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Broadbalk Wheat Experiment plan and cropping 1852-1925

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Date: November 2018, revised June 2021 with addition of cropping details.

Description: Experiment plan for the Broadbalk Wheat Experiment, 1852-1925, with details of fertilizer and manure treatments (not to scale). Also cropping details 1843-1925.

- **Page 1:** Cover page
- **Pages 2-3:** Broadbalk Wheat Experiment plan 1852-1925, showing plot layout and treatment codes, with full details of fertilizer and manure treatments applied.
- **Pages 4-5:** Broadbalk Wheat Experiment cropping details 1843-1925, showing winter wheat cultivars and the strip divisions. Also cropping 1839-1843 before the experiment was started.

Site: R/BK/1. Broadbalk field, Rothamsted Experimental Farm, Rothamsted Research, West Common, Harpenden, Hertfordshire, AL5 2JQ, UK. Latitude 51.80946, Longitude -0.37301

Derived from:

- Johnston, A.E. & Garner, H.V. (1969) *The Broadbalk Wheat Experiment 2. Historical Introduction*. Rothamsted Report for 1968, part 2, pp12-25.
<https://doi.org/10.23637/ERADOC-1-34916>
- Lawes, J.B. & Gilbert, J. H. (1864) Report of experiments on the growth of wheat, for twenty years in succession on the same land, J. Roy. Agric. Soc. England, 25, part I, pp 93-185 and Part II, pp449-501

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Fertilizer and organic manure treatments 1852-1925

(Fertilizer treatments on many plots varied 1843-51, see Lawes & Gilbert 1864 for details)

Strip/Plot Treatments applied each year since 1852:

- 2a (2.1) FYM since 1885. New plot made in 1885 receiving FYM as same rate as plot 2b
2b (2.2) FYM since autumn 1843; originally called plot 2, named plot 2b in 1885 when plot 2a was made
3 Nil. Originally 2 half plots, 3 (nil since 1844) and 4 (1844-51 NP; since 1852 nil).
Harvested separately until 1899
5 PKNaMg
6 N1 PKNaMg
7 N2 PKNaMg
8 N3 PKNaMg
9 N1* PKNaMg since 1894; 9a and 9b received different treatments 1852-93:
9a 1852-54 N1*; 1855-84 N2* PKNaMg; 1885-93 N1* PKNaMg
9b 1852-54 N2*; 1855-84 N2*; 1885-93 N1*
10 N2
11 N2 P
12 N2 P Na*
13 N2 PK
14 N2 P Mg*
15 N2 PKNaMg since 1873; 15a and 15b received different treatments 1852-72:
(timing of N application different to other plots, see below)
15a 1852-72 N2 PKNaMg
15b 1852-72 N1.5 PKNaMg + C
16 N2* PKNaMg since 1884; previously 1852-64 N4 PKNaMg; 1865-83 nil
(A) Strips 17 and 18 treatments alternate each year:
17 N2 applied in even years; PKNaMg applied in odd years
18 N2 applied in odd years; PKNaMg applied in even years
19 C (rape cake); plot made full size in 1904. Originally half plot, 1852-78 N1.5 P + C; 1879-1903 C
20 N2 KNaMg since 1906, previously nil

Annual treatment per hectare:

- Nil: No fertilizer or manure
FYM: 35 t farmyard manure from cattle supplying approx. 225 kgN/ha
C: Rape cake/castor bean meal: Supplying approx. 96kgN (N2).
0.56t 1852-78; 1.91t 1879-82; 2.12t 1883-1925 (omitted 1917-1920).
P: 35 kgP as superphosphate (omitted 1915)
K: 90 kgK as potassium sulphate (omitted 1915, 1917-19)
Na: 16 kgNa as sodium sulphate (omitted 1915)
Na* 57 kgNa as sodium sulphate (omitted 1915, 1917-19)
Mg: 11 kgMg as magnesium sulphate (omitted 1915)
Mg* 31 kgMg as magnesium sulphate (omitted 1915, 1917-19)

