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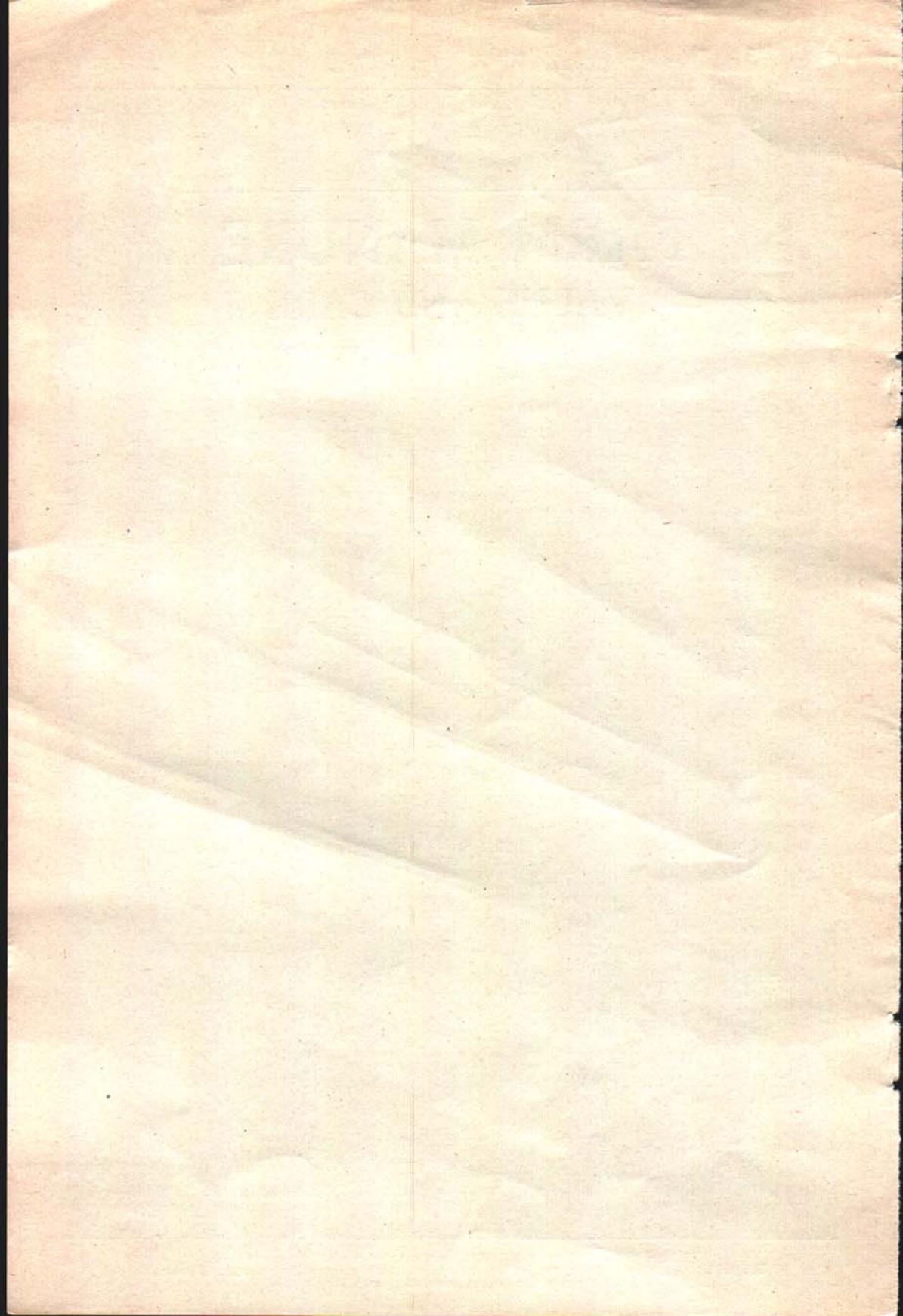
# FARM MANURE

## VALUE AND CARE



LINKS IN PROFITABLE FARMING

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# FARM MANURE

## VALUE AND CARE

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Every farmer is acquainted with the increased crop yield following an application of manure, but the indifferent care given to manure on many farms indicates that the full value of this fertilizer in the maintenance of soil fertility is not recognized. To save this valuable by-product requires good management because it is perishable and usually subjected to a number of severe losses. The manure produced in Michigan by all animals has almost one and one-half times the value of all the milk produced in the State, if the value of the milk is calculated in terms of butter fat at 20 cents per pound.

