Woburn Continuous Barley Experiment treatment details and plan, 1876-1926

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Description: Details of the fertilizer treatments, lime applications, plot divisions, plot areas and plan of the Woburn Continuous Barley Experiment, 1876-1926 (not to scale). See also details and plan for the Woburn Continuous Wheat Experiment.

- **Page 1:** Cover page
- **Pages 2-3:** Fertilizer and manure treatments
- **Page 4:** Applications of lime, t ha^{-1} $CaCO_3$ equivalent
- **Page 5:** Plot divisions and areas
- **Page 6:** Plan of the Woburn Continuous Wheat and Barley experiments

Site: W/XB/6. Stackyard field, Woburn Experimental Farm, Husborne Crawley, Woburn, Bedfordshire, UK. Latitude 52.0003, Longitude -0.6149

Derived from:

- Johnston, A.E. (1975). Experiments made on Stackyard Field, Woburn, 1876-1974. I. History of the Field, Details of the Cropping and Manuring and the Yields of the Continuous Wheat and Barley Experiments. *Rothamsted Experimental Station, Report for 1974*, Part 2, pp 29-44. **DOI:** https://doi.org/10.23637/ERADOC-1-33158
- Johnston, A.E. and Chater, M. (1975) Experiments made on Stackyard Field, Woburn, 1876-1974. II. Effects of treatments on soil pH, P and K in the Continuous Wheat and Barley Experiments. *Rothamsted Experimental Station Report for 1974*, Part 2, pp45-60. DOI: https://doi.org/10.23637/ERADOC-1-33159
- Rothamsted Experimental Station (1970) *Details of the Classical and Long-Term Experiments up to 1967*, Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK, (128 pp) **DOI:** https://doi.org/10.23637/ERADOC-1-192

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Woburn Continuous Cereals Experiments, Woburn Stackyard, 1876-1926.

Fertilizer treatments to Continuous Winter Wheat and Continuous Spring Barley experiments.

In both experiments plots with the same number had the same fertilizer treatment.

Plot	Fertilizer and manure treatment
1	Nil. No fertilizer or manure applied
2	N2, N1 since 1907
3	N2*. From 1907 the plot was divided, plot 3a received N2*, plot 3b N1*
4	PKNaMg, PK since 1907.
5	N2PKNaMg, N1PK since 1907
6	N2*PKNaMg, N1*PK since 1907
7	Nil. No fertilizer or manure applied
8	N4PKNaMg. From 1882 the plot was split; sub-plots 8a and 8b had N applied in alternate years only; 8a received N in odd years, starting in 1883, 8b received N in even years, starting in 1882. Since 1907 N2 instead of N4, still in alternate years. PKNaMg applied every year until 1906, PK every year since 1907.
9	N4*PKNaMg. From 1882 the plot was split; sub-plots 9a and 9b had N applied in alternate years only; 9a received N in odd years, starting in 1883, 9b received N in even years, starting in 1882. Since 1907 N2* instead of N4*, still in alternate years. PKNaMg applied every year until 1906, PK every year since 1907.
10a	FYM1 1877-81. Nil 1882-1906 except Rape Cake (R2) in 1889. N1*P 1907-1926.
10b	FYM1 1877-87. Nil 1888. Rape Cake 1889-1926: R2 in 1889, R4 in 1890-1906, R1 in 1907-26.
11a	FYM2 1877-81. Nil 1882-1906. N1*K 1907-26.
11b	FYM2 1877-1906; FYM1.5 1907-1926

N fertilizer. Comparison of ammonium-N and nitrate-N:
Until 1906 ammonia salts (equal weights of ammonium sulphate and ammonium chloride) were applied. Since 1907 ammonium sulphate only.
Nitrate N indicated as *. Applied as sodium nitrate.

