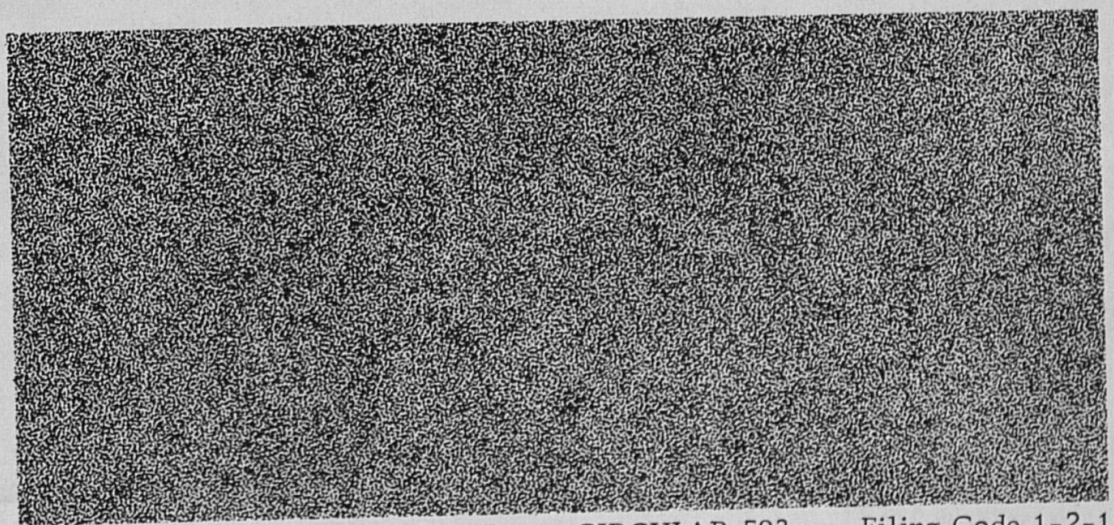
Farm Manures



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UNIVERSITY OF KENTUCKY
COOPERATIVE EXTENSION SERVICE
AGRICULTURE AND HOME ECONOMICS

CONTENTS

Farm Manures
Production—Value—Use

By G. D. CORDER and H. F. MILLER

More than 16 million tons of manures are produced annually by livestock and poultry in Kentucky. The estimated value of these manures based on their nitrogen, phosphorus, and potassium content alone is more than $47 million.

Table 1 shows the approximate annual production of fresh manures for animals of given sizes and groups of birds. Figures in the right-hand column (annual production) can be used for calculating the amounts of manures produced on individual farms.

Table 1.— Approximate Annual Manure Production by Animals and Groups of Birds[1]

Kinds of Animals	Approximate Annual Manure Production Excluding Bedding, Tons
Horses and mules	11.0 per 1,200-lb animal
Dairy cows and heifers	13.0 per 1,000-lb animal
Beef cows and heifers	8.5 " " " "
Steers	7.0 " " " "
Bulls	8.5 " " " "
Hogs	2.0 per 200-lb animal
Sheep	1.2 " " " "
Hens over 4 months	18.0 per 1,000 birds
Broilers up to 10 weeks	2.25 " " "
Turkey up to 26 weeks	22.0 " " "

[1] Information taken from Ky. Coop. Ext. Circ. 468, "Productive Soil" (now out of print), and *Feeds and Feeding*, 22nd edition, Frank B. Morrison, Chap. XXIV.

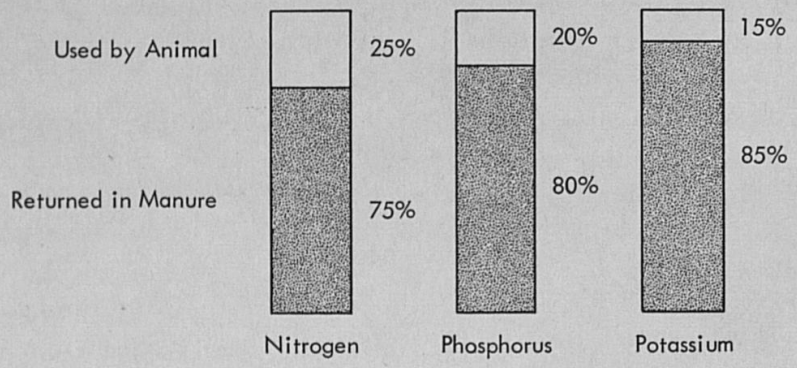
VALUE OF ANIMAL MANURES

Farm manures have long been regarded as valuable byproducts of livestock farming, and they are still preserved and used with diligence in many parts of the world. However, today's plentiful supply of commercial fertilizers and the high cost of labor and equipment to handle manure in this country have resulted in a reassessment of its value by many farmers.

