

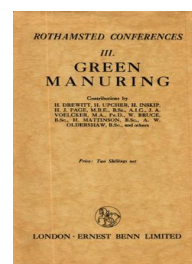
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Green Manuring

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Organic Manuring in the Lothians

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to the soil by the tares crop than by the mustard, and on two occasions the entire green crops have been cut, weighed and analysed, the results showing that not only is a greater weight of material conveyed in the tares, but also that more organic matter and more nitrogen are supplied by them, while, as already stated, the tares soil is found to be richer in nitrogen than the mustard soil. This would seem to indicate that for some reason, as yet unknown, the tares soil, though richer in nitrogen, cannot yield this up so well, so that it is not utilized by the corn crop. Again, it has been suggested that mechanical considerations of the condition in which the soil is relatively left by the growing of mustard and tares respectively have a bearing on the question, but, though it is certainly the case that the ploughing in of mustard leaves the soil in a more open and loose condition, the bearing of this would be negated by the similarity of the results when, as in Stackyard Field, the land is consolidated by the treading of the sheep.

These experiments have now been continued for such a long series of years, and with such consistent results, as to leave hardly any possibility of doubt being entertained as to their accuracy. But the question as to what these results are due to remains as far from solution as ever, and I shall welcome any suggestion made in the Discussion of to-day that will help in elucidating it.

ORGANIC MANURING IN THE LOTHIANS

BY W. BRUCE, B.Sc.

THE term "green manuring" is scarcely known in Scotland; but an increasing number of progressive farmers do appreciate the importance of keeping the humus content of their soil at a high level, and are becoming more alive to methods of doing it. The idea of catch-cropping is more popular in the North than just green manuring. The Scotsman looks for some direct return for his outlay, and the most successful efforts have been made on land in high condition. A cheap seeding is put down where opportunity occurs, growth is rapid, the herbage is consumed by sheep, and is highly prized for fattening off black-faced lambs from the hills. These usually pay the cost of the seeding and the land is benefited by the residue.

My first experience of green manuring in this way goes back nearly thirty years, when I commenced teaching. In the vicinity of Dundee my attention was drawn to great deterioration of soil where potatoes were lifted for the early market, in July or August, and nothing put on the land until the wheat was sown in November, as

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compared with fields where a late crop of potatoes was left on the ground until October. I had recently been at Rothamsted studying the work that had been done there and was impressed by figures obtained there on loss of nitrogen through nitrification and drainage. I advised catch crops after early potatoes and also catch crops of "seeds" put down with grain. Both these methods have caught on in the more intensively cultivated districts in Scotland. In the Lothians it is now quite common to put down a light seeding of, say, $\frac{3}{4}$ bushel Italian rye-grass and a few pounds of good cheap red clover seed, with the grain, in spring, for the purpose of providing a clean bite for lambs in autumn, and conserving and improving the fertility of the soil.

In a very dry climate it should be sown early to get a proper start. A heavy crop of grain keeps it in check till harvest. When on land in high condition it will come away very luxuriantly. As I have said, the lambs usually pay for the seeding and we think the residue is good for the land.

It is ploughed down during winter in preparation for the next crop, normally a green crop. Very often well-made dung that has been lying over for the summer is applied to the stubble after harvest, and this sets up a great growth. The growing vegetation prevents the waste of soluble manurial material and provides a wealth of green-stuff and roots to decompose in the soil as a preparation for the next crop—which is usually potatoes.

Catch-cropping after early potatoes is now practised wherever early potatoes are grown. This practice has been long esteemed in the early districts in Ayrshire and in the South-west of Scotland, where potato-lifting commences in June. A variety of crops have been used—*e.g.* rape, rye-grass and barley. Californian barley grows very quickly, and in rare seasons I have heard of its ripening into grain, but the chief aims are green keep for sheep, the cleansing and purifying of the land, and the maintenance of its fertility.

In my own districts, the best parts of the counties of Midlothian and East Lothian, there has been a considerable extension of early potato-growing followed by catch-cropping. In some cases early potatoes are grown year after year on the same soil. The seed of quick-growing early tuber varieties are sprouted or chitted in boxes or trays, set about the end of February, or as soon after as possible, and are heavily dressed with quick-acting manure. The land is continually worked to encourage growth and keep down weeds, until the crop is up and covering the ground, which happens about the end of May. Digging the crop takes place in July and August. Immediately after the digging, usually day by day, the seeding of the catch-crop takes place. Rape used to be a favourite crop, as it grows quickly, the seeding is cheap, and at one time it was supposed that there was nothing like it for feeding sheep, but Italian rye-grass is now more popular and more extensively used. It is probably just as good in the

circumstances for feeding sheep, and does not suffer from disease to the same degree as does rape. It grows very quickly, and when sown at the rate of about $2\frac{1}{2}$ bushels per acre, and harrowed into the freshly dug potato-land, it produces a close thick growth of very nourishing herbage, which grows about 6 in. high in the course of six or eight weeks. It is stocked with fattening lambs in September, carrying very often about four or five to the acre. It grows and keeps green until ploughed down about the beginning of the year in preparation for the next crop, when it is found that this seeding of Italian rye-grass has left in the soil a thick-felted mass of roots down to a depth of 6 or 8 in.