**Table 1. Amounts of manure, both solid and liquid, produced by animals per 1000 pounds live weight (Van Slyke)**

	Per day	Per year	Bedding per year	Total manure per year
	Pounds	Tons	Tons	Tons
Horse.....	49	9	3	12
Cow.....	74	13½	1½	15
Steer.....	41	7½	1½	9
Swine.....	83½	15½	3	18½
Sheep.....	34-1/3	6¼	3½	9¼
Poultry.....	23-1/3	4¼	—	4¼

Approximately twenty-three million tons of manure are produced annually in Michigan and probably somewhat more than one-half of this is voided when the livestock is in the barns or feeding pens, where the manure can be saved. Assuming that one-third of the value of this one-half is lost by poor management, which is a very low estimate, the annual loss is about eight and one-third million dollars per year for the State. This amounts to a loss of approximately \$49 per farm.

### Plant Food in Manure

Many factors influence the amount and composition of fresh manure; namely, the kind and age of animal, kind and amount of feed being fed, and condition of animal. Table 2 gives the composition of the various kinds of manure, with the proportion of liquid and solid, and shows the average distribution of plant food in the liquid and the solid

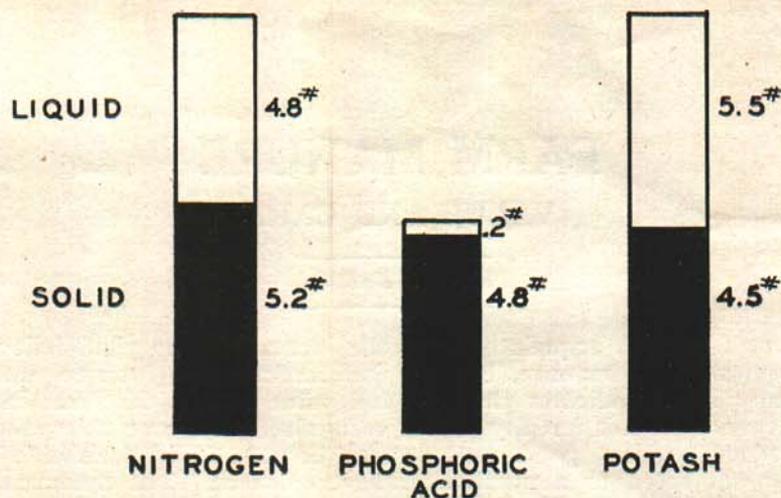


Fig. 1. Distribution of plant food between liquid and solid portions of a ton of manure.

portions. For example, the horse voids 400 pounds of urine during the same period that 1600 pounds of solid manure are produced. The 400 pounds of urine contain 5.4 pounds nitrogen, a trace of phosphoric acid, and six pounds of potash; and the 1600 pounds of solid manure contain only 8.8 pounds of nitrogen, 4.8 pounds of phosphoric acid, and 6.4 pounds of potash, making a total of 14.2 pounds of nitrogen,

Table 2. Composition and value of manure, as voided

		Pounds Per Ton	Pounds Nitrogen	Pounds Phos. Acid	Pounds Potash	Commercial Value
Horse.....	Urine.....	400	5.4	Trace	6.0	\$.87
	Dung.....	1,600	8.8	4.8	6.4	1.53
Total....		2,000	14.2	4.8	12.4	\$2.40
Cow.....	Urine.....	600	4.8	Trace	8.1	\$.93
	Dung.....	1,400	4.9	2.8	1.4	.74
Total....		2,000	9.7	2.8	9.5	\$1.67
Swine.....	Urine.....	800	4.0	0.8	3.6	\$.65
	Dung.....	1,200	3.6	6.0	4.8	1.00
Total....		2,000	7.6	6.8	8.4	\$1.65
Sheep.....	Urine.....	660	9.9	.3	13.8	\$1.77
	Dung.....	1,340	10.7	6.7	6.0	1.82
Total....		2,000	20.6	7.0	19.8	\$3.59
Poultry.....	Total.....	2,000	26.0	16.0	16.0	\$4.48

4.8 pounds of phosphoric acid, and 12.4 pounds of potash in a ton of manure, providing there has been no loss of either urine or dung.

