

nature are frequently employed against farmyard manure as compared with special manures, or those which supply only one or two constituents of plant food, it being claimed that the use of special fertilizers admits of applying only those substances in which the soil is deficient and therefore constitutes economical manuring. It is also claimed that farmyard manure is bulky, heavy and expensive to handle, whereas most special fertilizers are much more concentrated. Still further, it is claimed that farmyard manure is comparatively slow in its action, because a great deal of the plant food which it contains is in such forms that plants cannot make use of it until the manure has fermented and decayed; whereas the plant food in many special fertilizers is in forms which plants can readily make use of, and consequently such manures give quick returns. These objections to farmyard manure are perfectly valid, and no doubt special fertilizers have an important place to fill under some systems of farming; but there are several things in connection with farmyard manure which must not be overlooked, and, in order to emphasise them, they will be dealt with separately.

1. Farmyard manure is a by-product. In many, if not in most cases, the profit from the animals fed leaves very little to be charged against the manure. As a result the farmer can afford to spend some extra labor upon it and to put up with its slower action. He may also afford to apply more of certain constituents than the crop requires; in fact, excessive application of plant food is liable to happen with any fertilizer, since no one is able to estimate exactly to what extent a soil is deficient in a given element of plant food. Further, in no case do plants take from the soil all the plant food applied in the fertilizer, frequently not more than half, so that in the case of expensive fertilizers the loss is a serious one.

2. Farmyard manure, as already stated, is slow in its action, the plant food which it contains being gradually made available for plants. But, though only a small portion of its plant food becomes available each year, the greater part of the unused plant food is not lost under judicious management, but is held in the soil for the use of succeeding crops. In the case of quick acting fertilizers, nearly all of their influence is confined to the year in which they are applied; and, though some have a more lasting influence than others, their effect upon succeeding crops is not nearly so marked as that of farmyard manure. The reason for this difference in effects upon succeeding crops is comparatively simple. Before plants can take up their food from the soil, it must be in such forms as will dissolve in the soil moisture or in the juices of the plant roots. When plant food is in such a condition it is said to be *soluble*, and it must be soluble before it can be available to the plant, so that the term *available* plant food means soluble plant food. Now, only a small portion of the nitrogen, phosphoric acid, potash, etc., in farmyard manure is in a soluble condition, and before the remainder of it can become soluble, the manure must undergo fermentation and decay. In the process of decay, the vegetable compounds of the manure are broken up, and the elements of plant food which they contain form simpler compounds which are soluble, and hence available to plants. It takes many years for the whole of the vegetable matter in an ordinary dressing of farmyard manure to decay, and since only soluble plant food can be washed out of the soil by rains, it follows that only a small portion of the plant food will be lost in this way, and that there will be a residue left over from year to year for a considerable length of time. On the other hand, special fertilizers which contain a large proportion of soluble plant food and are therefore quick in their action upon plant growth, are in danger of having any residue that may be left by the first crop washed out of the soil during the succeeding winter and spring, owing to the soluble

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