N1	N as ammonium sulphate, 23 $kgNha^{-1}$ 1907-26
N2	N as ammonium salts, 46 $kgNha^{-1}$ 1877-1926
N4	N as ammonium salts, 92 $kgNha^{-1}$ 1877-1906. Applied in spring as two equal amounts
N1*	N as sodium nitrate, 23 $kgNha^{-1}$ 1907-26
N2*	N as sodium nitrate, 46 $kgNha^{-1}$ 1877-1926
N4*	N as sodium nitrate, 92 $kgNha^{-1}$ 1877-1906. Applied in spring as two equal amounts

Minerals (P, K, Na, Mg):

P	P as superphosphate (18% P_2O_5) supplying about 34 $kgPha^{-1}$ 1877-1906 (P2). Reduced to about 22 $kgPha^{-1}$ 1907-1926, as superphosphate (14% P_2O_5), P1
K1	K as potassium sulphate supplying about 25 $kgKha^{-1}$ 1907-1926
K2	K as potassium sulphate supplying 49 $kgKha^{-1}$ to plot 11a 1907-1926
K3	K as potassium sulphate supplying 90 $kgKha^{-1}$ 1877-1906
Na	Na as sodium sulphate supplying 16 $kgNa^{-1}$ 1877-1906. Not applied after 1906, (Na) indicates previously applied.

Mg Mg applied as magnesium sulphate supplying 11 kgMgha^{-1} 1877-1906. Not applied after 1906, (Mg) indicates previously applied.

Organic manures:

FYM (farmyard manure) made from cattle manure. Records were not kept for the actual amounts applied each year. Johnston (1975) calculated the following applications:

FYM1 FYM (average of 10 tha^{-1} fresh weight) supplying 61 kgNha^{-1} 1877-1887. Top-dressed to winter wheat in February, ploughed in in February before sowing spring barley.

FYM2 FYM (average of 20 tha^{-1} fresh weight) supplying 122 kgNha^{-1} 1877-1906. Top-dressed to winter wheat in February. For spring barley, ploughed in in February before sowing 1877-88, as a top-dressing in March or April 1889-1906.

FYM1.5 FYM amount adjusted each year to supply 92 kgNha^{-1} (average of 14.8 tha^{-1} fresh weight), 1907-1926. Ploughed in in October for winter wheat and in March for spring barley.

20 t FYM 1877-1906 also contained approximately 19 kgP and 56 kgK.
14.8 t FYM 1907-1926 also contained approximately 17 kgP and 45 kgK

Rape Cake, the residue from oilseed rape after it has been pressed to remove the oil. Amounts were adjusted to supply the following amounts of N:

R1 23 kgNha^{-1}, approximately 460 kg rape cake, applied 1907-1926

R2 46 kgNha^{-1}, approximately 920 kg rape cake, applied 1889

R4 92 kgNha^{-1}, approximately 1840 kg rape cake, applied 1890-1906

1000kg of rape cake also contained approximately 10kg P and 10 kgK

Data sources:

Johnston, A.E. (1975). Experiments made on Stackyard Field, Woburn, 1876-1974. I. History of the Field, Details of the Cropping and Manuring and the Yields of the Continuous Wheat and Barley Experiments. *Rothamsted Experimental Station, Report for 1974*, Part 2, pp 29-44.
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Rothamsted Experimental Station (1970) *Details of the Classical and Long-Term Experiments up to 1967*, Rothamsted Experimental Station, Lawes Agricultural Trust, Harpenden UK, (128 pp)
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Where there were minor discrepancies between *Details…* (1970) and Johnston (1975) we have used the values of Johnston.

Woburn Continuous Barley Experiment, Woburn Stackyard, 1876-1926

Applications of lime, 1898-1926. Amounts and harvest years applied.

Lime was applied as a test treatment to some sub plots from 1898 until 1921. Applied as high grade burnt lime (CaO), slaked with water immediately before use. Shown in the summary table as the more usual $CaCO_3$ equivalent, converted from CaO with a conversion factor of 1.79.

	t ha^{-1} $CaCO_3$ equivalent and harvest year of application					
Plot	1.1	2.2	4.50	9.00	Total 1898-1926	Code
2ai					0	L0
2aii	1905, 1909 1910, 1912	1923			6.7	L1
2bi				1898, 1912	18.0	L3
2bii				1898, 1905	18.0	L3
3ai					0	L0
3aii				1921	9.0	L2
3bi					0	L0
3bii				1921	9.0	L2
4a					0	L0
4b			1915		4.5	L1
5ai					0	L0
5aii			1905, 1916		9.0	L2
5b				1898, 1912	18.0	L3
8ai					0	L0
8aii				1898, 1912	18.0	L3
8bi					0	L0
8bii				1898, 1912	18.0	L3

Applied March each year, except 1898 when applied in December 1897 (November 1897 to plot 5b). No lime applied to the other plots which are not included above.

