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LECTURE.

[We extract the following Lecture delivered by Professor JOHNSTON, before the Royal Agricultural Society of England, from the August number of the Farmer's Magazine, received by the last Steamer.]

My Lord and Gentlemen,—the subject which has been selected by your council for the purpose of being made the subject of discussion this evening, is one of so very important and mighty a nature that I could not hope to explain to you the principles upon which it depends in a single hour, which is the very utmost time that I suppose ought to be placed at my disposal. But besides, gentlemen, the observations that I am about to offer to you are intended to lead to an after discussion, and therefore, inasmuch as the essential principles do not, perhaps, well admit of discussion in a meeting like the present, I shall select points to bring before your notice as are of practical nature—points which I hope will suggest to your mind topics upon which I trust you will be able to lay before the meeting observations far more valuable than I can offer you (applause). Gentlemen, the relation of British agriculture to the present condition of this country involves two great points. In the first place, the production of a larger amount of corn, for the purpose of rendering us independent of foreign supplies, so as to enable us to meet the wants of our large and increasing population; and, in the next place, it demands the production of this increase at a cheaper rate, so as to enable us better to contend with foreign competition (applause). The first of these ends—the production of a greater amount of corn—may be obtained in one of two ways—either by bringing more arable land into cultivation, or else by causing the land already under culture to produce a greater amount of corn (applause).

In regard to the first of these means there are, as you are doubtlessly aware, great difficulties in our way, which 20 or 30 years ago did not exist. As you know there was a large quantity of land twenty or thirty years ago, which lay waste, but which has since been brought into cultivation, and consequently it cannot be expected that an equal amount of land can be reclaimed during an equal number of years to come. On the other hand the present amount of corn may be increased by rendering the land more productive, that is, by causing land which now only yields four quarters an acre produce five. Again, corn may be rendered cheaper in two ways. It may be done by lowering rents or reducing the rate of the agricultural wages; or, secondly, by increasing the expense of production, by causing the lands which yield four quarters per acre to produce five without any increase of expense. Now an interesting question arises in the outset, which I am sure you will like to have your attention directed to. If by making the land more productive we are to raise more corn at a cheaper rate, how much of the land of the kingdom is capable of being so rendered more productive? If you were to ask my own individual opinion upon this point, I should at once state it as being my belief that nearly nine-tenths of the land under cultivation in Britain might be made to produce more corn than at present by the application of improved treatment. I speak this, gentlemen, as my own individual opinion; but as this is a point of great importance, I have merely thrown out this opinion for your consideration, and I trust that it will call up some gentleman who is better acquainted with the productive qualities of the land in the kingdom than I am. But suppose, gentleman, the land is capable of being rendered more productive, you will ask to what extent? Now, in regard to this question, I believe it is impossible to give a very decided or absolute answer. But I can examine the land in one part of the kingdom, and ascertain its formation. Unfortunately I have not a map with me as I supposed I had. We will however suppose there is a soil of a particular formation and a given geological quality at this end of the room, and that at the other end of the room there is a land of a similar quality; if then I find that the land I have pointed to in the first instance will grow 30 or 40 bushels an acre, then I say I am justified in inferring that the other land, having a similar or equal soil, will produce an equal quantity.