The value of manures depends on their plant nutrient (primary, secondary, and trace) content and their effectiveness as soil building and conserving agents. The nutrient content is the criterion most

often used in evaluating manures; however, the organic matter content, because of its effect on soil micro-organisms and soil structure, may have a value on some soils equivalent to the nutrients contained. Soil micro-organisms are essential for good soil structure and plant growth. These organisms require organic matter as a source of energy for their life processes. Farm manures are one of the best sources of food for soil organisms, especially where the use of green manure crops may not be practical.

Plant nutrients and organic materials in manures come entirely from the feeds consumed and the bedding used. The animals themselves do not create or add fertility. They merely excrete part of the nutrients and organic matter contained in the feeds they eat. Approximately one-fifth of the major nutrients in feeds is absorbed into the animal body while three-fourths are excreted in the manure (Fig. 1).



(Data from Ohio Agr. Exp. Sta. Bul. 605)

Fig. 1.— The approximate percentages of the plant nutrients in a feed that are absorbed into the animal body and the approximate amounts excreted in the manure—liquid and solid.

Manures from different kinds of animals vary considerably in the amounts of nutrients they contain. The same is true for like animals of different ages. In general, young animals absorb and store in their bodies a greater proportion of the nutrients in the feed than do older animals. Thus, their excrements contain lesser amounts of these nutrients. Likewise, manures from milking cows contain less nutrients than do those from cows not milking because the former not only supplies her body needs but produces milk which is rich in these same nutrients.

Further, the excrements from an animal fed a ration composed chiefly of leguminous plants will contain more nutrients than manures from one fed chiefly grasses. Also, the amount of nutrients recovered in manures from an animal receiving a protein supplement is greater than from one receiving a grain supplement. The amount and kind

of bedding used will greatly influence the percentage of moisture and pounds of nutrients per ton.

Because of the above and other factors, manures vary widely in composition and value. However, in spite of these variations, fairly accurate general values were arrived at by Michigan State University by chemically analyzing samples from different kinds of animals (Table 2).

Table 2.— Average Amounts and Combined Value of N, P, and K in Fresh Manures From Different Farm Animals[1]

	Percent Water	Pounds Per Ton			Value Per Ton[3]
		N	P^2	K^2	
Dairy cattle	79	11.2	2.0	10.0	$2.32
Fattening cattle	80	14.0	4.0	9.0	2.98
Hogs	75	10.0	2.8	7.6	2.19
Horses and mules	60	13.8	2.0	12.0	2.76
Sheep	65	28.0	4.2	20.0	5.36
Chickens	54	31.2	8.0	7.0	5.68

[1] See Table 1, footnote 1.
[2] Phosphorus (P) can be converted to P_2O_5 by multiplying the figures given above by 2.29, and potassium (K) can be converted to K_2O by multiplying by 1.2.
[3] Calculated on the assumption that nitrogen (N) retails at 12¢, phosphorus (P) at 19¢, and potassium (K) at 6¢ per pound in commercial fertilizers.

In round numbers, the manure produced annually by a horse, mule, or dairy cow should be worth about $30; fattening cattle $21; a hog $4; a sheep $6; and by 100 chickens $10 when only the value of the N, P, and K content is considered. In addition to N, P, and K, animal manures contain secondary and micro-nutrients that are essential to plant growth. Among these are boron, calcium, copper, iron, magnesium, manganese, molybdenum, sulfur, and zinc. Consequently, crops grown on soils that are deficient in any of these will benefit from applications of manure.

Manures from different kinds of farm animals were analyzed at Michigan State University for their secondary and micronutrient content. The results are shown in Table 3, page 6.