This system allows of heavy crops of early potatoes being taken year after year on the same soil. The soil gets frequent dressings of dung, and annually at least 10 cwt. of high-class potato manure containing 10 per cent. ammonia. It keeps like a garden soil, and with moisture gives crops that usually vary from 6 to 14 tons per acre. In the East of Scotland moisture is generally the limiting factor.

In other cases potatoes are not grown so closely and a rotation of crops is usually adopted, although not necessarily a hard-and-fast one. In my own case I have practised the following :

First Year.—Potatoes that have been dunged in autumn and further manured in the ridge when setting the seed with at least 10 cwt. of a mixture of artificial manure, composed of 4 cwt. sulphate of ammonia, 4 cwt. superphosphates (35 per cent. sol.), 1 cwt. steamed bone flour, and 1 cwt. of either muriate or sulphate of potash (50 per cent. potash). This provides 10 per cent. ammonia, 20 per cent. phosphates and 5 per cent. potash. The first planting may get up to 14 cwt. of this mixture.

The catch crop of Italian rye-grass follows.

Second Year.—The catch crop may be left down as it costs nothing for seed or cultivation. It grazes all winter and provides an early bite for ewes and lambs. It may be grazed all summer or top-dressed with sulphate of ammonia or nitrate of soda—sometimes both—and a good crop of hay may be got early in July. A further dressing of nitrogenous manure may be given and another crop of hay obtained, or the herbage may be grazed. The catch crop holds the ground for about eighteen months, which with all this growth becomes well stocked with organic matter, making an excellent preparation for another crop of potatoes.

Third Year.—Potatoes grown with about 12 cwt. artificial manure : followed by a catch crop which is grazed by sheep till the new year, when the land is ploughed.

Fourth Year.—Barley or oats, which are sown early in spring and get no manure, and a light seeding of Italian rye-grass and clover is put down with the grain : this gives autumn grazing, and an excellent medium for receiving the dung for the next crop of potatoes.

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One of the troubles of this kind of farming when the moisture is more plentiful than usual is that the barley may lodge badly.

Sugar-beet promises to be a much more profitable crop now that the price of barley has fallen so much. This year we had a gross revenue in the neighbourhood of £36 per acre from sugar-beet, which also provided a great mass of green organic matter for green manure.

From many observations of farm practice that I have made I have formed the opinion that it is very material that all turnip, mangel and beet tops should be ploughed into the land while they are still green. In that condition they have a telling effect on the next crop, but if allowed to lie on the surface of the soil until shrivelled and dead they seem to have little influence in promoting growth.

Early potato-growing gives scope for catch-cropping at either end. I have been dealing with crops after the main crop. Another method we practise to a limited extent is to seed down cabbage plants in August, after early potatoes. They can be sown and harrowed in without any preparation. The cabbage plants are cleared by the end of May, when the land is dunged, ploughed and set with early potatoes, which have been coming forward in trays. Good seed well sprouted may be planted with success as late as the middle of June. The soil is often very dry after the cabbage plants, but sprouted potatoes will probably start with less moisture than most crops.

The method of increasing the humus in the soil by putting land down to temporary leys of mixtures of seeds, whose dominant feature is cocksfoot and wild white clover, has in recent years become very well understood in Scotland, with the result that a great deal of second- and third-rate land is being systematically treated in this way. I have one farm that has been greatly improved by this means. In fact, on some of the better land under this treatment the condition stored up after three or four years in grass is beginning to give trouble with serious lodging in the succeeding grain crop. Another serious trouble in this case is the grub of daddy longlegs, but this pest is being successfully overcome by the Paris Green treatment, recently discovered by the West of Scotland Agriculture College.

The other day I had brought under my notice the case of a farmer who put his land down to grass for three years. He broke this up by tractor and took a crop of turnips which were consumed on the land by fattening sheep receiving cake. This was followed by potatoes and then wheat sown out again. The wheat straw was sold off and no dung was used. Not, perhaps, a system that could be universally applied. But these movements all indicate a growing appreciation of that great subject—the supply of organic matter to the soil—part of which we have under discussion.