And if I see some land of equal geological quality as the first named land, then I am entitled to say that it only requires the exercise of proper skill to bring it within an equal state of productiveness (applause). A short time ago I happened to visit the estate of an old friend of mine, Mr. Aitcheson, of Dromore, whom some of you doubtlessly know, and after walking over his farm, he showed me his books, in which he had kept an account of the extent of his land, the produce, and what it sold for, from the commencement of the present century. In 1820, I found that the produce of 100 acres of that land averaged 50 bushels of oats per acre. In 1832, I found that 120 acres of land sown with wheat produced 40 bushels per acre, whereas this 120 acres afterwards, the season being better for oats, produced 80 bushels of oats. Now, when I came to examine the nature of the soil, I found that this difference was caused by the application of an improved system of management and a proper system of manuring (applause). This soil was not of a good quality, being upon a coal sub-soil, and exposed to the east winds from the Firth of Forth, and yet in that district we find that a farmer has been able to raise the amont of his produce to 85 bushels of oats per acre on an extent of land amounting to 100 acres. I take this as my stand. You may say that this is the limit to which a man may go. For my part however I do not think it is but application of similar means to similar land the same results will follow. And then, again, gentlemen, if from these districts—if from these coal measures—and I allude to coal measures because you have them in abundance in this neighbourhood—if, I say in this country, you find this to be the case, I would carry you still farther north, and I will assume that some of you know the county of East Ross-shire, and some, I doubt not, have skirted the eastern coasts of Sutherlandshire, and beheld the large crops of wheat and turnips to be found there. Now if I had a geological map, as I intended to have had here, I could have shown you various districts, in different parts of the island, where the geological character of the soils identical with those of Ross-shire and Sutherlandshire. And if you find, in South Wales, land of a similar character to this which eats up all the dung and drinks up all the water given to it, but on which equal crops might be grown to those grown further north, but which in Wales produce much less, then, I say, I am entitled to believe that if equal skill was applied, equal results would follow. But I think as a scientific man, I am bound to ask myself a further question—I am bound to ask myself whether we may not justly and fairly compare unlike soils with like soils—compare good and naturally fertile soils with soils naturally unfertile; and you are entitled to ask of science whether it is not in the legitimate scope of the agriculturist to bring about such a state of things at least that the naturally unfertile soils shall grow as much as the naturally unfertile soils. Now, without saying it is impossible to do so with this or that peculiar soil, there is one thing which I can justly and fairly assume from the progress of scientific skill, that there has been, and can be, great improvements in poor lands. I am as unwilling as any man to be sanguine in my opinions, and I am still more unwilling to be sanguine in my expressions; but I do not think that practical men are justified in asking from science whether such an improvement is one which can be ultimately accomplished? And I do say that I cannot see my way to the result that the scientific man is justified in saying that this is an object which the practical man may not justly except from the scientific man: at the same time I must allow that for such result we must allow time for the further developement of science and knowledge. I allude to the progress of sound knowledge and practical experience, because I have lately found published, in various periodicals, a relation of several experiments—and experiments are valuable by whomsoever made, but more especially so when made by skilful men. Among those were some made by Mr. Vernon Harcourt, in which he had applied, for the growth of turnips, bones and guano, to certain soils. By the application of bones he produces 30 tons per acre; by the use of guano he got 30 tons, and by the use of both together he still procures no more than the same quantity; and from this he interred, that he had reached the utmost limits to which human limits could go. Now these experiments are excellent. They are so for materially contributing to the progress of knowledge; but the conclusion I believe to be hasty; for I am quite sure that the practice of other men would have produced still greater crops. Suppose, with myself, that the land can be made to yield larger crops, the question next arises how is this increased production to be brought about? There are two ways in which this increased production can be promoted: the one is by economy; and though I may not always use this word economy, I hold that no farmer is bound to undertake improvements which do not pay their own cost, and leave him a profit besides, and the principle pervades my observations whether I make use of the word or not. It is nothing in my eyes that, by the application of chemical mixtures, you can grow three or four bushels more corn than your neighbours, unless the value of that increase very considerably [illegible] out, I beg you to remember that is my opinion of improvement. There are two means of improving the land, then—draining, subsoiling, the use of any of those beautiful instruments which you have seen to day, or the application of manures. Draining, and the first things mentioned, will come more particularly under your consideration to-morrow. But the second set of means are chemical means, and this includes, among other things, the application of manures. Many of you perhaps might say—and justly—that your land required no draining, but you would perhaps also say that the land could be rendered more productive.

