ROTHAMSTED RESEARCH

The Long Term Experiments

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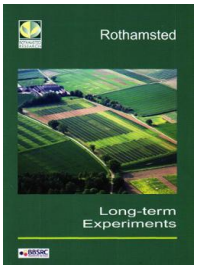

Hoosfield Wheat and Fallow

Rothamsted Research

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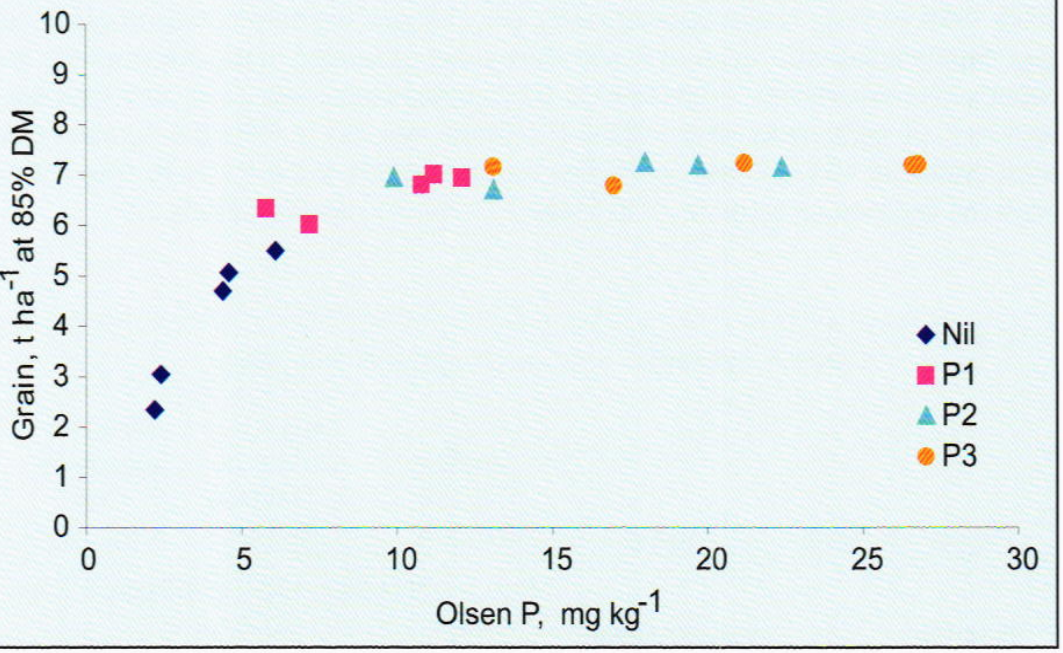
increased available-P (Olsen P) above a critical level, a yield "plateau" was reached (Fig 7). Although further applications of fresh P increased soil P, they did not increase yield. Applying three fixed rates of P stopped after seven years and, since 2000, maintenance dressings, equivalent to offtakes by the crop, have been applied (not to the no-fresh-P sub-plots). Wheat has been grown since 1992. Typically, it showed the same response to available-P as spring barley *i.e.* above a critical level, *on this soil*, of about 10-12 mg kg^{-1} there is no further increase in yield. In the first year that wheat was grown take-all was severe (especially in plots deficient in P) despite many decades of continuous spring barley. This raises interesting questions, as yet unanswered, about the nature and causes of take-all decline.

Fig.7 Exhaustion Land. Response of spring barley after 3 years fresh P



On the other half of the experiment, the effects of K residues (in the presence of basal P and N) on yield are investigated.

HOOSFIELD WHEAT AND FALLOW

From 1856 to 1932, this 0.4 ha area, which has received no applications of fertiliser or manure since 1851, was divided into two strips that alternated between wheat and fallow in successive years. From 1934 to 1982, a modification allowed a yearly comparison of a one-year and a three-year fallow but the effects were small and, since 1983, the experiment has reverted to the original design. It does receive chalk, when needed, and pesticides.

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The cultivar grown has usually been the same as on Broadbalk and the effects of fallowing may be roughly estimated by comparing yields of wheat on Hoosfield with continuous, unmanured wheat on Broadbalk. In the first 10 years of the experiment the one-year fallow gave an extra 0.6 t ha^{-1} but over the next 60 years the difference was smaller at only 0.14 t ha^{-1}. With modern cultivars, and since its reversion to the original design in 1983, average yields of the wheat after a one-year fallow have been 1.7 t ha^{-1}. When expressed on the basis of the whole area (i.e. wheat plus fallow), the yield of 0.85 t ha^{-1} is slightly less than the 1.0 t ha^{-1} for continuous wheat on Broadbalk. It was in this experiment, in 1935, that symptoms caused by *Gibellina cerealis* were first recorded in the UK.

GARDEN CLOVER

Garden Clover is the simplest of the Classical experiments, with (until 1956) only one, unmanured plot. Lawes and Gilbert were successful in growing wheat, barley and turnips each year on the same land but found that red clover, although a perennial, seldom survived through the winter when sown on farmland. Even when resown annually it soon failed to give an acceptable yield. To see whether red clover could be grown continuously on a "richer" soil, Lawes and Gilbert laid down this small plot in the Manor garden in 1854. Yields were very large for the first 10 years averaging about 10 t dry matter ha^{-1}, probably because the soil was rich in nutrients and because the soil-borne pests and diseases of clover were absent. Reasonable yields were obtained over the next 30 years but thereafter yields showed a marked decline and there were several complete failures.

Between 1956 and 1972 the plot was sub-divided and a sequence of tests made of K, molybdenum (Mo), formalin, N and Mg. N, K and Mg all increased yields, Mo and formalin did not. With N, P, K and Mg, yields of about 6 t dry matter ha^{-1} were obtained in the year of sowing. The crop was usually severely damaged during the winter by clover rot (*Sclerotinia trifoliorum*) and was resown each spring. Since 1973 basal N, P, K, Mg and chalk have been applied.

Between 1976 and 1978 aldicarb was tested as a control for clover cyst nematode, *Heterodera trifolii*, which was known to be present, and the cultivar Hungaropoly, believed resistant to clover-rot, was compared with the standard susceptible variety S.123. The combination of aldicarb and Hungaropoly gave yields up to 8 t dry matter ha^{-1} but winter survival remained poor.

The plot then grew Hungaropoly only, with basal aldicarb (until 1988), and tested the fungicide benomyl from 1980-90. Initially, there was a benefit from applying benomyl but averaged over the 11 years in which it was tested there was none. The cultivar was changed to Merviot in 1996. Between 1979 and 2006 the experiment has been resown seven times. A mean yield of 13t ha^{-1} has been achieved in this period, with up to 20 t ha^{-1} in some years.

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