

which the urine and excess of liquid in the manure heap is collected and retained until it is to be applied to the land. In British husbandry the introduction of reservoirs for the collection of liquid manure is of comparatively recent date; the practice of the British farmer has been rather to apply the liquid in conjunction with the solid portion of his manure than by itself—nor is this practice to be hastily condemned. It is only when the urine is allowed to go to waste by running out of the yards that the practice is reprehensible; there is no doubt, indeed, that considerable loss is annually sustained by our farmers from inattention in the construction of reservoirs for its preservation; and the prevention of rain-water mixing with it would be productive of great advantage.

It has been ascertained, and, in fact, may be apparent to every one by observation, that the application of fresh urine to plants is not advantageous—nay, that when applied in considerable quantities in this state it is decidedly injurious. In practice it is, therefore, allowed to ferment for a period of several weeks, according to its composition and the state of the weather, before being applied to the growing crops, and such additions are to be made to it from time to time as will concentrate the gaseous matter, which would otherwise be evolved and escape during that period. The necessary arrangements for this purpose are tanks in communication with each other, or divided into different compartments, each containing urine in different stages of decomposition, and communication with each other in such a way that when the contents of one are taken out for application, it can be immediately filled by urine less fermented, which, in its turn, is there to remain until the necessary changes have taken place in its composition. The circumstances to be attended to in the construction of these reservoirs are, that they shall be impervious to moisture, to secure the urine from being wasted, and that they shall present a small surface to the atmosphere to guard against waste from evaporation. When proper attention is paid to the retention of the gaseous matters already referred to, by the introduction of suitable substances to enter into combination with them, and thus form compounds not volatile in their nature, the loss from evaporation cannot, however, be considerable.

The proper materials for the construction of liquid manure tanks are bricks laid in cement and well coated over with the same material; after the cement has properly set, it is impervious to moisture in the highest degree. The size will obviously be regulated by the quantities which they are required to contain, which will depend on the number of animals, and, in some degree, on the nature of their food. The most convenient form is oval or circular, the dimensions being gradually diminished towards the top, which may be covered by a flag, through which a circular opening is made for the admission of a pump to remove the contents when necessary, and the flag itself can be raised to remove any accumulations of more solid matters which may from time to time take place. The passage of the urine from the manure heap and the cattle sheds must, as already observed, be secured from the surface of the yards or from the roofs of the buildings, otherwise it may become so diluted as not to contain more than a few per cent. of the really important ingredients, in which case its effects would scarcely repay the expense of the application. The importance of this precaution becomes the more apparent when it is considered that even in its natural state urine contains from ninety to ninety-five parts of water, so that the fertilizing matters are, in any case, present only in small quantity.

The composition of urine is very various, not only

in the case of different animals, but also in that of the same animals under different circumstances, as regards health or disease, or the quality of food with which they are supplied. The same circumstances affect the quantities voided by each. The following table may be regarded as exhibiting the average composition of that of man and some other animals in their healthy state, with the quantity voided by each, so far as they appear to have been ascertained, as quoted by Professor Johnston:—

	Water in 1000 parts.	Solid matter in 1000 parts.			Produced in 24 hours.
		Organic.	Inorganic.	Total.	
Man...	969	23.4	7.6	31	3 lbs.
Horse...	940	27	33	60	3
Cow...	930	50	20	70	40
Pig...	926	56	18	74	—
Sheep.	960	28	12	40	—

It is seen from the foregoing table that the urine of the cow is not only the most valuable, but is also produced in much greater quantity than any of the others: the urine of the pig, indeed, contains a few per cent. more of solid matter, but then it is produced in so small quantity as to be of comparatively little importance. Although the farmer is, generally speaking, little interested in detailed analyses, yet it will be interesting to exhibit the extremely compound character of the urine of the cow, as given by Sprengel, both in its fresh and fermented state; in the latter case being allowed to stand four weeks exposed to the open air, by which, it will appear, it is become considerably concentrated.

	Fresh.	Fermented.
Water,	926.2	954.4
Urea,	40.0	10.0
Mucus,	2.0	0.4
Hippuric and lactic acids,	6.1	7.6
Carbonic acid,	2.6	1.7
Ammonia,	2.1	4.7
Potash,	6.6	6.6
Soda,	5.5	5.5
Sulphuric acid,	4.0	3.9
Phosphoric acid,	0.7	0.3
Chlorine,	2.7	2.7
Lime,	0.6	a trace.
Magnesia,	0.4	0.1
Alumina, oxide of iron, and oxide of Manganese,	0.1	a trace.
Silica,	0.4	0.1
	1000.0	998.2

Urea is seen to constitute a large proportion of the solid matters in the urine of the cow, as in other animals, and the change produced in it by fermentation is apparent from the table. The quantity of ammonia is seen to be increased by fermentation, but not by any means in proportion to the quantity of ammonia that escapes during that process, where proper measures are not taken for its retention. Dilution to a certain extent is favourable to fermentation, and, consequently, to the production of ammonia. Under any circumstances a portion of the ammonia will escape, so that it is desirable that it should be applied as soon as possible after fermentation has taken place.

Various matters may be added to the tank, with the view of preventing the escape of the volatile ingredients: Ammonia and carbonic acid gas are freely given off by the fermentation of animal matters, whether liquid or solid; and perhaps the most convenient and efficacious substances at the command of the farmer for retaining both of these are refuse vegetable matters, rich earth, ashes, &c. Charcoal, for instance, will absorb nearly ninety times its bulk of ammoniacal gas, nearly forty times its volume of carbonic acid gas; diluted sulphuric acid, added in small quantities,