If I ask you, as I did Mr. Aitcheson, of Dromore, how that was to be done, you also perhaps would inform me that it was because your land had been highly manured. This was the secret of his success. If it were necessary for me to bring before you an illustration of the observation I have mentioned, in the great benefit of this high farming on a large scale, I might draw attention to the neighbourhood of many of our large towns—not, I am sorry to say, in the neighbourhood of Newcastle—and the fertility of these neighbourhoods. I take you particularly to Edinburgh; but I might also take you into Lincolnshire, and ask you how it is that in Lincolnshire the heats and the wolds have been rendered fruitful? I would answer, that high manuring was the source of all this success. Now the question which you will naturally ask of me, and which I am called on to answer is, how that high manuring acts to produce so beneficial a result? This is answered just by telling what those plants require from the soil, and secondly of what manures consist. The first is easily answered. If you burn a piece of wood, it burns away, but all is not consumed. A small quantity remains behind, and that is the case with all the vegetables you produce—the residium being in some cases more, in others less. In the burning of all vegetable and animal substances you have this portion left behind, and this is called ash, or the inorganic portion of plants, whilst the part which disappeared was the organic part: the inorganic parts differed quantityin various plants. (Mr. J. here referred to the tables placedon the wall toillustrate the difference in the quality of ashes, and continued). Now let me draw your attention for a moment to the organic parts which constitute the largest portion of plants. I can best illustrate this to you by taking a quantity of flour, which I will make into dough. If I wash this dough, and pour the water with which I have washed it into a tumbler, through a piece of muslin, the water will pass through into a milky colour; in a short time a pure white substance will settle to the bottom--that is starch. But upon the muslin there will be a substance which will not wash through, and which is totally different from the starch, and also different from the dough itself—this substance is what is called 'gluten.' You must apply what you see here to every other plant and part of plants. It is true that every plant has their kinds of matter: one somewhat like starch, and the other somewhat like gluten. Now this starch—the one portion of organic matter—consists of three elementary substances. In this part of the country (in the north of England) it is hardly necessary for me, for the instructing of the inhabitants of the town, to make them acquainted with these three elementary substances; but I do it at the request of the council, and I shall, therefore, for a moment or two draw your attention to them. Gluten then, consists of carbon, hydrogen, and oxygen. Of these three substances, the first of them, carbon, is most familiar to you under the name of charcoal. This black charcoal which you see here is carbon, with a very trifling foreign mixture. The next two substances consist of different kinds of air. Now, it is impossible for us, by the senses, to perceive the difference of these two kinds of air—oxygen and hydrogen. But it is very fortunate that we are not bound by our senses, that [illegible] which can discover us to make discoveries which twenty senses would never do. Now, I take this simple instrument, this lighted taper, and place it in the bottle containing hydrogen, the taper is extinguished, and the hydrogen takes fire and burns. If I put the taper into this other vessel containing oxygen, we perceive at once the difference between these two elementary substances, which our senses would not enable us to do. The taper does not refuse to burn; on the contrary, it burns with far more brilliancy than in common air. Now of these three substances—of these two gases, hydrogen and oxygen, and of carbon—this charcoal, this starch, consists in all the vegetables you reap; in all the vegetable food which is for the support of our bodies, there exists a large proportion of those substances which consist of those three elements only. But I have told you there exists in all vegetables a substance called gluten. Now this gluten—besides the three things to which I have called your attention—contains a fourth called *nitrogen*, and a very small quantity of sulphur and phosphorus. Now the senses of sight and smell will not tell you that this is anything but common air. The same little instrument which we used before, however, enables me to tell you that here is something besides common air, and oxygen, and nitrogen. When I put in the taper, it is extinguished as it was in hydrogen; but you will remember the hydrogen took fire: this does not. Here, then, there is a clear distinction between hydrogen and oxygen, & nitrogen. Now these four, carbon, hydrogen, oxygen, and nitrogen—with a little sulphur and phosphorus, exist in all plants; and also in all plants, I must beg of you to remember as a point which, before I close, will be of great importance, there is a substace called 'gluten,' or some substance which resembles it in containing nitregen. I now come to the inorganic matter or ash. What does this ash consist of? Potash, soda, lime, magnesia, oxide of iron, manganese, phosphoric acid, sulphuric acid, chlorine, silica. Now it