Data sources:

Johnston, A.E. and Chater, M. (1975) Experiments made on Stackyard Field, Woburn, 1876-1974. II. Effects of treatments on soil pH, P and K in the Continuous Wheat and Barley Experiments. *Rothamsted Experimental Station Report for 1974*, Part 2, pp45-60. DOI: https://doi.org/10.23637/ERADOC-1-33159

Russell, E.J. and Voelcker, J.A. (1936). *Fifty years of field experiments at the Woburn Experimental Station*. Rothamsted Monographs on Agricultural Science, No. 7. E.J. Russell and J.A. Voelcker (eds), Longmans, Green and Co., London. Appendix Tables, pp 350-351.

Woburn Continuous Barley Experiment, Woburn Stackyard, 1876-1926

Plot division dates and areas:

Plots 1, 6, 7 not divided

Plot 2: Divided into 2a and 2b 1898 to test effects of lime.
Plot 2a divided into 2ai and 2aii in 1905 to test effects of lime
Plot 2b divided into 2bi and 2bii in 1905 to test effects of lime
Plot 3 divided into 3a and 3b in 1907 to test different N rates.
Plot 3a divided into 3ai and 3aii in 1921 to test the effects of lime
Plot 3b divided into 3bi and 3bii in 1921 to test the effects of lime
Plot 4 divided into 4a and 4b in 1915 to test effects of lime
Plot 5 divided into 5a and 5b in 1898 to test effects of lime
Plot 5a divided into 5ai and 5aii in 1905 to test effects of lime
Plot 8 divided into 8a and 8b in 1882 to test effect of N, applied in alternate years
Plot 8a divided into 8ai and 8aii in 1898 to test the effects of lime
Plot 8b divided into 8bi and 8bii in 1898 to test the effects of lime
Plot 9 divided into 9a and 9b in 1882 to test the effect of N, applied in alternate years
Plot 10 divided into 10a and 10b in 1882 to test different fertilizer treatments
Plot 11 divided into 11a and 11b in 1882 to test with and without FYM

Main plot 0.10 hectare	**Sub-plot (a, b)** 0.05 hectare	**Sub sub-plot (i, ii)** 0.025 hectare	**Old plot notation**
1 1876-1926			1
2 1876-1897	**2a** 1898-1904	**2ai** 1905-1926	2a
		2aii 1905-1926	2aa
	2b 1898-1904	**2bi** 1905-1926	2b
		2bii 1905-1926	2bb
3 1876-1906	**3a** 1907-1920	**3ai** 1921-1926	3a
		3aii 1921-1926	3aa
	3b 1907-1920	**3bi** 1921-1926	3b
		3bii 1921-1926	3bb
4 1876-1914		**4a** 1915-1926	4a
		4b 1915-1926	4b
5 1876-1897	**5a** 1898-1904	**5ai** 1905-1926	5a
		5aii 1905-1926	5aa
	5b 1898-1926		5b
6 1876-1926			6
7 1876-1926			7
8 1876-1881	**8a** 1882-1897	**8ai** 1898-1926	8a
		8aii 1898-1926	8aa
	8b 1882-1897	**8bi** 1898-1926	8b
		8bii 1898-1926	8bb
9 1876-1881	**9a** 1882-1926		9a
	9b 1882-1926		9b
10 1876-1881	**10a** 1882-1926		10a
	10b 1882-1926		10b
11 1876-1881	**11a** 1882-1926		11a
	11b 1882-1926		11b

Plan of the Woburn Continuous Winter Wheat and Continuous Spring Barley experiments, showing arrangement of plots, with old plot notation. Taken from Johnston (1975). Notation since 1966 refers to Stackyard I, II and III. Woburn Intensive Cereals (W/RN/13) continued on Stackyard I.