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PROFESSOR JOHNSON'S LECTURE AT LIMERICK.

ON THE APPLICATION OF CHEMISTRY TO AGRICULTURE.

Gentlemen, the means by which agriculture is to be promoted are of two kinds. There is first the mechanical, as by draining, and the use of improved implements. Draining, subsoiling, &c., belong to the mechanical part of agriculture; and in regard to them, their utility and advantage all, in some measure, understand, as there are few persons—I think I may say there are none here who have not discovered the advantage of such mechanical means for rendering the soil more fertile than before. But the second class are the chemical means, and unfortunately the use of these is less understood, and yet, my lord, it is materially important that they should be understood; for, though I grant the necessity of draining before all other means, yet I believe that the highest advantages—the utmost limit of fertility—is to be attained only by the application of chemistry; it is, therefore, I think, of the greatest possible consequence that the application of chemistry to the soil should be thoroughly understood. I cannot hope, in two short lectures, to lay open to you the details of these applications of chemical science. I can give you nothing more than the general heads; but I think it will be of great advantage, in a district like this, to lay before you a general sketch of the way in which chemistry may be brought to bear on agriculture. In the first place, among the materials with which a farmer works, his land is the most important.—In the next place, stand the crops which he grows upon it, and then the manures that he applies to the land, for the purpose of resuscitating and invigorating it. These matters are of general importance—and lastly, he considers in what way the crops may be best disposed of or distributed amongst his cattle for feeding. In regard to these four different subjects, with which the farmer has to do, there are certain common properties, and, therefore, we should inquire what those common properties are. If you kindle vegetable matter, you find that it burns, (then the lecturer lighted a lucifer match.) If you allow it to burn, you know that the greater part of it is wholly consumed, but there is a small portion of ash remaining. This which remains is called inorganic matter—that which is burned is called organic matter: and if, instead of a vegetable substance, you applied fire to the soil, you will find that what is true of the plant, is true of the soil; and you will, on investigation, find, that the soil consists of two matters, namely, that which will burn away, and that which will not. If you take a part of the animal body—your own body, for instance—you will find that there is, as in the vegetable and in the soil, a portion which will burn away, and another portion which will not. And this is the first point to which I would wish to draw your attention, as practical farmers, that there are in the soil, and in the vegetable and animal kingdoms, two bodies, namely, one which will burn away, and one which will not. But in different cases the relative proportions of those bodies are different. In the plant, there is a great deal more which will be consumed than in the soil; and the same difference applies to manures according to the kinds to which they belong; and if we take the animal body, we shall find that it contains a large proportion of organic matter. But again, the animal and the plant differ as to the amount of the ash which will remain after burning; for instance, in 100 pounds of bone, from 50 to 60 pounds will remain behind. And now let me ask, whence do these different substances get this inorganic matter? To-day I propose to discuss the inorganic part, because it forms a large proportion in the soil; and the first question rises as to where the inorganic matter is obtained. Beneath all our soils, at a greater or less depth, we find the solid rock. These rocks are of different kinds and different composition. They have crumbled down and formed the inorganic portion of the soil. It is from the soil that the plant acquires its inorganic matter; there is nothing of the kind in the air; there are no inorganic particles floating in the atmosphere; and it is also from the soil that the animal procures its inorganic matter, through the plant. Manures consist of animal and vegetable substances. Having ascertained whence these matters are derived, we come to their analysis, that is, a process by which the chemist discovers the component parts of any substance, and when these matters are put into his hand, and he is asked what they are, he analyses them. Now, the general components of the inorganic part of the soil, are as follows:—

COMPOSITION OF THE INORGANIC PARTS OF PLANTS.

The soil contains	Plants contain	Animals contain
Potash,	Potash,	Potash,
Soda,	Soda,	Soda,
Lime,	Lime,	Lime,
Magnesia,	Magnesia,	Magnesia,
Oxide of Iron,	Oxide of Iron,	Oxide of Iron,
Oxide of Manganese,	Oxide of Manganese,	Oxide of Manganese,
Phosphorus,	Phosphorus,	Phosphorus,
Sulphur,	Sulphur,	Sulphur,
Silica,	Silica,	—
Alumina,	—	—

Plants contain all these but alumina; and animals contain them all, but alumina and silica. Such is the nature of the inorganic substance of the plant, the animal, and the soil. Now these substances are all present; but the next question is, are they all present in equal proportion? No, they are in unlike proportions. In some there is but a small quantity, as is the case with potash; of others there is a much larger one. There is a difference between the soil and the plant, and the plant and the animal. Nor are those matters contained in different soils in the same proportion. That is the next question—are their relative proportions alike in each? They are not. Here the lecturer pointed to the following table:—

COMPOSITION OF SOILS.

	Fertile without Manure.	Fertile with Manure.	Very Barren.
Organic matter	50	97	40
Silica	833	648	778
Alumina	51	57	91
Lime	18	59	4
Magnesia	3	8	1
Oxide of Iron	30	61	81
Manganese	3	1	trace
Potash	trace	2	do.
Soda	do.	4	do.
Chlorine	do.	2	do.
Sulphuric Acid	1	2	do.
Phosphoric Acid	2	4	do.
Carbonic Acid	4	40	do.
Loss	0	15	5
	1000	1000	1000

You will see that the above table is divided into three columns, that the first represents a fertile soil without manure; the second one fertile with manure, and you will see the difference in lime is 59 to 18; in sulphuric acid as 2 to 1, and in phosphoric acid as 1 to 2. Here the lecturer described at length the differences between soils, and also between soils producing crops and those entirely barren, and then continued—In what way shall we make the soil in the second column equal to that in the first? I will allow that the same physical qualities of the soil shall be the same; why, by adding to the second the proportions of the different substances necessary to make it equal to the first, and this must be done by judicious manuring. But it may happen that there are too large quantities of some of the substances in it. This would, at