

Leguminous Plants.

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1. In a field at Rothamsted where continuous crops of barley are grown, red clover is occasionally sown with the barley on a portion of the land. The amount of nitrogen and mineral matter removed in the clover hay is very much larger than the amount of these substances removed in the barley; but the crop of barley which follows the clover is much larger than that which follows the barley alone. Analysis of the surface soil also shows a larger amount of nitrogen where the clover was grown.

2. All attempts to grow red clover continuously in the adjoining field have failed, although a great variety of artificial manures as well as the ordinary manures of the farm have been used. Large crops of other leguminous plants have, however, been grown on this field, some of which remove both more nitrogen and more minerals than would be removed in the clover.

3. Upon an unmanured garden soil, red clover has been grown continuously for thirty years, and the seed sown this year is growing most luxuriantly. The surface soil of this experiment shows by analysis a large reduction of nitrogen.

4. A permanent pasture was manured for twenty years in succession with a considerable amount of nitrate of soda. The crops of hay removed every year were large, and consisted almost entirely of grasses, with hardly any leguminous herbage. In 1876, the application of nitrate of soda ceased, and on that and each year since a manure containing potash, soda, magnesia and phosphate of lime has been applied. The result of this treatment is that since the application of nitrate ceased the crop of hay has declined considerably, and the leguminous herbage has greatly increased.

In parts of the experiment this year the *lathyrus* (wild vetch)—a leguminous plant with a creeping root—occupies several square yards of the land. The growth is from one foot to eighteen inches in height, and so thick as almost to exclude all other plants. On another part of the plot white clover has spread, and there the grass grows with considerable luxuriance. On other portions of the plot there are either no leguminous plants at all, or only isolated specimens of perennial red clover. Here the grass shows great signs of poverty and it is quite certain that this poverty is due to the absence of available nitrogen.

I have here brought together some very interesting results bearing upon the source of the nitrogen of the leguminous plants; and I think it is quite possible that those who hold the source to be in the atmosphere and those who consider it to be in the soil, might, from the results I have brought forward, derive some arguments in support of their respective views.

A correspondent in the COUNTRY GENTLEMAN very justly remarks that a science which is a creation of yesterday cannot compete with one like astronomy, which has its centuries of observation and record. The facts I have brought forward are the result of but a few years of observation, and yet what a wide field of inquiry is opened by them!

Assuming it to be a fact that the surface soil of the garden has lost large amounts of nitrogen by the growth of clover, while the soil in the field has by the same process gained some nitrogen, are we to explain these contradictory results by saying that the plant in the garden, finding abundance of nitrogen in the soil, will not take the trouble to extract it from the atmosphere, or that, finding all the nitrogen it requires near the surface of the soil, it will not push its roots into the subsoil to obtain its supply?

If the clover had failed to grow upon either of the soils, the argument in favor of the atmospheric supply of nitrogen

would have been quite as valid as that in favor of the source being in the soil; but the continuous growth of the clover in the rich soil, and its failure in the poorer one, rather point to the source being in the soil. A new feature in the case, however, turned up when it was found that in the same soil, where red clover had failed, several other leguminous plants were able to flourish, as vetches, sainfoin, lucern and Bokhara clover produced large crops on land which had received no manure containing nitrogen for thirty years. Surely it might be said this is a point in favor of those who support the atmospheric theory!

If we turn from these results on arable land to those on pasture, we see that the minerals have encouraged the growth of clover, and the grass has become more luxuriant where the clover is growing. Whether this luxuriance will continue where the latter grass is now growing remains to be seen.

In a paper which we have recently published on fairings, we have established on tolerably good evidence that the fungus destroys large amounts of the organic matter in the soil, and appropriates to itself the nitrogen contained. Its action is more like that of an animal than a plant, in burning off large quantities of carbon to obtain the nitrogen it requires. By removing the fungi as fast as they were formed, I satisfied myself that the growth of the grass was not due to the decay of the above-ground growth of the fungus alone, for I found that the removal made little, if any, difference in the luxuriance of the grass. It is to the under-ground action of the fungus, therefore, that we must attribute its beneficial effects upon the pasture. By its action the total amount of organic matter in the soil is reduced, but at the same time portions have been rendered available as food for the grass.

A question of considerable importance has still to be solved, as to whether plants with green leaves also possess the power of feeding upon organic compounds, and if so, whether some plants possess the power more than others.

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PREPARATIONS FOR WINTERING STOCK.

Already the tints of autumn warn us that the summer is past, the cold nights succeeding hot days are having their effects on animal as well as vegetable life; not only do the leaves turn yellow, and the grasses brown, but the coats of the different varieties of stock are becoming dry, thick, and dusty; all betokening a preparation by nature for the coming cold of winter. This is a subject which we in this province may consider with advantage, convinced as we are by long experience that in the treatment of animals, both in health and disease, the maximum of success will be attained by studying nature, following nature's laws, and seconding her efforts. In the different species of wild animals, nature adopts different methods of preparing for winter. Some escape it altogether, by migration. Most, however, especially quadru-