

nature of the plant food they contain. This is especially true of soluble nitrogenous fertilizers, which leave practically no residue for succeeding crops. Phosphoric acid does not leach out of the soil in the drainage water so readily as nitrogen, because much of it is changed into insoluble compounds in the soil, after which it is but slowly made available for plants.

The lasting influence of farmyard manure is strikingly brought out in the Rothamsted experiments in England. At this noted experiment station, barley was grown for a great many years in succession on the same soil with different manures, and also without any manure. It will be sufficient for the present purpose to notice two of these plots. Plot 1 was continuously unmanured for forty years, and produced a crop of barley every year. Plot 2 received at the rate of fourteen tons of farmyard manure per acre every year for twenty years and was sown with barley each year. At the end of this period, plot 2 was divided into two parts. One part received farmyard manure at the same rate as before for twenty years more, while the other part received no manure of any kind during the next twenty years, and barley was sown every year on both parts. There are, therefore, two periods of twenty years each, and the results may be compared. The average yield of grain on the continuously unmanured plot for the first twenty years (1852 to 1871) was twenty bushels per acre. The average yield from the continuously manured plot during the same period of time was $48\frac{1}{2}$ bushels per acre. For the second twenty years (1872 to 1891), the average yield from the continuously unmanured plot was $13\frac{1}{2}$ bushels per acre; on the part of plot 2 which received no manure during the second twenty years, the average yield was $30\frac{1}{2}$ bushels per acre; while on the part of plot 2 which was continuously manured as before, the average yield was 49 bushels per acre. Thus, it will be seen that the influence of the first twenty years of manuring extends over the second twenty years, producing an average crop of $30\frac{1}{2}$ bushels, as compared with $13\frac{1}{2}$ bushels on the plot which received no manure during the whole forty years. Nor did the influence end there, for the experiment was continued longer, and during the next five years, 1892 to 1896 inclusive, the average yield from the continuously unmanured plot was $11\frac{1}{2}$ bushels per acre; whereas on the part of plot 1 which had received farmyard manure from 1852 to 1871, but nothing after that date, the average yield during the same five years (1892 to 1896) was $24\frac{1}{2}$ bushels per acre. Therefore, after twenty-five years without manure, plot 2 continues to show a marked advantage over the continuously unmanured plot, and no one can foretell how much longer the influence of that twenty years of manuring with farmyard manure will be traceable. To be sure, if the land had received but a single application of farmyard manure, the results would not have been so striking, but the example just given will serve to illustrate the lasting effect of farmyard manure, which is one of its remarkable and valuable characteristics.

3. Farmyard manure increases the humus (vegetable matter) of the soil. This action is extremely important, because humus, besides supplying plant food as was previously explained, also improves the water-holding power of soils, and makes clay soils more open in texture, more easily worked, and altogether more favorable for the development of plant roots. What were once barren sands have been brought to a high state of productiveness by simply supplying them with humus; and it is a well known fact that many clay soils which are now so difficult to manage, were much more easily worked and produced better crops when the land was new, the explanation of which is found in the fact that years of cultivation and cropping have reduced the supply of humus in the soil. A manure, therefore, which increases the supply of humus is worthy of much more care and attention than it frequently receives.