From the data in Tables 1 and 2, one can readily estimate the amounts of plant food produced annually by each kind of animal and by the entire group of animals on the farm. Mixing of bedding with the clear manure somewhat alters its composition. There is some loss of plant food and humus regardless of how manure is handled. Numerous analyses have shown that average manure, as drawn out, contains about 10 pounds of nitrogen, five pounds of phosphoric acid, and 10 pounds of potash per ton.

### Fertilizing Material Recovered from Feed

In general, farm animals, as a group, return in the manure from the feed consumed about 80 per cent of the nitrogen, 80 per cent of the phosphoric acid, 90 per cent of the potash, and 50 per cent of the organic matter. Animals not at work and not gaining weight return practically all of the plant food elements from their feed in the form of manure, but high producing dairy cows and rapidly growing animals may return only 50 per cent of the plant food elements in their manure.

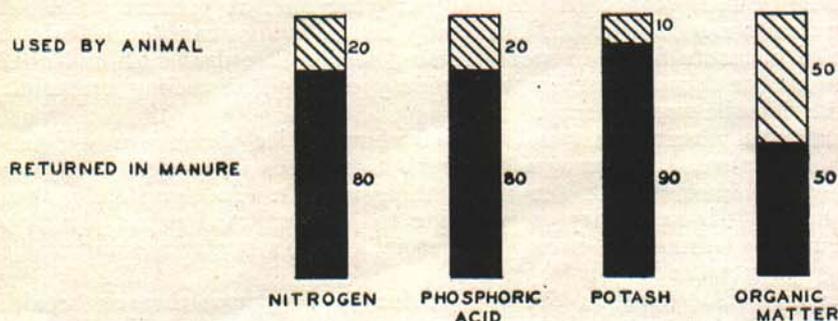


Fig. 2. Average portion of plant food in feed consumed by animals which is excreted in manure.

### How Much Is Manure Worth Per Ton

The value of manure may be calculated on the basis of how much it will increase the crop yield and the returns from that crop, or on what the amount of plant food contained in the manure would cost if purchased in the form of commercial fertilizer. At present prices of fertilizers, sulphate of ammonia at \$41 per ton, 20 per cent superphosphate at \$25 per ton; and muriate of potash at \$55 per ton, the plant food in a ton of fresh mixed manure is worth \$1.86. In terms of crop value increases, the value of manure per ton is usually much greater. In one long continued field experiment, eight tons of manure applied every three years in a rotation of corn, wheat, and clover produced crop increases valued\* at \$23.80, in comparison to crop values when there was no manure treatment. The value per ton of manure in this case becomes \$2.97.

\*Corn 50c bu. Wheat 75c bu. Clover \$6.00 ton.

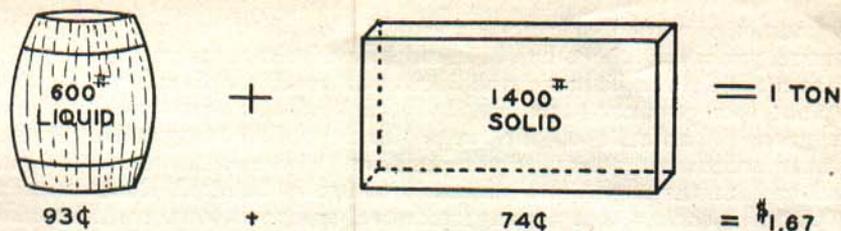


Fig. 3. Value of plant food in one ton of fresh cow manure.

### Losses Occurring with Manure

Manure losses occur in four ways: 1, Loss of urine in barn and stables; 2, by leaching; 3, by fermentation, heating; 4, and by being scattered about the lots.

1. It can be seen from Table 2 that about one-half of the nitrogen and potash of manure is in the liquid portion. To prevent this loss in the stable, concrete floors are useful. By replacing a loose plank floor with concrete, the Ohio Experiment Station saved 16 pounds of nitrogen and 24 pounds of potash per cow per year and, at present prices, this represents a saving of \$2.94. Equally large savings can be made by the use of concrete floors in steer feeding sheds. Tile drains should not be used in the trench, but, instead, plenty of good absorbing material to make the tile unnecessary.

Oat and wheat straw will absorb about twice their own weight of liquid manure, cut straw will absorb five times its weight, and muck and peat absorb six to ten times their weight. To completely absorb all liquid, it is necessary to use nine to 10 pounds of straw per day in the trench behind the cows. Horses will need a larger amount of bedding because the stall is larger.

