

LIVESTOCK MANURE PRODUCTION RATES AND NUTRIENT CONTENT

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The use of livestock and poultry manure as a crop fertilizer supplement has come full circle. Before the advent of inexpensive inorganic fertilizers after World War II, farmers routinely used manure to complement a good fertility program. Today, because of rising costs of commercial fertilizers and increasing emphasis on sound manure management to protect water quality, renewed interest has been focused on maximizing the fertilizer returns of organic manures.

Waste production and characteristics are influenced by several factors. Waste from open housing systems and manure storage areas is diluted by rainfall. Manure drying reduces the nitrogen content because of associated ammonia losses. The longer manure remains in the housing or storage area before removal, the more chance there is for nitrogen loss. Liquid manure storage pits or basins retain the urine and manure fluids, which can contain as much as 50 percent of the total nitrogen. Lagoon treatment reduces total nitrogen by 50 to 85 percent and phosphorus by as much as 90 percent in the lagoon effluent. The following tables give average manure and wastewater characteristics for various handling methods, but because of the variability in nutrient values, wastes must be sampled and analyzed within 60 days of application. Waste samples can be analyzed for primary, secondary, and micronutrients at a nominal fee by the N.C. Department of Agriculture, Waste Advisory Section, 4300 Reedy Creek Road, Raleigh, NC 27607-6465; (919) 733-2656.

It is important that the land application of manures

become an integral part of the overall soil-fertility management strategy. Decomposition and mineralization of the manure in soil release significant amounts of nutrients essential for crop growth. Manure must be incorporated with the soil to conserve nitrogen. If left on the surface, up to 25 percent of the ammonia nitrogen can be lost within 2 days, and 75 percent or more can be lost within 1 month after application. Table 10-21 gives first-year availability coefficients which, when multiplied by the appropriate total nutrients in the other tables or by an actual nutrient analysis, approximate the plant-available portion of the total manure nutrients. Moisture must be accounted for in predicting nutrient availability of solid wastes. Apply manure as close to the period of maximum plant demand for nutrients as possible.

Base manure application rates on the available portion of the nutrients; do not apply more than the receiver crop needs. Excessive amounts not only waste valuable nutrients but may result in surface and/or groundwater pollution. Use soil testing to predict nutrient and lime requirements and plant analysis to monitor the nutritional status and effectiveness of the nutrient management program. Additional information on the use of animal manure is available in Soil Facts AG-439-4, *Swine Manure as a Fertilizer Source*, AG-439-5, *Poultry Manure as a Fertilizer Source*, and AG-439-28, *Dairy Manure as a Fertilizer Source*. Fact sheets are available at county Cooperative Extension centers.

TABLE 10-14. LIVESTOCK FRESH MANURE CHARACTERISTICS

Manure Source	Average Animal Weight lb	Feces and Urine Production ¹		Density lb/ft ³	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/ton	Potassium K ₂ O lb/ton
		lb/day	tons/yr ²			Total lb/ton	NH ₃ -N lb/ton		
DAIRY	1,400	122.3	22.3	62.5	13.9	10.4	1.9	5.1	8.2
BEEF	800	48.5	8.3	61.4	14.7	13.4	3.9	7.3	8.9
VEAL	200	12.4	2.0	62.2	6.5	7.9	3.7	4.0	10.6
SWINE	135	11.1	1.9	61.5	10.3	12.3	7.5	9.3	8.8
SHEEP	60	2.4	0.4	62.3	28.1	20.8	5.8	9.4	19.0
GOAT	140	5.8	1.1	62.5	32.5	21.8	6.1	12.1	23.6
HORSE	1,000	50.3	9.2	61.1	29.6	12.1	2.4	6.3	12.0
RABBIT	10	0.31	0.056	28.0	51.6	24.5	0.4	25.2	11.1
LAYER	4	0.26	0.047	61.6	24.9	26.6	6.6	21.3	11.6
BROILER	2	0.16	0.024	63.7	25.6	26.3	6.7	16.3	11.7
TURKEY	15	0.68	0.112	63.5	25.3	28.0	8.1	24.4	12.1
DUCK	3	0.33	0.050	62.4	27.0	28.0	8.2	23.4	17.2

¹ As voided.

² Based on one-time animal or bird capacity.