PRESERVING ANIMAL MANURES

Almost half of the manures produced in Kentucky accumulates in barns, feedlots, and loafing areas. The amounts that accumulate in these areas will vary from farm to farm depending on the type of livestock and method of handling. These manures must be removed from time to time, and the cost of handling is unavoidable. Preserving their value and using them wisely on soils and crops that benefit from them will give a fair return on handling costs. Since the

Table 3.— Secondary and Micronutrients in Fresh Manures from Different Kinds of Animals[1]

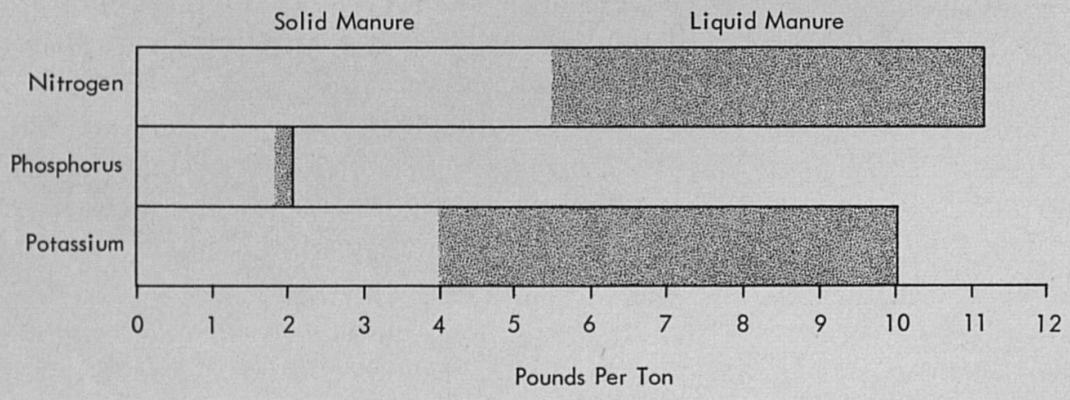
Kind of Animal	Pounds of Nutrients per Ton								
	Secondary			Micronutrients					
	Calcium	Magnesium	Sulfur	Boron	Copper	Iron	Manganese	Molybdenum	Zinc
Dairy cattle	5.6	2.2	1.0	0.03	0.01	0.08	0.02	0.002	0.03
Fattening cattle	2.4	2.0	1.7	0.04	0.01	0.08	0.01	0.001	0.03
Hogs	11.4	1.6	2.7	0.08	0.01	0.56	0.04	0.002	0.12
Horses and mules	15.7	2.8	1.4	0.03	0.01	0.27	0.02	0.002	0.03
Sheep	11.7	3.7	1.8	0.02	0.01	0.32	0.02	0.002	0.05
Chickens	74.0	5.8	6.2	0.12	0.03	0.93	0.18	0.011	0.18

[1] See Table 1, footnote 1.

value of manures is in both the liquid and solid forms, it is important to save both (Fig. 2).

Using Bedding

Usually the largest loss in animal manures that accumulate in feeding and loafing areas results from loss of the liquid portion. This liquid will, in general, contain 56 percent of the nutrients excreted (Fig. 2). Thus, it is important that proper amounts of high quality bedding be used to reduce liquid losses.



(Data from Ohio Agr. Ext. Service Bul. 262)

Fig. 2.— Distribution of N, P, and K in the solid and liquid portions of manure from a dairy cow when assuming that it contains 11.2 pounds of N, 2.0 pounds of P, and 10.0 pounds of K per ton.

Bedding materials should have these characteristics:

1. Easy to obtain and inexpensive.
2. Have high absorptive power for liquids.
3. Free of dust.

Common bedding materials vary somewhat in their ability to absorb liquid. Whole wheat straw will absorb about twice its weight in water. Whole oat straw is somewhat better. Cut or shredded straw and sawdust will absorb about twice as much water as uncut straw. Whole corn stalks are poor absorbents, but work well when shredded. Peat moss and wood shavings are good absorbents.

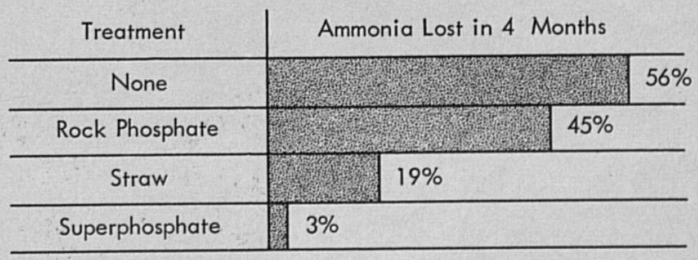
Table 4.— Standard Allowances of Uncut Straw Per Animal Per Day

Animal	Daily Straw Allowance per Head
Cattle	9 pounds
Steers	7-10 pounds
Horses	10-15 pounds
Hogs	1½ pounds
Sheep	1 pound

USING PHOSPHATE FERTILIZER

Table 2 shows that manures from all farm animals are much higher in nitrogen and potassium than they are in phosphorus. Frequently farmers add phosphorus fertilizers to manures that accumulate in barns, feedlots and loafing areas to make them more balanced in their nutrient content and to prevent the loss of nitrogen as gaseous ammonia.

