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CLEAN WATER FOR WASHINGTON

Animal Manure Data Sheet

By Ronald E. Hermanson, P.E. and Prasanta K. Kalita

You need to understand the properties of animal wastes to solve the problem of their treatment, handling, and disposal.

The physical and chemical properties of animal wastes are affected by the physiology of the animal, the feed ration, and the environment. Size of the animal, as measured by its live weight, is perhaps the most important physiological factor. Sex, breed, and activity of the animal affect the manure properties to the extent that they partially determine the feed conversion efficiency under a given environment. The digestibility of the feed ration, the protein and fiber content, and the nature of the other feed elements also affect the physical composition of the manure. Temperature appears to be the most important factor.

Feed quality influences not only the amount the animal eats daily (which will be reflected in the quantity of manure produced), but also the chemical composition of the waste. Proteins, which contain most of the nitrogen of the feed, vary in digestibility. Nitrogen in the undigested protein is excreted in the solid feces; in the digested proteins, it is absorbed and later excreted in the urine except for the portion that is used to build flesh in the animal. Potassium is absorbed during digestion, but practically all is excreted.

Part of the phosphorus content of the feed is absorbed, but most is excreted in the feces. Feed is spilled on pen floors, hence, is included undigested in the manure collected from the animal pens. Consequently, manure from animals in a confinement building will contain all the ingredients of the feed-some of them in their original form, others in chemically simpler forms.

Most animal rations include antibiotics for disease control. When large doses of these antibiotics are administered to the animals, a sufficient portion may pass through the digestive tract to severely inhibit or at times limit biological treatment of the manure unless the manure is diluted sufficiently that toxic concentrations of the antibiotics do not develop.

Table 1. Livestock manure production and properties
Source: Adapted from American Society of Agricultural Engineers ASAE D384.1 and Midwest Plan Service MWPS-18

		Wet Raw Manure[a]					BOD[b]	COD[c]	Total Solids		Volatile Solids
Animal	Weight, lb	lb/ day	ton/ yr	gal/ day	cu ft/ day	MC,[d] %	lb/day	lb/day	lb/day	ton/yr	lb/day
Dairy Cow	1400	120	22	14.3	1.9	87	2.2	15.4	16.8	3.0	14.0
Dairy Heifer	1000	86	15.7	10.2	1.4	87	1.6	11.0	12.0	2.2	10.0
Beef Stocker	500	29	5.3	3.5	0.5	88	0.8	3.9	4.3	0.78	3.6
Beef Feeder	1000	58	11[e]	6.9	1.0	88	1.6	7.8	8.5	1.55	7.2
Beef Cow		63	11.5	7.5	1.0	88	1.7	8.5	9.2	1.68	7.8
Horse	1000	51	9.3	6.0	0.8	80	1.7		15.0	2.70	10.0
Nursery pig	35	2.9	0.54	0.35	0.047	91	0.11	0.29	0.39	0.07	0.30
Growing pig	65	5.5	1.00	0.65	0.089	91	0.20	0.55	0.72	0.13	0.55
Finishing pig	150	12.6	2.30	1.50	0.20	91	0.47	1.26	1.65	0.30	1.28
	200	16.8	3.07	2.00	0.27	91	0.62	1.68	2.20	0.40	1.70
Gestating sow*	275	11.6	2.11	1.38	0.19	91	0.43	1.16	1.51	0.28	1.17
Sow and litter	375	31.5	5.75	3.75	0.51	91	1.16	3.15	4.13	0.75	3.19
Boar*	350	14.7	2.68	1.75	0.24	91	0.54	1.47	1.93	0.35	1.49
Sheep Feeder	100	4	0.73	0.48	0.06	75	0.12	1.10	1.10	0.20	0.92
Laying Hen	4	0.26	0.047	0.030	0.004	75	0.013	0.044	0.064	0.012	0.048
Broiler	2	0.17	0.031	0.020	0.003	75	0.002	0.032	0.044	0.008	0.034

[a]Bulk density of raw manure is about 32 cu ft/ton, or 62 lb/cu ft, or 8.4 lb/gal with no flushing or wash water.

[b]Five-day biochemical oxygen demand.

[c]Chemical oxygen demand.

[d]Moisture content.

[e]Evaporation and decomposition reduce feedlot manure in dry climates to 1 to 2 tons of 50% moisture content manure for a 150- to 180-day feeding period.

*For gestating sows and boars that are limit fed, the Midwest Plan Service recommends using hog feeder data prorated according to weight and divide by 2.

Table 2. Fertilizer nutrients in fresh manure[a]

Source: Adapted from American Society of Agricultural Engineers ASAE D384.1 and Midwest Plan Service MWPS-18

Animal	Weight, lb	Total Nitrogen		Phosphate[b]		Potash[c]	
		lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Dairy Cow	1400	0.63	230	0.302	110	0.490	179
Dairy Heifer	1000	0.45	164	0.216	79	0.350	128
Beef Stocker	500	0.17	62	0.106	39	0.126	46
Beef Feeder	1000	0.34	124	0.211	77	0.252	92
Beef Cow		0.36	131	0.221	81	0.266	97
Horse	1000	0.30	110	0.162	59	0.301	110
Nursery pig	35	0.018	6.6	0.0144	5.3	0.012	4.5
Growing pig	65	0.033	12	0.0268	9.8	0.023	8.3
Finishing pig	150	0.079	29	0.063	23	0.052	19
	200	0.104	38	0.082	30	0.071	26
Gestating sow*	275	0.071	26	0.057	21	0.049	18
Sow and litter	375	0.195	71	0.156	57	0.131	48
Boar*	350	0.091	33	0.072	26	0.061	22
Sheep Feeder	100	0.042	15	0.020	7.3	0.039	14
Laying Hen	4	0.0033	1.2	0.0028	1.0	0.0014	0.53
Broiler	2	0.0022	0.80	0.0014	0.50	0.0009	0.35

[a]Manure fertilizer elements are not completely available to plants.

[b] $P=0.436\ P_2O_5$
[c] $K=0.830\ K_2O$
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