Nitrogen: Annual treatment per hectare

- | | | | |
|------|------------------------------|------|--------------------------|
| N1: | 48 kgN as ammonium sulphate | N1*: | 48 kgN as sodium nitrate |
| N1.5 | 72 kgN as ammonium sulphate | N2*: | 96 kgN as sodium nitrate |
| N2: | 96 kgN as ammonium sulphate | | |
| N3: | 144 kgN as ammonium sulphate | | |
| N4: | 192 kgN as ammonium sulphate | | |

Timing of Nitrogen applications:

Ammonium sulphate:

- 1852-72 All applied in autumn
1873-77 All applied in autumn, except plot 15 in spring
1878-83 All applied in spring, except plot 15 in autumn
1884-1967 24 kgN applied in autumn, remainder in spring (except plot 15 all in autumn)

Sodium nitrate (N*):

- 1867-1967 All applied in spring, as one application except N2 (strip 16) was applied as two equal amounts since 1899, applied from six days to six weeks apart

Broadbalk Winter Wheat Experiment Cropping 1843-1925

Winter Wheat Cultivar	Harvest Year	Cropping	Strip Divisions		Notes		
Old Red Lammas	1844	W			No division of strips		
Old Red Lammas	1845	W			No division of strips		
From 1846 most strips divided into field-length halves, a (North) and b (South) with DIFFERENT fertilizer treatments							
Old Red Lammas	1846	W,W	a	b			
Old Red Lammas	1847	W,W	a	b			
Old Red Lammas	1848	W,W	a	b			
Old Red Cluster	1849	W,W	a	b			
Old Red Cluster	1850	W,W	a	b			
Old Red Cluster	1851	W,W	a	b			
From 1852 fertilizer treatments on most strips became established, a and b halves received the SAME fertilizer treatments							
Old Red Cluster	1852	W,W	a	b			
Red Rostock	1853	W,W	a	b			
Red Rostock	1854	W,W	a	b			
Red Rostock	1855	W,W	a	b			
Red Rostock	1856	W,W	a	b			
Red Rostock	1857	W,W	a	b			
Red Rostock	1858	W,W	a	b			
Red Rostock	1859	W,W	a	b			
Red Rostock	1860	W,W	a	b			
Red Rostock	1861	W,W	a	b			
Red Rostock	1862	W,W	a	b			
Red Rostock	1863	W,W	a	b			
Red Rostock	1864	W,W	a	b			
Red Rostock	1865	W,W	a	b			
Red Rostock	1866	W,W	a	b			
Red Rostock	1867	W,W	a	b			
Red Rostock	1868	W,W	a	b			
Red Rostock	1869	W,W	a	b			
Red Rostock	1870	W,W	a	b			
Red Rostock	1871	W,W	a	b			
Red Rostock	1872	W,W	a	b			
Red Rostock	1873	W,W	a	b			
Red Rostock	1874	W,W	a	b			
Red Rostock	1875	W,W	a	b			
Red Rostock	1876	W,W	a	b			
Red Rostock	1877	W,W	a	b			
Red Rostock	1878	W,W	a	b			
Red Rostock	1879	W,W	a	b			
Red Rostock	1880	W,W	a	b			
Red Rostock	1881	W,W	a	b			
Red Club	1882	W,W	a	b			
Red Club	1883	W,W	a	b			
Red Club	1884	W,W	a	b			
Red Club	1885	W,W	a	b			
Red Club	1886	W,W	a	b			
Red Club	1887	W,W	a	b			
Red Club	1888	W,W	a	b			
Red Club	1889	W,W,W,W	aT	aB	bT	bB	Four sub-plots: 'T' sown in 9 wide rows, to allow cultivation to control weeds; 'B' in usual 18 row spacing
Red Club	1890	W,W,W,W	aT	aB	bT	bB	Four sub-plots: 'B' sown in 9 wide rows to allow cultivation to control weeds; 'T' in usual 18 row spacing
Red Club	1891	W,W	a	b			
Red Club	1892	W,W	a	b			

