ROTHAMSTED RESEARCH

Details of the Classical and Long-term Experiments Up to 1967

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Agdell - Formerly Four-course Rotations

Rothamsted Research

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AGDELL, FOUR-COURSE ROTATIONS, 1848–1951, RESIDUAL EFFECTS, 1952–67

The experiment tested two four-course rotations in combination with three different manuring treatments applied to the root-break. Details are given in Table 6.

TABLE 6

Manures applied to roots every fourth year, 1848–1948
(Unless otherwise stated)
(In this table 'roots' means turnips or swedes)

(i) *Symbols, materials and rates of application*

N	Sulphate of ammonia to supply 43 lb N (1)
P	500 lb superphosphate (18% P_2O_5) supplying 85 lb P_2O_5 (about 37 lb P) (2)
K	500 lb sulphate of potash supplying 245 lb K_2O (about 200 lb K) (3)
Na	100 lb sulphate of soda supplying about 14 lb Na (3)
Mg	200 lb sulphate of magnesia supplying about 10 lb Mg (3)
R	2000 lb castor meal supplying about 100 lb N (4)

(ii) *Treatments*

Plot	Rotation	Manures to roots*
1	F	NPKNaMgR
2	C	NPKNaMgR
3	F	PKNaMg (5)
4	C	PKNaMg (5)
5	F	None
6	C	None

* Other crops unmanured

Rotations (6)

F	Roots, barley, bare fallow, wheat.
C	Roots, barley (undersown), clover or beans (7), wheat.

Notes

(1) Until 1912 a mixture of ammonium sulphate and ammonium chloride.

(2) Until 1884 made from 200 lb bone ash and 150 lb sulphuric acid supplying about 65 lb P_2O_5 per acre; 1888–92 ordinary superphosphate 68 lb P_2O_5; 1896–1900 basic slag 108 lb P_2O_5.

(3) Until 1892 the rates were 147 lb K_2O, 200 lb sulphate of soda, 100 lb sulphate of magnesia.

(4) Until 1936 rape cake. The rape cake and castor meal each provided about 100 lb N.

(5) No K 1848–80. 294 lb K_2O in 1884.

(6) The plots were further subdivided to show the effect of carting the roots and leaves of the root crop off the land as compared with feeding them off by sheep or ploughing them in. This comparison was discontinued after the root crop of 1900; all roots and leaves have since been carted off.

(7) Clover was grown in 16 seasons, and was replaced by beans in 10 seasons.

Size of plots. 0·4 acre.

Varieties

Roots. Since 1932 swedes, variety Bruce; previously several varieties had been grown for short periods only. In 1944 14 varieties of turnips and swedes were compared for resistance to club-root.

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Barley. Plumage Archer since 1917, previously Chevalier and Archer Stiff Straw.

Wheat. Squarehead's Master since 1903 (Little Joss 1911), previously Red Rostock and Red Club. In 1947 winter wheat failed and was replaced by spring wheat, Atle.

Clover. Red.

Note that the varieties of wheat and barley were the same as on Broadbalk and Hoos Barley in each year.

End of the rotation experiment. Club-root (*Plasmodiophora brassicae*) was first mentioned as causing serious damage to the turnip crop in 1920, thereafter the yields declined rapidly and by 1948 the crop was too small to weigh.

After the end of the 26th rotation in 1951 the experiment ended but cropping continued to measure the residual effects of the phosphate and potash applied to the root crop since 1848. Uniform dressings of nitrogenous fertiliser were given to all plots according to the needs of the crops, all as 'Nitro-Chalk' except 1954 and 1957 (sulphate of ammonia).

The cropping has been:

1952 Bare fallow.

1953 Barley, Plumage Archer, unmanured.

1954 Barley, Plumage Archer, 1·0 cwt N divided dressing.

1955 Spring wheat, Koga II, 0·6 cwt N.

1956 Winter beans, S.Q. Giant, unmanured.

1957 Potatoes, Ulster Supreme, 1·0 cwt N.

1958 Italian Ryegrass S22. The original six plots were divided; one half of each was sown with ryegrass, the other was bare fallowed. The ryegrass was cut twice and 0·8 cwt N per acre was applied for each cut.