TABLE 10-15. LIVESTOCK LOT SURFACE SCRAPED MANURE CHARACTERISTICS

Manure Source	Average Animal Weight lb	Manure Accumulation		Density lb/ft ²	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/ton	Potassium K ₂ O lb/ton
		lb/day	tons/yr ¹			Total lb/ton	NH ₃ -N lb/ton		
BEEF paved feed lot ³	800	33.5	5.7	59.7	28.6	14.3	4.9	9.4	12.9
unpaved feedlot ⁴		12.7	2.2	60.3	58.9	25.1	4.7	17.8	21.6
DAIRY ²	1,400	88.0	16.1	56.4	21.8	10.3	2.5	7.1	8.6
HORSE	1,000	32.9	6.0	14.0	49.7	12.8	1.9	9.7	13.9
LAYER undercage scraped ⁵	4	0.16	0.028	62.4	35.2	28.3	14.0	31.7	19.5
highrise stored ⁶		0.11	0.020	51.2	52.8	38.6	11.8	51.1	26.3
SWINE ²	135	7.8	1.3	62.4	18.5	13.0	5.6	13.3	9.1

¹ Based on one-time animal or bird capacity.² Manure collected within 1 week.³ Manure collected within 2 days.⁴ Manure collected after each group of cattle.⁵ Annual manure accumulation on unpaved surface.⁶ Stable manure and bedding on unpaved surface.**TABLE 10-16. POULTRY HOUSE LITTER CHARACTERISTICS**

Manure Source	Average Animal Weight lb	Manure and Litter Accumulation		Density lb/ft ²	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/ton	Potassium K ₂ O lb/ton
		lb/day	tons/yr ¹			Total lb/ton	NH ₃ -N lb/ton		
BROILER Broiler ²	2.0	0.041	0.0063	31.7	78.6	72.1	12.0	69.3	46.6
Roaster ³	4.0	0.063	0.010	29.0	76.2	69.5	16.0	69.9	46.7
Breeder ³	6.0	0.13	0.023	50.0	68.6	37.5	8.0	58.3	35.2
TURKEY Poult ²	2.5	0.048	0.0070	22.9	79.5	40.1	9.6	43.3	26.9
grower hen ³	10.0	0.16	0.02	32.3	73.2	55.6	12.1	63.3	39.9
grower tom ³	15.0	0.24	0.041	32.3	73.2	55.6	12.1	63.3	39.9
DUCK ³	3.0	0.17	0.026	500	37.0	17.0	3.7	21.4	12.7

¹ Based on one-time bird capacity.² Based on cleanout after each group of birds.³ Based on annual cleanout after full production.**TABLE 10-17. POULTRY STOCKPILED LITTER CHARACTERISTICS**

Manure Source	Average Animal Weight lb	Manure and Litter Accumulation		Density lb/ft	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/ton	Potassium K ₂ O lb/ton
		lb/day	tons/yr ¹			Total lb/ton	NH ₃ -N lb/ton		
BROILER ²	2	0.038	0.0057	33.1	60.6	32.7	6.9	76.7	32.0
TURKEY ²	15	0.22	0.037	24.1	61.2	32.1	5.5	69.6	30.1
DUCK ²	3	0.09	0.014	50.0	49.1	22.3	4.3	41.2	21.7

¹ Based on one-time bird capacity.² Annual house accumulation removed to uncovered stockpile to be spread within 6 months.**TABLE 10-18. LIVESTOCK LIQUID MANURE SLURRY CHARACTERISTICS**

Manure Source	Average Animal Weight lb	Manure Slurry Accumulation ¹	Density lb/gal	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/1,000 gal	Potassium K ₂ O lb/1,000 gal
		gal/animal/day			Total lb/1,000 gal	NH ₃ -N lb/1,000 gal		
DAIRY	1,400	22.5	8.3	7.0	22.5	9.2	13.8	20.0
BEEF	800	6.8	8.3	12.0	35.0	14.6	22.6	31.6
VEAL	200	1.4	8.5	2.6	30.4	25.3	17.0	42.1
SWINE	135	2.3	8.4	5.1	26.7	16.8	18.9	15.2
LAYER	4	0.046	7.8	11.2	57.6	36.8	52.0	33.1

¹ Based on 6 to 12 months' accumulation of manure, excess water usage, storage surface rainfall surplus; does not include fresh water for flushing or lot runoff.

TABLE 10-19. LIVESTOCK ANAEROBIC LAGOON LIQUID CHARACTERISTICS

Manure Source	Average Animal Weight lb	Lagoon Liquid Accumulation ¹	Density lb/gal	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/acre inch	Potassium K ₂ O lb/acre inch
		acre-inch/animal/year			Total lb/acre inch	NH ₃ -N lb/acre inch		
DAIRY	1,400	0.41	8.3	0.52	132	88	75	176
BEEF	800	0.13	8.3	0.59	92	63	50	134
VEAL	200	0.032	8.3	—	56	36	10	82
SWINE	135	0.035	8.3	0.32	128	103	51	132
LAYER	4	0.0095	8.3	0.49	180	152	46	279

¹ Based on accumulation of manure, excess water usage, and average annual lagoon surface rainfall surplus; does not include fresh water for flushing or lot runoff.

