tle more nitrogen present than could be utilized by the mineral food already contained in the soil, consequently any further application would lie dormant. If nitrogen were now to be applied to plot 5, I have no doubt but that it would yield triple the produce of lot 3.

If we refer to the report of Messrs. Lawes & Gilbert, we read :

"Mineral manures alone gave very little increase; nitrogenous manures alone gave considerably more than mineral manures ; but the mixture of the two gave very much more than either separately." This is sufficiently conclusive as to the efficiency of the phosphatic element in the cereal crop, but a word or two may be desirable as to the nitrogenous manure alone giving better results than the mineral manure alone. Well, the mineral constituents of a soil are a stable quantity natural to the soil, and not readily to be exhausted, while the nitrogenous element is a more or less transitory introduction more easily eliminated than retained. Last spring, when visiting Rothamsted, Sir Henry Gilbert remarked to me that as regarded the prevailing idea that land was exhausted by nitrate of soda, he, Sir Henry, considered that the immediate fertility would be much more injured by exhausting the nitrogen with repeated dressings of superphosphate. There was something in this reversion of the original idea which opened out for me new lines of thought. Of course it is not difficult to supply the soil with durable phosphate, but the furnishing it with durable nitrogen, as humus, is a harder matter to fight. It is a noteworthy fact that in the Rothamsted Park experiments, and some others of the series, the more durable *basic slag* has for the last two or three years been used as a source of phosphate instead of the acidulated phosphate.

But to return to the question ; a certain goodly supply of mineral plant food was in this Rothamsted soil 50 years ago, also a useful supply of humus, but the immediate supply of readily available nitrogen had been exhausted by a course of previous cropping. Consequently, as the humus slowly decomposed and came into action, its nitrogen found a sufficient balance in the mineral matter already in the soil ; any further addition of mineral matter but slightly affecting the business. When nitrogenous salts were added, they would immediately exert an influence on both the humus and the store of mineral food, thus for a time appearing to have a more beneficial effect than had the mineral manure. Yet really this is but the difference between tweedledum and tweedledee, as each, separately, sooner or later, comes to an end. And as the sages of Rothamsted say, "the two gave very much more than either separately." They do not say that one was better than the other, they report the facts, which are that both are required, and that the combination is "*very* much better." How can it be maintained after such proof that phosphatic manures are not beneficial to the wheat crop !

It may be well, however, to compare the exact figures for a year or two. We will take 1871 as a season of medium yields ; the no manure plot, No. 3, yields but 9 bushels per acre ; mineral manures alone, 11 bushels ; ammonia salts alone, 10 bushels ; nitrate of soda, 17 bushels ; while the mixture gives the fairly good yield of 34 bushels per acre. These are fairly in sequence with the entire series, for if we take lots 17 and 18 where mineral and nitrogenous manures have been used alternately in alternate years, we find where the minerals have been applied that year a return of 16 bushels, and where the nitrogen has been applied we get 28 bushels ; but here we must remember that where nitrogenous salts only had been applied continuously, the ammonia and nitrate yielded but 10 and 17 bushels respectively. Then how do we account for the 28 bushels on plot 18? Why, simply because it had been dressed with phosphate and potash in the previous and other years, and that there was a considerable remaining residue to draw upon. If we now pass on to that worst of years, 1879, we find after about 40 years wheat growing, that no manure yields 4 bushels, or 1 sack per acre ; mineral manures alone under equal conditions, were but able to raise this by 1 bushel, yet even this was more than any of the nitrogenous salts were able to accomplish, they all three being each credited with the normal sack, while mixed minerals and nitrogen brought out 22 bushels in one instance, and 20 in another. The alternating plots 17 and 18 yielded 3 bushels and 20 respectively ; this latter again looks bad for minerals, until we remember that the conversion of the 4 bushels into 20 is due to the previous phosphatic dressings ; and that the poor show of 3 bushels is due to the fact of the nitrogen having exhausted itself in producing the good yield of 29 bushels on the same lot in the preceding year.

So far I have only referred to the question of quantity. It would require a lifetime to examine the thousands of samples at Rothamsted, but I had ample evidence placed before me to satisfy me that the phosphatic influence had added materially to the quality and market value of the grain. I passed along to Woburn, and there found the foregoing evidence corroborated. I also examined the samples reported on in the Journal of the R.A.S.E., where the beneficial influence of phosphate on the market value of the grain is officially appraised at from 3 per cent. to 5 per cent. per quarter. I consider that if submitted to the selling test it would have been even more.

These remarks have been so lengthened out that I can but refer to one or two more examples, and will first take the Glasgow Technical College experts, as being a prominent series, and dealing with the manuring of cereals question, oats being there given preference, as the prevailing corn crop. I will take the Laurieston Hall Home Farm as my example, because it is described as a poor, sandy, gravelly soil ; No. 1 plot, unmanured, only yielding 620 lbs. of dressed grain per acre, and 18 cwt. 3 qrs. of straw and chaff ; but with a dressing of 1 cwt. nitrate of soda, 2 cwt. superphosphate, and 1 cwt. of kainit, the yield was raised to 1820 lbs. of grain and 32 tons of straw. We have now to consider to which of these factors the increase is due in particular, if to any. The increase of kainit to 2 cwt. made no difference, but when increased to 4 cwt. there was an increase of grain by 300 lbs. but when the kainit was again dropped to 2 cwt. and the super increased to 6 cwt. the yield rose to 2520 lbs of grain, with 43 tons of straw. This clearly shows that whatever influence the nitrate of potash may have exerted, the phosphate was a necessary and powerful factor. This is further proved by the fact that another form of phosphate—*basic slag*—has worked out to even better advantage ; 1 cwt. nitrate, 2 cwt. kainit, and 226 lbs. of basic slag produced the same amount of grain as the 6 cwt. of super ; but when the *basic slag* was increased to 453 lbs., the other factors remaining the same, the grain yield was raised up to 2940 lbs. and the straw to upwards of 50 cwt. It is impossible for us to credit the greater share in this last splendid return to the nitrogenous influence, because with the aid of 2 cwt. of super, and 2 cwt. kainit, the 1 cwt. of nitrate was only able to produce an increase of 1,200 lbs. of grain and 14 cwt. of straw ; with the same nitrate and an increase of phosphate (4 cwt. slag phosphate) it made the above wonderful increase of 2,320 lbs. of grain, and 31 cwt. of straw ; in fact nearly three times the quantity of straw and four or five times the yield of grain ; which is indeed remarkable on "poor sandy land." There is, of course, an enormous amount of evidence from practical farmers in support of these views, which cannot now be dealt with ; but we find the University College, Reading, gives the following advice :—"When the soil is in good condition a top dressing of 1 cwt. nitrate of soda per acre, or an equivalent amount of a good guano, may prove useful, but this should not be applied if the corn is likely to lodge. On soils in poor condition 1 cwt. nitrate of soda and either 2 cwt. superphosphate, or 3 cwt. basic slag may be applied per acre." The Wiltshire County Council further support the principle of phosphatic manures for cereals, and complete their report by recommending for barley 1½ cwt. nitrate, and 4 cwt. of basic slag per acre. The same mixture has also given the best results on the oat crop ; somewhat singularly, this is practically the same manure which achieved that great Scottish success at Laurieston Hall.

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