1959 Second year Italian Ryegrass; 3·2 cwt N in four dressings. Fallow plots sown with strips of potatoes, sugar beet, barley, each crop testing 0·0; 0·25; 1·0 cwt P_2O_5 as superphosphate with basal N and K.

1960 Cocksfoot S37 after Italian Ryegrass; 0·8 cwt N for each cut. Rotation of potatoes, sugar beet, barley continued testing direct application 0·0; 0·25; 1·0; 1·5 cwt P_2O_5.

1961 Second-year cocksfoot; 0·8 cwt N for each cut. Plots 1, 3, 5 only: crops in rotation, testing superphosphate as follows:

None; 0·75; 1·50 cwt P_2O_5 either ploughed-in or in seedbed; also 0·75 cwt ploughed in plus 0·75 cwt in seedbed, and 1·5 cwt ploughed in plus 1·5 cwt in the seedbed.

1962 Third-year cocksfoot; 0·8 cwt N for each cut. Plots 2, 4, 6 only: treatments and cropping as in 1961 on plots 1, 3, 5.

1963 Fourth-year cocksfoot, 0·8 cwt N in spring; grass ploughed after first cut and area fallowed. Areas carrying strip crops in 1961 and 1962 bare fallowed.

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1964 Plots in ley re-sown to Timothy, S51; 0·8 cwt N for each cut, remaining area continued in fallow. New scale of P and K dressings applied to sub-plots of both grass and fallow areas: 0, 4, 8, 16 cwt P_2O_5 with 10 cwt K_2O; 0, 2·5, 5, 10 cwt K_2O with 16 cwt P_2O_5.

1965 Second-year Timothy; 0·8 cwt N for each cut. Remainder fallow.

1966 Third-year Timothy; 0·8 cwt N for each cut. Remainder fallow. Dressings of P were applied to all grass sub-plots (except PO) to balance withdrawals by grass in 1965. Part balancing dressings of K were applied to all grass sub-plots (except KO).

1967 Fourth-year Timothy; 0·8 cwt N in spring, ploughed after first cut and re-sown in late summer with 0·8 cwt N in seedbed. Remainder of balancing dressings of K applied to grass plots. Rest of area fallow.

Liming. In 1954 the plots were limed with ground chalk at the following rates as tons calcium carbonate: plot 1, 3 tons; plot 2, 4 tons; plot 3 (part only), 0·5 tons; plot 4, parts at 0·5, 1·0 and 1·5 tons. See *Rep. Rothamsted exp. Stn for 1954*, pp. 146–148. In spring 1959 plots 1 and 2 received 36 cwt ground chalk. In 1967 plots 1 and 2 and the south halves of plots 3 and 4, both grass and fallow, received 46 cwt ground chalk in mid-season.

References

For further details of the early years of the experiment and yearly yields see *Memoranda of the Field Experiments, Rothamsted, 1901*, 110–121.

For residual effects of the manures see Warren, R. G. (1957), *Rep. Rothamsted exp. Stn for 1957*, 252–260.

TABLE 7

Crops in rotation: Agdell

Manure to roots until 1948	None		PKNaMg		NPKNaMgR	
Plot	5	6	3	4	1	2
Rotation	Fallow	Clover	Fallow	Clover	Fallow	Clover
			1848–1919			
Swedes, roots: tons	1·7	0·6	8·8	9·6	18·0	15·9
Barley, grain: cwt	11·4	10·8	12·0	12·0	16·4	18·4
Beans, grain: cwt	—	7·7	—	10·7	—	13·1
Clover, hay: cwt	—	30·7	—	58·6	—	60·2
Wheat, grain: cwt	13·8	12·8	16·3	17·7	16·9	17·8
			1920–53			
Swedes, roots[1]: tons	1·00	0·35	7·69	10·84	13·88	6·99
Turnips, roots[2]: tons	0·72	0·23	3·27	3·78	5·19	4·03
Barley, grain[3]: cwt	7·7	6·5	11·1	14·5	10·8	10·7
Clover, hay[4]: cwt	—	8·6	—	30·2	—	25·2
Wheat, grain[5]: cwt	13·3	11·6	16·6	17·1	14·0	16·0

[1] Mean of two years: 1920 and 1928.
[2] Mean of four years: 1924, 1932, 1936 and 1940.
[3] Mean of eight years: 1921, 1925, 1929, 1933, 1941, 1945, 1949 and 1953.
[4] Mean of four years: 1922, 1926, 1930, 1938.
[5] Mean of seven years: 1923, 1927, 1935, 1939, 1943, 1947, 1951.

