Well, I do not think I need bother you any further with the tables. We have seen enough to satisfy ourselves that the true manure for wheat must depend, for its value, on the quantity of its ammoniacal constituents. There remain, then only a few observations.

From the unmanured plot were taken from the land *seven* successive crops of wheat, and this without any return of manure. Yet, no signs of diminished fertility appear, the average yield of the seven crops being 17½ bushels per acre, with about 1700 lbs. of straw, the crop depending upon the season, whether it was a good or bad "wheat-year." The difference which the season made was sometimes very great, as, for instance, in the year 1845, a good wheat-year all over England, the yield of the unmanured plot was 23¼ bushels, with 2712 lbs. of straw; the yield of the same in 1848 being only 14¾ bushels, with 1712 lbs. of straw, a difference of 8½ bushels of grain, and 1000 lbs. of straw, attributable solely to the variation in climateric influences. So we see clearly, that in land which has been properly cultivated for a number of centuries, I may say, like the soil of England, where grain and meat constitute almost the exclusive exports from the farm, the straw of the grain, and the dung of the animals fed upon the farm, finding their way back to the fields in the form of manure; we may see, I say, that even after seven successive crops of the same plant without any return, the soil still contained, relatively to the ammonia available from natural sources, an *excess* of the necessary mineral constituents.

But do not imagine for a moment that all soils, even in England, will go on producing 17½ bushels of wheat and 1700 lbs. of straw for ever. On the contrary, light soils which, under high farming, will yield great crops of grain in favourable seasons will soon fall off if neglected. As every Canadian farmer knows, heavy lands do possess a *native fertility*, or how can we account for the price at which land at Saint-Hugues sells as compared with the value of the land at Sorel, for instance? The one goes on yielding from 8 to 12 bushels of wheat per acre and other crops in proportion, and this without the sight of a dung-cart; the other, treated in the same way for a couple of years, would yield next to nothing, but well farmed and frequently though not copiously manured, will turn out most remunerative crops of anything you like to sow there. No; we cannot go on selling all our produce off the farm and making no return to it in manure; but what we can do is this: if there is any truth in the experiments we have been considering, we can feel safe in cultivating our farms in accordance with the ordinary methods of practical agriculture, and if at any time our crops in the spring show signs of a want of vegetative power, we know that a moderate top-dressing of nitrogenous manures will enable them to start again into vigorous growth, and to utilise the *mineral* constituents which we are well assured will be, in such a case, in excess.

The following is the condensed history of one plot:

First year.—Mineral manures give one bushel more than the unmanured plot;

Second year.—Ammoniacal manures give 8¾ increase;

Third year.—After the heavy ammoniacal dressing of the previous year, and the heavy crop caused by it, the cessation of manuring reduces the produce to slightly *less* than the continuously unmanured plot;

Fourth year.—Ammoniacal salts alone increase the produce by one-half;

Fifth year.—A complex mineral manure, supplying nearly every mineral constituent in excess, and this combined with ammonia, gives an average produce even rather less than was obtained in the previous year without the minerals, and the proportion of increase over the unmanured plot is very little greater.

When mineral manures are added to the ammoniacal dressings, as in ordinary farming in England is always done at least every fourth year in the usual farm-yard dung, we have added to the soil everything that plants can demand, but in the case we are considering it is worth while looking at the effects of this treatment with artificial manures. Thus, at Rothamstead the yield was:—

| | bush. | lbs. straw |
|---|---|---|
| 1845, sulphate and muriate of ammonia, 168 lbs. each. | 31¾ | 4266 |
| " do do 112 lbs. each of do *with minerals*. | 33 | 3819 |
| 1846, same ammoniacal dressing alone | 27¼ | 2244 |
| " do do *with minerals* | 30½ | 2784 |
| 1847, with ammoniacal manure only | 25¾ | 2891 |
| " do do *and minerals* | 32¼ | 3852 |
| 1848 was a failure altogether | | |
| 1849, with ammoniacal manure | 32½ | 2854 |
| " do do do and minerals | 33¾ | 3858 |
| 1850, with ammoniacal manure | 27 | 3089 |
| " do do and minerals | 29½ | 4031 |

Here we see that, although the plot in which ammoniacal manures alone are used, gives a considerably higher return than the unmanured plot, in every case in which *both* ammoniacal and mineral manures were employed, there was a considerably larger increase still.

The effect of mineral manures, then, for the growth of wheat is in these cases clearly shown; but what are the circumstances under which this result is obtained? It is only when, after taking from the land the whole of the produce of a rotation without return, we provide *ammoniacal salts* alone, in such quantity as to yield crops year after year larger than the average obtained in the country in which the experiments were tried under the *ordinary course of rotation* treated with farmyard dung, and the produce obtained by these ammoniacal salts alone was very nearly equal to that obtained by the *annual* supply of 14 tons of the best manure, a dressing that nine English farmers out of ten would suppose sufficient to "lay" the crop and cause it to produce nothing but rotten straw and "chickens' victuals."

Now, if we consider the effect of these annual dressings of dung we shall be rather surprised. The seven years of the experiment saw 98 tons applied to the acre, and the produce of that enormous quantity was only 73 bushels of wheat more than the produce of the unmanured land. This is equal to only ¾ of a bushel of wheat for every ton of dung supplied! A ton of such manure as that we are speaking of would probably contain nitrogen equal to about 18 lbs. of ammonia, so that it took that quantity of ammonia to produce ¾ of a bushel of wheat, an absurdity on the face of it, as we see that 224 lbs. of ammoniacal salts, containing probably, 55 lbs. of ammonia, produced, in 1845, 9 bushels of wheat more than was produced by the unmanured land, and that, therefore, 6 lbs. of ammonia, in the form of sulphate and muriate, produced one bushel. It is evident, then, that in the dressing of farmyard dung there must have been an enormous expenditure of nitrogen beyond what the wheat plant was capable of absorbing, and that the mass of carbon, amounting to somewhere about 220 lbs., was absolutely useless, except as a mechanical agent in lightening the land, and, by darkening it, enabling it to absorb more readily the rays of the sun and bring the crop more rapidly to maturity.

I presume all my readers will agree with me in thinking that the experiments we have been studying prove the incorrectness of Baron von Liebig's theory, that: The crops on a field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manure.

ARTHUR R. JENNER FUST.