Losses also occur in the stable, due to decomposition or breaking down of the manure before it is removed. This loss may be decreased by the daily addition of superphosphate to the manure. The superphosphate continues to exert a preserving effect after the manure is placed in the pile. Experiments during the past year conducted by the Soils Department at Michigan State College, have shown that the daily addition of two pounds of superphosphate per cow made large savings in the loss of nitrogen. One pound of superphosphate per 100 hens sprinkled on the dropping boards daily is recommended.

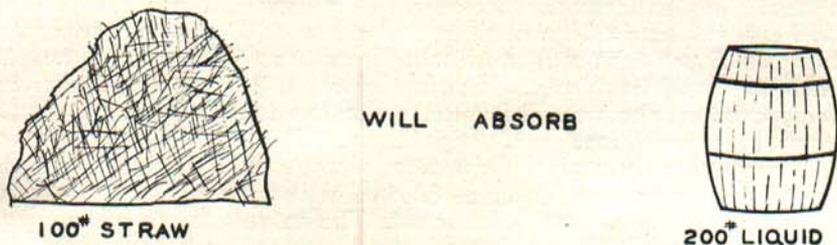


Fig. 4. Ample straw or other litter should be used to absorb all the liquid in the stable.

2. Losses by leaching occur principally in the barnyard when manure is thrown in loose, open piles and rain water is allowed to wash through and over it. Very little excuse can be offered for storing manure in unprotected piles in the barnyard. If the manure must be stored in the open, it should be drawn to the field and placed in straight-sided, flat-topped piles. This same type of pile should be used whenever manure is piled outside, as less leaching results and less aeration occurs. This reduces the loss of nitrogen and organic matter through formation of gasses. Over one-half the value of manure is lost by the usual careless method of piling in the barnyard.

3. Loss by fermentation. Every farmer is aware of the shrinkage that takes place in the manure pile when heating occurs. The losses incurred this way are principally, a loss of nitrogen, which is the most



Fig. 5. Manure stored in this manner will suffer a large loss from leaching by water from the eaves.

expensive plant food element in cost per pound, and organic matter, which is so essential in the soil. These losses in manure may be reduced by immediate spreading or by well built manure piles. Little loss of phosphoric acid or potash takes place during the heating process.

4. Another important loss suffered by manure piled in lots occurs through scattering of the material by chickens, hogs and other live-stock. This loss may be prevented by direct hauling of the manure to the field or by protection from such mechanical scattering. It may be greatly reduced by piling the manure in the straight-sided, flat-topped piles previously described.

#### **Manure Is An Unbalanced Fertilizer**

Manure, composed of urine and dung, is an unbalanced fertilizer for Michigan crops and soils. A ton of average, mixed manure plus bedding, as previously mentioned, contains 10 pounds of nitrogen, five

pounds of phosphoric acid, and 10 pounds of potash, or in terms of a complete commercial fertilizer would be a  $\frac{1}{2}$ - $\frac{1}{4}$ - $\frac{1}{2}$  analysis. To balance this plant food content, it is advisable to add superphosphate to the manure. Two pounds per cow per day in the trench immediately after cleaning stables will change the analysis of the manure from a  $\frac{1}{2}$ - $\frac{1}{4}$ - $\frac{1}{2}$  to a  $\frac{1}{2}$ - $\frac{3}{4}$ - $\frac{1}{2}$ . Compared to complete commercial fertilizers commonly used on Michigan soils, this manure-phosphate mixture is still low in phosphoric acid. Manure may be reinforced or balanced by the direct application of phosphate to the soil to which the manure is added. The phosphate should be added at the rate of 50 pounds of 20 per cent superphosphate per ton of manure applied, and it may be applied to the soil either in advance of seed bed preparation or at seeding time, or it may be added directly to the manure at the time of spreading.

### Hauling Manure Direct to Field a Good Practice

Many farmers in Michigan haul the manure directly to the field as soon as it is produced, which is undoubtedly the best practice. Very little loss is incurred when manure is hauled directly to the field, except when it is spread on hillsides where it may be washed down the

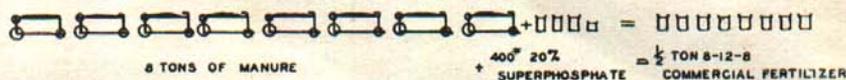


Fig. 6. Manure so handled as to save the plant food in it and reinforced with superphosphate makes an excellent fertilizer.

slope. Manure spread thinly dries out almost immediately and very little, if any, decomposition takes place when dry. If the liquid portion has been thoroughly absorbed by straw or other materials there will be very little or no loss from run-off. If the liquid has not all been absorbed, it is better to have the liquid in the field where it may go into the soil for plants to use than to have it soak in the soil of the barnyard or to be washed away through the drain. Results from Ohio for 34 years show an increase of  $3\frac{1}{4}$  bushels of corn,  $\frac{1}{2}$  bushel of wheat, and 368 pounds of clover when fresh manure was applied in January to soil on which corn was to be planted as compared to yields obtained when the same amount of manure was left in the barnyard in good, flat, compact piles until April and then spread.