1931: wheat failed. 1937: barley failed.

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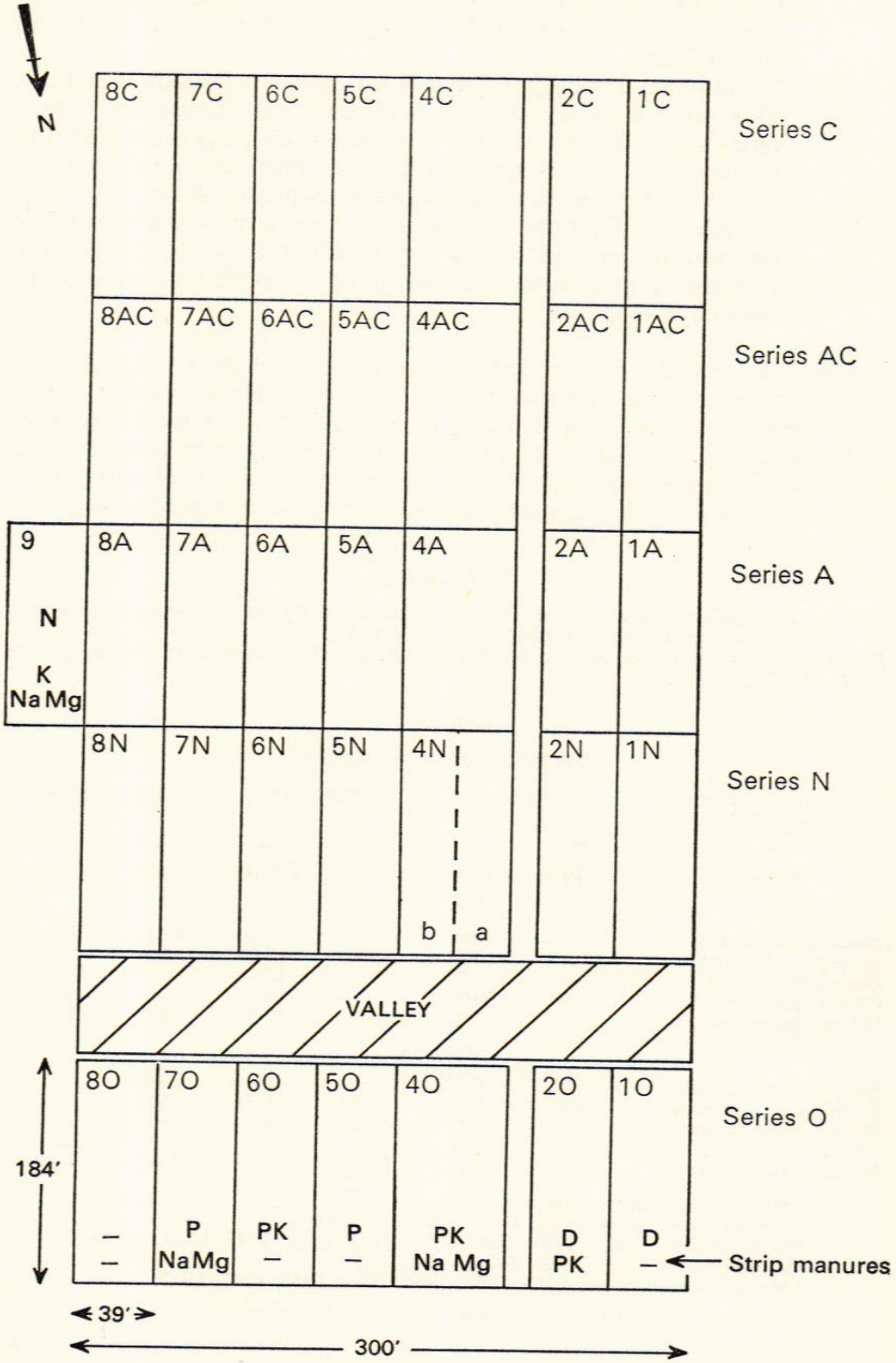
BARNFIELD _ ROOT CROPS 1843-1959



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