Red Club	1893	W,W	a	b		
From 1894 a and b halves combined (except 9a, 9b, 10a and 10b), paths added between all strips, reducing the size of the cropped area. Strips 5-8, 15 and 16 divided into T (Top, West) and B (Bottom, East) halves, receiving the same fertilizer treatments. The other strips were not divided.						
Red Club	1894	W,W	T	B	Division of strips 5-8, 15 and 16	
Red Club	1895	W,W	T	B	Division of strips 5-8, 15 and 16	
Red Club	1896	W,W	T	B	Division of strips 5-8, 15 and 16	
Red Club	1897	W,W	T	B	Division of strips 5-8, 15 and 16	
Red Club	1898	W,W	T	B	Division of strips 5-8, 15 and 16	
Red Club	1899	W,W	T	B	Division of strips 5-8, 15 and 16	
Squarehead's Master	1900	W,W	T	B	Division of strips 5-8, 15 and 16	
Squarehead's Master	1901	W,W,W	TT	TM	B	Strips 6-8, 10-14 and 18 divided into three. T strip harvested as two equal parts, TT and TM. TT and B received usual ammonium sulphate, TM received bicarbonate of ammonia in the spring.
Squarehead's Master	1902	W				No division of strips
Squarehead's Master	1903	W				No division of strips
Squarehead's Master	1904	W,F	T	B		In most strips T sown to wheat, B bare fallow
Giant Red	1905	F,W	T	B		In most strips B sown to wheat, T bare fallow
Squarehead's Master	1906	W				No division of strips
Squarehead's Master	1907	W				No division of strips
Squarehead's Master	1908	W				No division of strips
Squarehead's Master	1909	W				No division of strips
Browick Red	1910	W				No division of strips
Little Joss	1911	W				No division of strips
From 1912 all strips divided into T (Top) and B (Bottom) halves except strip 20						
Little Joss	1912	W,(W)	T	B		B only harvested as there was little crop on T due to weeds
Squarehead's Master	1913	W,W	T	B		
Squarehead's Master	1914	F,W	T	B		T bare fallowed, B cropped as usual
Squarehead's Master	1915	W,F	T	B		T cropped as usual, B bare fallowed
Squarehead's Master	1916	W,W	T	B		
Red Standard	1917	W,W	T	B		
Red Standard	1918	W,W	T	B		
Red Standard	1919	W,W	T	B		
Red Standard	1920	W,W	T	B		
Red Standard	1921	W,W	T	B		
Red Standard	1922	W,W	T	B		
Red Standard	1923	W,W	T	B		
Red Standard	1924	W,W	T	B		
Red Standard	1925	W,W	T	B		

Winter wheat (W) grown every year, except for occasional bare fallow (F, no crop) to control weeds. Harvest year refers to the year in which the crop was harvested. Winter wheat was sown the previous autumn. The first crop was sown in autumn 1843 and harvested in summer 1844. Fertilizer and manures were applied to the different treatment strips, which ran the whole length of the field.

Cropping on the whole field before the wheat experiment was started in 1843:

Turnips	1839		FYM applied
Barley	1840		No fertilizer or manure
Peas	1841		No fertilizer or manure
Wheat	1842		No fertilizer or manure
Oats	1843		No fertilizer or manure

Straw incorporation, 1867-1879:

The straw which grew on strip 5a-8a, 11a-14a and 17a or 18a in the previous season was chopped and incorporated, 1867-1879 only. No straw was incorporated on the 'b' strips. Strips 17a and 18a alternated, with straw incorporated in the year when N fertilizer was not applied (see plan for details). Mean yield differences were less than 5%, except for strips 17/18 where straw incorporation reduced yields by 10%.