TABLE 10-20. LIVESTOCK ANAEROBIC LAGOON SLUDGE CHARACTERISTICS

Manure Source	Average Animal Weight lb	Lagoon Sludge Accumulation ¹	Density lb/gal	Total Solids TS %w.b.	Nitrogen		Phosphorus P ₂ O ₅ lb/1,000 gal	Potassium K ₂ O lb/1,000 gal
		gal/hd/day			Total lb/1,000 gal	NH ₃ -N lb/1,000 gal		
DAIRY	1,400	5.9	8.3	7.3	19.2	6.2	41.8	9.2
BEEF	800	2.3	8.3	11.4	38.2	17.1	58.9	14.6
SWINE	135	0.1	8.9	10.0	24.4	5.9	52.6	6.5
LAYER	4	0.013	8.3	16.5	20.8	6.5	77.2	9.8

¹ No manure solids removed before waste enters the lagoon.

TABLE 10-21. LIVESTOCK MANURE NUTRIENT FIRST-YEAR AVAILABILITY COEFFICIENTS

Manure Source	Application Method							
	Injection ¹		Soil Incorporation ²		Broadcast ³		Irrigation ⁴	
	Plant Nutrient							
	N	Other	N	Other	N	Other	N	Other
PAVED SURFACE SCRAPED MANURE								
Dairy	—	—	0.6	0.8	0.4	0.7	—	—
Beef	—	—	0.6	0.8	0.4	0.7	—	—
Swine	—	—	0.6	0.8	0.4	0.7	—	—
Sheep	—	—	0.6	0.8	0.4	0.7	—	—
Goat	—	—	0.6	0.8	0.4	0.7	—	—
Rabbit	—	—	0.5	0.8	0.5	0.7	—	—
Layer	—	—	0.6	0.8	0.4	0.7	—	—
UNPAVED SURFACE MANURE								
ACCUMULATION								
Beef, feedlot	—	—	0.6	0.8	0.5	0.7	—	—
Horse, stable	—	—	0.5	0.8	0.5	0.7	—	—
Layer, deep pit	—	—	0.6	0.8	0.4	0.7	—	—
POULTRY HOUSE LITTER								
Broiler	—	—	0.6	0.8	0.5	0.7	—	—
Broiler breeder	—	—	0.6	0.8	0.5	0.7	—	—
Turkey	—	—	0.6	0.8	0.5	0.7	—	—
Duck	—	—	0.6	0.8	0.5	0.7	—	—
POULTRY STOCKPILED LITTER								
Broiler	—	—	0.6	0.8	0.5	0.7	—	—
Turkey	—	—	0.6	0.8	0.5	0.7	—	—
Duck	—	—	0.6	0.8	0.5	0.7	—	—
LIQUID MANURE SLURRY								
Dairy	0.7	0.8	0.6	0.8	0.4	0.7	0.4	0.7
Beef	0.7	0.8	0.6	0.8	0.4	0.7	0.4	0.7
Veal	0.9	0.8	0.7	0.8	0.4	0.7	0.3	0.7
Swine	0.8	0.8	0.7	0.8	0.4	0.7	0.3	0.7
Layer	0.8	0.8	0.7	0.8	0.4	0.7	0.3	0.7
ANAEROBIC LAGOON LIQUID								
Dairy	0.8	0.8	0.7	0.8	0.5	0.7	0.5	0.7
Beef	0.7	0.8	0.7	0.8	0.5	0.7	0.5	0.7
Veal	0.8	0.8	0.7	0.8	0.5	0.7	0.5	0.7
Swine	0.9	0.8	0.8	0.8	0.5	0.7	0.5	0.7
Layer	0.9	0.8	0.8	0.8	0.5	0.7	0.5	0.7
ANAEROBIC LAGOON SLUDGE								
Dairy	0.7	0.8	0.6	0.8	0.4	0.7	0.4	0.7
Beef	0.7	0.8	0.6	0.8	0.4	0.7	0.4	0.7
Swine	0.6	0.8	0.6	0.8	0.4	0.7	0.4	0.7
Layer	0.6	0.8	0.6	0.8	0.4	0.7	0.4	0.7

¹ Manure injected directly into soil and covered immediately.

² Surface-spread manure plowed or disked into soil within 2 days.

³ Surface-spread manure uncovered for 1 month or longer.

⁴ Sprinkler irrigated liquid uncovered for 1 month or longer.

These recommendations apply only to North Carolina. They may not be appropriate for conditions in other states and may not comply with laws and regulations outside of North Carolina. These recommendations are current as of August 2001. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county Cooperative Extension Service agent. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by the North Carolina Cooperative Extension Service nor discrimination against similar products or services not mentioned.

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