Texas A&M AgriLife Extension

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Manure Production & Characteristics

Its importance to Texas and animal feeding operations

Saqib Mukhtar*

The design of animal waste management systems and comprehensive nutrient management plans require sampling and analyses of specie-specific manure. Therefore, it is important to understand how to estimate annual manure production and its chemical, physical and thermal constituents from animal feeding operations (AFOs) in Texas.

Tables 1 and 2 contain information on manure production and characteristics. **Remember that their data is for planning purposes only.** These estimates do not replace the need for manure sampling and analyses.

Table 1

This table shows data on the following:

- Average animal weight
- Number of days the animal is on feed
- Daily excretion of manure per animal

and its *total solids* (TS) and *volatile solids* (VS), or organic matter that can be converted into combustible gases by microbial activity or by exposure to temperatures greater than 1,100 degrees Fahrenheit

- Moisture content and nutrient – nitrogen (N), phosphorus (P) and potassium (K) – value.

Since commercial fertilizer is sold as having different ratios of inorganic N, P (as phosphate or P_2O_5) and K (as potash or K_2O), P and K equivalents of P_2O_5 and K_2O in manure, respectively, are also included in this table.

Values of P to P_2O_5 and K to K_2O have been converted by multiplication factors of 2.29 and 1.2, respectively.

Associate Professor and Extension Agricultural Engineer, The Texas A&M University System.

Table 2

It presents number of animals *finished* (removed from AFOs and marketed), such as chickens for meat (broilers), or *raised* (e.g., milk cows per year). This information is based upon the most recently available information from National Agricultural Statistics Service and other sources noted at the bottom of this table.

Using animal population information in this table and the data from Table 1, annual production of manure and mass of TS, VS, N, P, P_2O_5, K and K_2O from various animal types has been estimated on an "as excreted" basis.

The last column in Table 2 presents estimates of the energy value of manure in British Thermal Units (BTUs) on a "dry and ash free basis." This measurement represents the heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Total energy or heating value of manure for each animal specie per year has been calculated by multiplying total pounds of VS for every animal type and poultry litter by 8,500 BTUs per pound of VS.

Extensive field research by Texas Agricultural Experiment Station and Texas Cooperative Extension (TCE) has shown that 8,500 BTU/lb is a good estimate of dry, ash free heating value of livestock and poultry manure. For comparison, 1 kilowatt hour (kWh; 1,000 Watts of electrical energy for 1 hour) is equal to 3,413 BTUs. One Therm or 100 cubic feet of natural gas will equal approximately 100,000 BTUs.

