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# Annual Report for 1914 With the Supplements to the Guide to the Experimental Plots Containing the Yields per Acre, Etc.



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## The Green Manuring Experiment

### Rothamsted Research

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## THE GREEN MANURING EXPERIMENT.

Throughout the Rothamsted experiments a number of observations have shown the marked effect of ploughing-in a green crop or a crop residue as a preparation for a succeeding crop. Every four years the residues of a clover crop after carting the hay are ploughed-in on half of the Agdell Field, and the effect on the succeeding crops in the rotation is recorded. In Hoos Field some leguminous crop has periodically been ploughed-in and a number of grain crops have then been grown, almost always with beneficial results.

The growing scarcity of stable manure renders it imperative that some method should be worked out whereby the farmer can get all the benefit of stable manure in some other way, and green manuring affords an obvious means of doing this. Experiments in the laboratory and pot culture house, however, showed that the growing plant has a complex effect on the soil and on other crops, and that one could not without further trial advocate unrestricted green manuring. For example, it was found that the growing plant apparently depressed nitrification and other bacterial actions in the soil, and that some interval was needed between two crops in order that the bacterial processes might become completed.

Another action is indicated as the result of Mr. Pickering's work at Woburn: one growing crop has an injurious effect on another growing crop apparently through exerting some deleterious influence on the soil. It appears, therefore, that there is another side to the question, and that a growing crop not only takes out certain plant foods (which are automatically returned when the crop is ploughed-in, or can be added as artificial fertilisers), but it may also have other effects. This is while it is actually growing: the residues ploughed-in seem to be wholly beneficial—at any rate no ill-effect has yet been detected in the field, although one (a destruction of nitrate in certain circumstances) has been indicated in the laboratory. So far as our present knowledge goes the best results are only attained when a period of fallow comes after the green manure crop.

Thus green manuring is intimately bound up with fallowing. It was shown in the last Report that fallowing had a very beneficial effect on the crop of barley and further observations to the same effect have been made this year. Winter oats on Sawpit Field taken after a fallow were better than crops fertilised with nitrogenous manures. No green manure or crop residue was ploughed in either for the barley or oats, but this year an experiment was made to find the effect of combined crop residues and fallow on wheat. A four-year-old lucerne ley on Broadbalk Field was broken up, fallowed during the hot weather and sown with wheat in October, 1913. The land had received no manure for some years, but the wheat crop was greater than on any plot receiving artificial manures, and at least as large as that on plot receiving 14 tons of farmyard manure. Even more remarkable, however, was the effect on the weight of the grain. Practically all the wheat on the regular plots with the exception of the unmanured had the same density, viz.: 62'2 lbs. per bushel, this being independent of the amount or nature of the fertiliser used. The wheat after lucerne had a heavier grain, weighing 63'9 lbs. per bushel.

But in regard to fallowing a difficulty at once arises. While the land is lying fallow it is subject to loss of nitrates by leaching; indeed one of the great merits of green manuring is that it puts a crop on the land in autumn when the stock of nitrates is high and the crop takes up the nitrates and holds them safely from the winter rain. A simple way round the difficulty is to have the necessary fallow only during the dry weather, and it so happens that all our experiments were made under these conditions.

It is to clear up these and similar problems that a definite green manuring experiment has been begun. A field is divided into four parts, one of which is farmed with artificials only, one with farmyard manure and artificials, and two with artificials and green manure but no farmyard manure. One of the two last carries leguminous crops and the other non-leguminous crops for the green manure. An eight-year rotation has been drawn up to keep the green-manured land as closely cropped as possible, and to reduce to a minimum all losses by leaching; whether other losses will also be reduced has yet to be determined. The eight-year run should show how far green manuring can be regularly practised under farming conditions, and whether periodical fallows will be necessary.

Meanwhile, in view of the marked benefit just recorded of the fallow coming after the lucerne ley and of other results of like nature, the question arises whether, in a dry summer, it is worth while to trouble about the aftermath of the seeds or clover ley (unless wanted for clover seed), and whether it would not be better to take the first cut early and plough up immediately so as to secure a long bastard fallow before the next corn crop. Under dry conditions the aftermath may be worth only little, while the benefit of the fallow is great. The practical difficulty on a heavy loam like ours consists in breaking up a hard baked ley at midsummer sufficiently quickly to avoid interference with other work. Not only for this purpose, but for the general object of being well forward in autumn, there is great need on medium sized heavy-land farms of a plough which will cheaply and efficiently do more than the one acre a day that has for untold years been considered the ploughman's proper and sufficient duty.

#### MIXED CROPS.

The harmful effect of some growing crops on others observed by Mr. Pickering, at Woburn, gives an added interest to the study of weeds. Hitherto it has been supposed that weeds are mainly harmful through depriving the plant of water, food, and root space, but Mr. Pickering's observations indicate that there is something more. Pot experiments have therefore been started and careful field observations taken to ascertain the importance of these effects in practice. We must know the real case against weeds before we can decide how much it is worth spending in order to eliminate them.

It does not always appear that one crop injures another. It is not uncommon in the west country for farmers to grow a mixture of oats and barley as dredge corn, and it is commonly stated that the yields are larger than when the two are grown separately. An experiment with the mixture has therefore been made at Rothamsted