

the basis of practice. In our opinion the old saying, "The land wants a rest," is an anachronism, and the sooner this is realised the better it will be for agriculture in general.

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Fermentation in Manures.

IN our last article we considered nitrification as it occurs in the soil! In this we will consider it in connection with organic manures; especially those connected with the farm yard, glancing briefly at the different modes of preserving and applying these to the best advantage as far as preservation of nitrogen is concerned.

The question which has and still is agitating the farmers of this country more than any other problem on the farm is; at what season of the year and how is it best to apply farm yard manures so as to preserve to the crop the nitrogen which they contain? We will not attempt to dictate the proper time and mode of application, but simply give some of the methods generally followed with their advantages and disadvantages, so far as preservation and loss of nitrogen is concerned. Before doing this, let us review briefly fermentation in manures, and the conditions favorable to such a process.

The fermentation in manures, like that going on in soils, is the result of the growth of certain low forms of plant life, which act upon the organic material, breaking it up into various compounds. Of these the most important from the farmers standpoint are those directly connected with the changing of organic nitrogen into ammonia. The conditions favorable to such a change are similar to those which favor this process in soils; namely, heat, moisture, and air. When all of these conditions are present in a manure heap, the formation of ammonia from organic nitrogen goes on very rapidly, resulting often in a loss of a large part of this most valuable constituent.

With this in view let us look at the different modes of preserving and applying manures.

The one most generally followed by farmers in this Province, is that of keeping manure either in a heap in the barn yard or else in a shed or cellar, prepared specially for this purpose, until spring, when it is drawn out and plowed into the soil. This, no doubt, has many strong points in its favor; for in this manure, the time that it is applied to the field, fermentation is generally going on with great rapidity, which acts as a stimulus in increasing the fermentation of the organic matter of the soil, which is necessary to the formation of nitrates for the use of the young growing crop. It has also a tendency to warm the soil, which is of much importance at that season. Although these may be strong points in favor of such a method, yet there are other things which tend to counteract these; the most serious of which is the loss of nitrogen which escapes as ammonia during the process of fermentation which takes place in the heap. There is no doubt that much of this nitrogen is unnecessarily lost owing to carelessness in not trying to check fermentation or by neglecting to apply substances like Calcium Sulphate which act as fixers of ammonia. The most economical way of checking fermentation is by excluding air from the interior of the heap as far as possible. There are two classes of ferments which cause this decomposition of organic substances in manures, namely, Anaerobic and Aerobic. The first is active when air is excluded, and is not connected with a loss of nitrogen, producing such as marsh gas, butyric acid, &c. With an evolution of free hydrogen. Where air has free access to the interior of the heap the aerobic ferments act with great rapidity and often result in a loss of a large part of the nitrogen. To prevent this the manure should always be in such a position that it can easily be kept trapped so as to lessen at any rate the amount of air in the heap.

Horse manure is harder to control in this way, being of a much drier and more nitrogenous character, nitrification takes place with great rapidity, and there is an enormous loss of ammonia and free

nitrogen gas. This difficulty is often overcome by mixing it with cattle manure which being of a more compact and cooler nature, tends to check this rapid loss of nitrogen.

The composting of manure with peat or mould is very extensively practiced by some, especially by market gardeners, whose aim is to present the plant food in as available a form as possible. The chief advantages of this system are; It renders the organic nitrogen directly available, it reduces the bulk, and, on account of the addition of mould or peat, increases the quantity. When proper care is taken to have fermentation take place slowly, and sufficient quantity of laud plaster is present to hold any ammonia that may have escaped absorption by the mould or peat, no doubt this method will represent all the advantages that is claimed for it; but notwithstanding this a question still remains which the general farmer must answer; that is, will the more ready available plant food, the lessened bulk, and the slightly increased quantity of nitrates added by the mould or peat, more than compensate for risk of loss by fermentation, and the amount of labor and time expended in bringing about these conditions.

The method of drawing manure out in the winter and spreading it on the snow to be plowed under in the spring, is receiving considerable attention from the farmers at the present time. This in some cases besides being a great saving of time, has given excellent results especially where the surface is flat and the soil well drained. This no doubt where the conditions are favourable is one of the safest ways of applying manure to soil. I think we might say that the risk of loss, where the land is favorable, is reduced to a minimum; for it is impossible for fermentation to take place at such a temperature. The only way that loss might occur is by drying and washing. In regard to the first recent experiments have shown that a comparatively small amount of nitrogen is lost when the moisture is dried out by exposure to sun or wind. As far as washing is concerned, if the soil is well drained little will be lost. The only disadvantage of this method is the slowness with which fermentation takes place when plowed under, making it necessary in case of early crops where the best results would be attained, to apply some soluble nitrogenous fertilizer like guano, to supply the needs of the young growing crop until sufficient decomposition has taken place to render the organic nitrogen of the manure available.

Although we have not condemned any of the previous methods of applying manure, yet there is one which we see practiced during the early fall especially on soils intended for winter wheat, which we must condemn, that is, the practice of leaving manure in small heaps over the field until such a time as is convenient for spreading and plowing under. In this manure active fermentation is going on and when left in small loose heaps, decomposition takes place very rapidly, resulting in a great loss of nitrogen in a short time. It is better to spread it on the soil at once. By this means active fermentation and the temperature of the manure is reduced and the loss is comparatively small.

The depths to which manure should be buried depends to a large extent on the character of the soil. The fact that moisture and air are essential, that decomposition takes place, points to the conclusion, that it will be proper to bury manure deeper on light land than on heavy, in order to bring it within the reach of capillary moisture; but of course this will vary according to the climate and the relation of soil to ground water.

Although scientific men have devoted years to the study of this subject, conducting numerous and varied experiments, yet many difficult problems still remain unsolved. Comparatively nothing has been done towards finding out just what quantity of nitrogen is lost by fermentation when manure is kept under the best conditions in barn yard heaps. Why so few experiments have been conducted along this line is difficult to explain. It certainly is of the utmost importance because the solution of the whole problem comprising the proper application of farm yard manure seems to hinge directly upon the truths which accurate investigation must reveal.

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