussion Points

How does FYM compare to the N fertilisers?

How do increasing N levels affect wheat yield?

Why might wheat yield be levelling out after N4?

Which growing method gave highest yields (continuous or rotational?) and why do you think might be?

Does any of the data seem anomalous?

Why are longterm experiments like Broadbalk important?

Conclusions

Growing wheat in rotation tends to result in better yields. This is due to a number of factors including increasing soil stability, replenishing soil nutrients and deterring pests.

FYM is a good fertiliser and gives yields similar to N2. N3/N4 tends to result in even higher yields.

Wheat grown using N4, N5 and N6 fertiliser result in similar yields. This is likely to be due to surface runoff and there is little benefit in farmers using fertiliser with such high levels of N.

Long term experiments allow scientists to see overall trends that are not skewed by anomalies (such as very hot or dry summers). They can also study rotational crop data over several cycles, giving more robust results.

Continuous Wheat Data

Fertiliser Treatment	Yield (t/ha) 2016	Yield (t/ha) 2017	Yield (t/ha) 2018	Average Yield (t/ha)
Nil	0.74	0.44	0.44	
FYM	5.65	6.37	6.36	
N1	2.59	3.43	2.56	
N2	4.48	4.03	4.59	
N3	6.7	4.96	6.38	
N4	7.16	3.96	6.98	
N5	9.67	4.39	6.49	
N6	9.63	4.26	7.38	

Nil is the control plot which did not receive any fertiliser

Farm Yard Manure (FYM) is an organic fertiliser but getting enough can be tricky.

N1 to N6 are chemical fertilisers containing Nitrogen (N), Phosphorus (P), Potassium (K) and Magnesium (Mg).

N1 contains the lowest amount of Nitrogen.
N6 contains the highest amount of Nitrogen.
They all contain the same amount of P, K and Mg.

Rotational Wheat Data

Fertiliser Treatment	Yield (t/ha) 2016	Yield (t/ha) 2017	Yield (t/ha) 2018	Average Yield (t/ha)
Nil	1.75	2.27	0.95	
FYM	6.45	7.1	7.16	
N1	4.94	4.29	2.55	
N2	7.71	6.53	4.34	
N3	9.31	8.09	7.2	
N4	10.2	9.06	8.14	
N5	11.09	9.82	8.08	
N6	11.66	10.41	8.16	

Nil is the control plot which did not receive any fertiliser

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