If snow, muddy fields, or other conditions make it impossible to spread manure at certain times of the year, the manure can be hauled directly to the field and placed in flat-topped, straight-sided piles, of 8 to 10 loads per pile. This plan permits faster spreading when conditions are suitable and gets the manure out of the barnyard where it is sure to be scattered about, and it also prevents loss from washing. Although this plan necessitates extra handling, it is worth the additional cost.

### Light Application Gives Best Returns

Greater returns per ton of manure can be obtained by covering an entire field with a light application rather than to give only a part of the field a heavy coating. Small applications per acre pay best as shown

Tons manure per acre	Increase in produce from 5 crops of alfalfa hay and 6 grain crops. Pounds per acre		Increase in produce per ton of manure the first year after applying
	Total	Average per ton applied	
4.....	5,935	1,484	509
8.....	7,737	967	496
12.....	10,015	834	376

by the following work carried on at the Michigan Station (Spec. Bul. No. 128, Sandy Soils of Michigan). Ordinarily, applications of six to eight loads per acre are more economical than larger amounts. Eight loads per acre reinforced with 400 pounds of superphosphate is equivalent in terms of plant food to a broadcast application of 1,000 pounds per acre of an 8-12-8 fertilizer. Heavier applications of manure are often used on potatoes and truck crops because a good supply of organic matter is essential to produce a good yield.

To obtain the best results, manure should be spread evenly. This may be difficult to do by hand, but can be accomplished easily by the use of a manure spreader.

#### Where to Use Manure in the Crop Rotation

All crops respond to manuring but some are benefitted more than others. Cultivated crops and grasses usually show the greatest response and the manure should be applied to those crops which are stimulated most. Therefore, one is justified in using a large share of the manure on corn, potatoes, and truck crops. It is an excellent prac-



Fig. 7. An expensive and inefficient method of handling manure.

tice to apply manure to a sod that is to be plowed under for a corn crop or for some other cultivated crop. The sod land furnishes an excellent place in the fall and winter for spreading manure. In some cases, it may be practical to use part of the winter manure for wheat. A light top dressing on wheat may protect it from severe winter killing, give it an early start in the spring, and greatly increase the yield. Manure collected in the summer may be applied to grass land to advantage. A poor stand of grass may be improved and its growth materially increased by applying manure as a top dressing. Old stands of alfalfa can often be top dressed with satisfactory results, but this is not the most effective place for manure as the alfalfa, if inoculated does not need the nitrogen in the manure.

Manure applied for cultivated crops gives best returns, on the average, when plowed under or thoroughly disked in after plowing. The manure should be turned under on sandy soils. With grass crops, top dressing is the only recourse, and this method of application also gives satisfactory results on wheat.

### Summary

1. Barnyard manure is a valuable by-product of the farm.
2. Nearly half the value is in the liquid.
3. About 80 per cent of the plant nutrients and 50 per cent of the organic matter in feed fed to livestock is recovered in the manure.
4. Use plenty of good absorbent to take up the liquid.
5. Balance manure with superphosphate.
6. Spread as soon as made.
7. Apply at not to exceed eight loads per acre and cover more acres more often.

The following table is prepared for calculating the amount and value, based on cost of equal quantities of plant food in commercial fertilizer, of manure produced on the farm.

Amount of manure produced by various animals in 1 year	List here the number of livestock you have	Tons manure produced on your farm	Value of manure per ton	Value of manure on your farm
1,000 pound Cow 13.5 tons	×	=	×	\$1.67 =
1,500 pound Horse 13.5 tons	×	=	×	\$2.40 =
200 pound Hog 3.1 tons	×	=	×	\$1.65 =
125 pound Sheep 0.78 tons	×	=	×	\$3.59 =
4 pound Hen 0.017 tons	×	=	×	\$4.48 =

