could obtain of it to fertilize their various crops with. The technical principles involved in their practice were not understood by them nor did they appear to know of any other source of plant food than animal excreta. (1) In what condition or quantities the article could be most usefully employed, were questions which have remained to this day undecided. We know pretty well what will happen under definite circumstances to the excreta of any given number of animals fed on an allowance whose chemical constitution can be estimated, but to tell what the phrase "barn-yard manure" means, even in the case of intelligent farmers living side by side, is what baffles all. Probably, there is no more perplexing subject than that of farm wastes, and yet how little have the English-speaking agriculturists of the world done towards its solution. In France, Belgium, and Germany, the preservation and, I might add, the manufacture of the farm yard wastes, both in the manure heap and the compost stack, are among the most important functions of the farmer. He would think it almost as prodigal a waste to neglect the storage of this material to feed his plants, as he would to pass over some important feature of the hay, grain, or root harvests, in preparing food for live stock. It should be quite as easy to form standards of quality for farm-yard manures, as it is to make grades of commercial fertilizers, based on the materials used in making them. There can be no reason why at least fixed standards should not exist for indicating the quality and money value of farm-yard or stable manure. We know approximately the composition of the varied feeding stuffs used on the farm, and we also know about how much of the food eaten by animals will pass through their stomachs. It therefore follows, as a matter of comparative arithmetic, that we can estimate, nearly enough for working commercial purposes, the constitution of a ton of yard manure kept under cover. To arrive at these standards, it would be necessary to work on a corresponding number of feeding tables, for dairy and beef cattle constructed in harmony with the market values of the articles which are cheapest. I mean, of course, those which yield the largest amount of nutriment for the money expended. Thus, in the East, straw, hay, bruised oats, corn meal, linseed and cotton seed meal, roots and fodder, can be made available for horses, beef cattle, sheep and cows, in such proportions as suit their physiological requirements In carrying out such a plan, the country could be divided into districts somewhat as follows: The New England States, the Northern, Middle, Gulf, and Western States, and the food tables might be prepared by one of the well known experimentalists presiding over the stations located within these districts. When we remember the facts elucidated by the leading experimental chemists of the great countries of Europe, and verified by our own scientists on this side of the Atlantic, it needs but little reasoning to show how much we lose by present methods. According to these results, the manurial residues of the articles of food referred to may be stated as follows: Straw, $1 50 to $3; hay $2 50 to $3 5; oats, $4 50 to $6; corn meal, from $4 to $6 50; linseed and cotton seed meal, from $12 to $25, per ton. These values can be determined by any intelligent farmer taking the market prices of ammonia, phosphoric acid, and potash, in the commercial fertilizers sold in his district. For example, let us take the average manure product of a cow at ten or eleven tons. The manure ought to be worth, on any farm between Boston and New York, at least $2 per ton, if properly protected from drainage and exposure to the weather.

If an average of two pounds only of cotton seed meal per day be used, and its manurial residue be valued at $20 per ton, we have a consumption of 730 lbs., which gives $7.30, or one third the value of our manure heap. The balance can be ascertained from the quantities of straw, corn meal, oats, hay, and roots, fed. Some feeders, who produce high class cream, use much larger quantities of concentrated foods, such as pea and bean meals, linseed meals containing little oil, rape-cake, and tares. Every thinking husbandman values the economies of the farm, however small, and will make the estimate of value in his manure heap as he would the yield of butter.

Let us take another test. Connecticut farmers know that ammonia in blood and in the sulphate from the gas-house cannot be bought under sixteen cents per pound. This is a concentrated article, while his farm manure may contain say one per cent, if his cattle are fairly fed, and the manure be properly kept. Every ton ought, therefore, to give at least 20 lbs, which, if valued at but ten cents per pound, would be worth $2 per ton without taking into account the phosphoric acid and the salts of potash.

Now in addition to errors of drainage and storage, there is the danger of over-fermentation, which favors the formation of carbonate of ammonia, a most volatile compound, which has the unhappy habit of taking to itself invisible wings to effect its escape into the atmosphere. Nearly every farmer uses land plaster, and very many use German kainit, both of which are very cheap, selling at from 4 to 5 mills and from 6 to 8 mills per pound respectively. Now there is no more economical mode of using these very important fertilizers than as preservers of farm yard manure. Thus, according to the quantity of moisture in the heap, and its consequent temperature, carbonate, or other compounds, of ammonia may be formed. About 2 lbs per day per animal of either sulphate of lime (land plaster) or kainit, which yields sulphates of potash, magnesia, lime, and chlorides, may be used. Either will help to retain the moisture, but at the least rise of temperature, a mutual exchange may commence by which the sulphates will yield their sulphuric acid to the ammonia, and the metallic bases become carbonates, yielding sulphate of ammonia and carbonates of potash, magnesia and lime. All such applications should be added to the heap in the morning as the litter is removed from the stalls and placed on the heap, care being taken to apply it in a finely ground state, passed through a sieve of 20 or 30 mesh, to insure an even distribution throughout the bulk. To farmers who keep 100 head of cattle, the results of such a practice would be immense. It is not exaggerating to assert, that the waste of soluble and volatile compounds on a farm is fully $1 where grain is used. The waste of forty head is therefore equivalent to the price of one ton of commercial fertilizer, and the waste of eighty equal to one ton of ammonia. The value of dung heaps on the farm, where sulphates have been used as preservers, would range from $3 to $10 per ton, varying, of course, with the quantities of moisture, carbonates of potash and magnesia, sulphates of ammonia, and phosphoric acid.

The varied results obtained in cropping indicate in a forcible way the differences of value which the article bears. The variations in the crop results will correspond almost precisely with those found in the composition of the manure, other conditions being equal. Hence the declamations we hear on one side against the value of farm manure, and the claims made on the other in its favor. There is now no reason to doubt that scientists who have conducted experiments regard farm manures as the very cheapest form of fertilizer a farmer can possess. Of the natural manures which we have to deal with, lime is by no means common and not the least useful. The word lime is another example of the vagueness with which we employ phrases of common use. A farmer

(1) Oh! They ploughed in lupines, spurry, and other green crops.
A. R. J. F.