Figure 3 illustrates the effectiveness of superphosphate (18-20 percent) in reducing nitrogen losses.



(Data from Ohio Agr. Ext. Service Bul. 262)

Fig. 3.— Superphosphate cuts ammonia losses when added to manure as they accumulate in barns, loafing areas, and feedlots.

A standard practice for many dairymen is to add 50-60 pounds of superphosphate (18-20 percent) per ton of manure. Horse and sheep manures, being more fermentable, should get about 60-70 pounds per ton.

Daily rates of superphosphate are about as follows:

Animal	*Superphosphate per day*
Cattle and Horses	1-2 pounds per head
Hogs and sheep	½-1 pound per head
Chickens	1 pound per 100 hens

STORING MANURES

Manures that accumulate in loafing barns or sheds under the feet of animals will be kept moist and tightly packed. If enough high quality bedding is used to absorb the liquid, little nitrogen or organic matter will be lost from decay or fermentation according to the University of Illinois (U. of Ill. Agr. Ext. Circ. 595). Manures from milking parlors or stalls may be added to that in the loafing area for preservation. The addition of superphosphate (18-20 percent) will help reduce the loss of nitrogen (Fig. 3).

The Ohio Agricultural Experiment Station found that manures exposed to winter rains during January, February, and March lost more than one-third of the organic matter and nitrogen, about one-fourth of the phosphorus, and one-half of the potassium (Fig. 4).

Fig. 4.— Improperly stored manures, as those shown above, lose one-third of the organic matter and nitrogen, about one-fourth of the phosphorus, and one-half of the potassium.

These losses can be reduced, however, if the manure is stored in pits or in deep, well packed piles with straight sides. Such piles have less air space resulting in less fermentation and will absorb more of the water that falls on them thus reducing the amount of leaching.

Tight-walled manure pits with concrete floors reduce storage losses by preserving the liquids and by keeping the manure cool and moist, thus slowing down oxidation and loss of nitrogen as gaseous ammonia. The pit can be constructed of concrete blocks with one end open to permit loading with a manure loader. A roof is not necessary if the manure is piled deep and enough high quality bedding has been used to absorb all the rainfall. If the manure becomes dry in summer, it may be well to add water occasionally.

The manure pit or pile should be located some distance from barns for sanitary reasons but should be readily accessible when manures are to be removed.

HANDLING ANIMAL MANURES

Research at Michigan State University indicates that the cost of handling and hauling manures, including labor and depreciation on loaders and spreaders, from dairy cows under loose housing was about 87 cents per ton. The herds included in this study averaged 52 cows each. Another study by the same institution indicates that the cost of handling manures from 200 steers fed to gain 600 pounds was about 95 cents per ton.

Costs of handling manures will vary from farm to farm. Factors that influence this cost include type of housing used, number of times the manures are handled, size and type of equipment, and the distance to the fields where the manures are spread. The cost of removing manures from the barn or yard just to get rid of them, plus the cost of disposing of them, may be as great as the cost of spreading them on the field.

WHERE AND WHEN TO SPREAD MANURE

Greater benefits will be obtained from manures when they are used on non-leguminous crops and on land that is tilled often. Leguminous crops provide their own nitrogen if well inoculated; therefore, the nitrogen in the manures is not needed by them. Usually the legume in a grass-legume mixture will supply enough nitrogen for both species.

Organic matter is depleted more rapidly in cultivated soils than it is in soils covered by sod. The addition of animal manures will replace some of this organic matter as well as supply part or all of the plant nutrients needed for crop growth (Fig. 5), page 10.

Animal manures can be spread in the fields any time the ground will support spreading equipment. However, there may be some loss

Fig. 5.— Animal manures can be spread in the fields any time the ground will support spreading equipment.

of nutrients through water runoff if the manures are not plowed or disked into the soil. Also some ammonia will be lost by volatilization if fermented manures stay on the surface during warm, dry, windy weather. The Wisconsin Agricultural Experiment Station found that one-fourth to one-third of the total nitrogen in fermented cow manure was lost within 12 hours to 7 days at 68°F with an 8.5 mile an hour wind. This loss, however, may be balanced off by getting the manure on the fields when it is most convenient.

Rotation grazing on pasture fields can be accomplished by spreading small amounts of manures evenly over fields on a rotation basis. Only a small amount is needed to keep livestock from grazing an area for a few days.

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