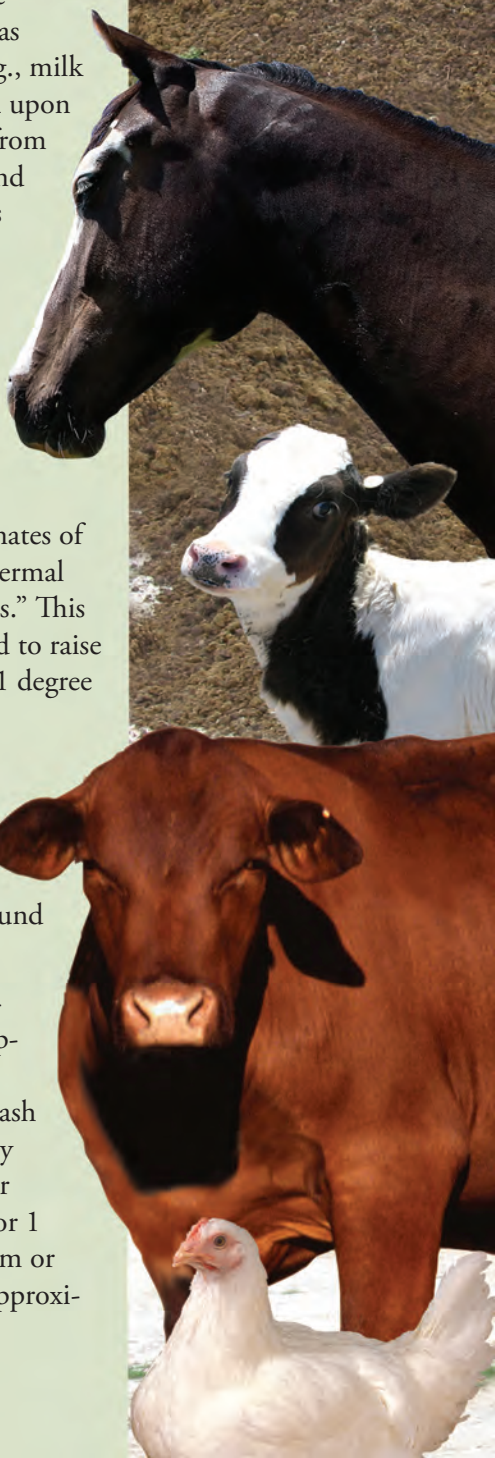

Table 1. Animal manure production and characteristics.*

Animal type	Average weight (pound)	Days on feed	Total solids (TS)	Volatile solids (VS)	N	P	P_2O_5	K	K_2O	Manure	Moisture
			Pounds per day per animal on an "as excreted" basis								%, wb[1]
Cattle											
Cows/Heifers **	1000	365	9.5	8.1	0.36	0.048	0.11	0.23	0.28	82	88
Finishing	1200	153	5.1	4.2	0.36	0.048	0.11	0.248	0.30	64	92
Bulls**	1100	365	6.2	5.7	0.54	0.092	0.21	0.267	0.32	80	92
Calves**	450	210	3.4	2.9	0.14	0.044	0.10	0.092	0.11	26	92
Dairy-Milk cows[Π]	1300	365	18	15.3	0.92	0.16	0.36	0.44	0.53	141	87
Swine											
Nursery	27.5	36	0.3	0.2	0.025	0.0042	0.01	0.01	0.01	2.4	90
Finishing	154	120	1.0	0.8	0.083	0.0142	0.03	0.037	0.04	10	90
Gestating	440	365	1.1	1.0	0.071	0.02	0.05	0.048	0.06	11	90
Lactating	423	365	2.5	2.3	0.19	0.055	0.13	0.12	0.14	25	90
Sheep**	100	365	1.1	0.9	0.04	0.009	0.02	0.03	0.04	4	75
Poultry											
Layers	3	365	0.05	0.04	0.0035	0.0011	0.003	0.0013	0.002	0.19	75
Broilers	2.8	48	0.06	0.04	0.0025	0.00073	0.002	0.0014	0.002	0.23	74
Turkeys[2]	25	140	0.12	0.1	0.0072	0.00212	0.005	0.0033	0.004	0.47	74
Litter[3]			2	1.6	0.089	0.038	0.086	0.049	0.059	2.5	21
Horse[4]	1100	365	8.5	6.7	0.27	0.05	0.12	0.14	0.16	56.5	85

* ASAE Standard D384.2. 2005. Manure Production and Characteristics. ASABE, St. Joseph, MI 49085-9659.

** Manure Characteristics. 2000. Mid West Plan Service, Ames, IA 50011-3080. MWPS-18, Section 1.

[Π]Milk cow data on TS, N, P, K and manure provided by Dr. Tamilee Nennich, TCE Dairy Specialist. Volatile solids (VS) estimated to be 85% of TS.

[1] %, wb= percent wet basis.

[2]Days on feed data from "Economic Impact of the Texas Poultry Industry," 2004, TCE publication, L-5214. Average weight, TS, VS, N, P, K and total manure averaged from data for female and male turkeys.

[3]Poultry Waste Management Handbook," 1999. Natural Resource, Agriculture, and Engineering Service. Ithaca, NY 14853-5701. NARES-132. Pounds of whole poultry litter (as removed from production houses) per broiler sold. N, P and K values in pounds per 2.5 pounds of litter.

[4]Average weight, TS, VS, N, P, K and total manure averaged from data for sedentary and intense exercise horses.

Table 2. Annual production of manure, solids, nutrients and energy.

Animal type	Year*	Animal numbers** (thousands)	Total manure	TS	VS	N	P	P_2O_5	K	K_2O	Total energy***
			Thousands of tons per year on an "as excreted" basis								BTU x 10^{12} Tera BTUs
Cattle											
Cows/Heifers	2006	5780	86498	10021	8544	380	51	116	243	291	145
Finishing		5520	27026	2149	1765	152	20	46	105	126	30
Bulls		370	5402	419	385	36	6	14	18	22	6.54
Calves		2430	6634	868	740	36	11	26	23	28	12.6
Milk cows		334	8581	1096	936	56	9.7	22.3	27	32	15.8
Swine											
Nursery	2006	270	12	1.36	1.16	0.12	0.02	0.05	0.05	0.06	0.02
Finishing		565	339	34	28	2.81	0.48	1.10	1.24	1.49	0.48
Other[1]		95	312	31	29	2.26	0.65	1.49	1.46	1.75	0.48
Sheep & Goats[2]	2006	2410	1759	484	400	18	4	9	13	16	6.8
Poultry											
Layers[3]	2005	18688	648	167	123	12	4	9	4	5	2.1
Broilers	2005	627900	3451	874	659	38	11	25	21	26	11.2
Turkeys[4]	2004	14100	468	120	96	7	2	5	3	4	1.63
Litter			785	622	494	28	12	27	15.4	18	8.4
Horse[5]	1998	1067	11000	1655	1304	53	10	23	26	32	22.2

*Year of estimated total population or production data from National Agricultural Statistical Service.

**Animals finished or on feed per year.

***Dry and ash free basis.

[1]Includes all hogs other than nursery and grow-finish. Estimates based on average nutrient data from gestating and lactating sows in Table 1.

[2]Includes sheep and goats. Manure and nutrient totals calculated using sheep data only.

[3]Includes hens and pullets of egg-laying age.

[4]Animal numbers for turkeys estimated from the difference between total turkey and broiler population in Texas (615.6 million from TCE publication L-5214) and National Agricultural Statistical Service estimated number of broilers (601.5 million in 2004).

[5]Animal numbers for horses adopted from Texas Horse Industry Report, 1998, and from the Texas Horse Industry Quality Audit Initiative, TCE, January 1998.

http://tammi.tamu.edu

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