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Memoranda of the Plan and Results of the Rothamsted Field Experiments, June 1862

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Experiments on the Growth of Root-crops

Rothamsted Research

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EXPERIMENTS ON THE GROWTH OF LEGUMINOUS CROPS.

I.—Beans, Peas, and Tares.

Experiments on the growth of Leguminous corn-crops, with different descriptions of manure, were commenced in 1847, about 9 acres being devoted to the purpose. The experiments with beans were continued for thirteen consecutive seasons, to 1859 inclusive; but with a great falling off in the crop during the later years. The land was then fallowed for one season; in the next (1861) a crop of wheat, without manure, was taken; and beans have now (1862) again been sown, but with some variation in the manuring. The experiments with peas were soon abandoned, owing to the difficulty of keeping the land free from weeds, and an alternation of beans and wheat was substituted: the beans being manured as in the case of the other experiments with the same crop. Those with tares were also soon abandoned for the same reason; beans being substituted, with a slight variation in the description of the manures employed.

The general result of the experiments with beans was, that mineral constituents added as manure (more particularly potass, and, to a certain extent, phosphoric acid also) increased the crop very much during the early years; and, to a certain extent, afterwards, whenever the season was favourable for the crop. Nitrogenous manures, on the other hand, produced very little effect; notwithstanding that a Leguminous crop contains two, three, or more times as much nitrogen as a Graminaceous one grown under parallel circumstances. But Leguminous crops grown too frequently on the same land seem to be peculiarly subject to disease, which no combination of manuring that we have hitherto tried seems to obviate.

In alternating wheat with beans, the remarkable result has been obtained that about the same amount of wheat and about as much nitrogen were yielded in 5 crops in alternation with the highly nitrogenous beans, as in 10 crops of wheat grown consecutively without manure. It is also remarkable that about the same amount of wheat, and of nitrogen were obtained in another field in 5 crops alternated with fallow.

II.—Red Clover (*Trifolium pratense*).

Experiments on the growth of clover, with different descriptions of manure, were commenced in 1849, and, with the occasional interposition of a corn-crop, or fallow, have been continued up to the present time. As with beans, the result was that mineral constituents, applied as manure, particularly potass, and, more or less, phosphoric acid also, considerably increased the early crops; whereas ammonia-salts had comparatively little effect. But after the first few years all further attempts to grow clover year after year on this land have failed, notwithstanding that fresh seed has again and again been sown. Neither ammonia-salts, nor organic matter rich in carbon as well as other constituents, nor mineral manures, nor a mixture of all, has availed to restore the clover-yielding capabilities of the land.

It is, however, worthy of remark that, in 1854, red clover was sown in a kitchen-garden only a few hundred yards distant from the experimental field, on soil which has been under ordinary garden cultivation probably for two or three centuries, and it has every year since shown very luxuriant growth; and (after once re-sowing during the period) there is, at the present time, little or no indication of failure.

EXPERIMENTS ON THE GROWTH OF ROOT-CROPS.

Experiments with turnips were commenced in 1843. Eight acres, divided into numerous plots, were set apart for the purpose, and the crop was grown for ten consecutive years (1843-52) on the same land, without, and with different descriptions of manure, on the respective plots. Barley was then grown for three consecutive years (1853-55), without manure, in order to test the comparative corn-growing condition of the different plots, and also to equalize their condition, as far as possible, by the exhaustion of some of the most active and immediately available constituents supplied by the previous manuring. A new series of turnip experiments was then arranged, having regard to the results previously obtained and to the character of the manures previously applied on the different plots. This series commenced in 1856, and is still in progress.

It is impossible adequately to state the bearing of the results in a few words, but the following are some of the most characteristic indications:—

1. Without manure of any kind, the produce was reduced in a few years to a few cwts. per acre; but the diminutive plants contained a very unusually high percentage of nitrogen.

2. Of "mineral" constituents, phosphoric acid (in the form of superphosphate of lime) was by far the most effective manure; but when the crop is grown by this manure alone, the immediately available nitrogen of the soil is rapidly exhausted.

3. Really large crops of turnips can only be obtained when the soil supplies a liberal amount of both carbonaceous and nitrogenous matter; and when these are already available, or are supplied in the form of farmyard manure, rape-cake, Peruvian guano, ammonia-salts, &c., the rapidity of growth (and consequently the amount of the crop) is greatly increased by the use of superphosphate of lime applied near to the seed.