

APPENDIX I: ANIMAL TYPE INFORMATION**Table 1. The Typical Animal Production**

Animal Type	Average Weight (lbs)	No. of Animals per animal unit	No. For Large Confined Livestock Operation
Beef or dairy calf	250	4	4,000
Beef or dairy weaned calf	550	1.82	1,820
Beef Feeder	800	1.25	1,250
Beef Cow	1,000	1	1,000
Dairy Replacement Heifer	1,065	0.94	940
Dairy Cow	1,400	0.71	714
Layer	4	250	250,000
Pullet (<3 months old)	2.5	400	454,545
Pullet (>3 months old)	4	250	250,000
Broiler	2.2	455	454,545
Turkey Hen	20	50	50,000
Turkey on feed	15	66.67	66,667
Wean-Feeder Swine	30	33.3	33,333
Feeder-Finish Swine	135	7.41	7,410
Farrow-Wean Swine	433	2.31	2,310
Farrow-Feeder Swine	522	1.92	1,920
Farrow-Finish Swine	1,417	0.71	710
Replacement Gilt	150	6.67	6,670
Boar	400	2.5	2,500

An Animal Unit is defined as 1,000 pounds of live weight of any given livestock species or any combination of livestock species. A large confined livestock operation is defined as that which exceeds 1,000 Animal Units or 1,000,000 lbs. of live weight.

Calculation for total pounds of live weight in the confined livestock operation:

<u>Animal Type</u>	<u>No. Animals</u>		<u>Avg. Animal Wt.</u>	=	<u>Total Live Wt.</u>
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
			*Total	=	_____

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APPENDIX II: ANIMAL MANURE INFORMATION**Table 2. Animal Manure Generation**

Animal	Manure Production		Nutrient Content		
	(lb/d/1000#)	(cf/d/1000#)	N	P	K
Dairy Cow	80.00	1.30	0.45	0.16	0.31
Feeder Swine	63.40	1.00	0.42	0.36	0.26
Gestation Sow	27.20	0.44	0.19	0.14	0.14
Lactation Sow w/pigs	60.00	0.96	0.47	0.34	0.36
Nursery Pig	106.00	1.70	0.60	0.57	0.42
Pullet Litter	10.10	0.36	0.16	0.20	0.18
Breeder Litter	13.40	0.30	0.21	0.27	0.23
Broiler Litter ¹	17.80	0.57	0.52	0.43	0.33

¹In absence of actual production date use the following for broiler litter production:
1.6 ton/animal units/year.

Table 3. Pounds of Nutrients per 1000 Gallons of Effluent

	(Liquid)	(Sludge)
<i>Dairy:</i>		
Nitrogen	1.67	20.83
Ammonia- NH ₄	1.00	4.17
Phosphorous- P ₂ O ₅	1.10	20.98
Potash- K ₂ O	4.85	15.00
<i>Swine:</i>		
Nitrogen	3.336	25.00
Ammonia- NH ₄	2.856	6.33
Phosphorus-P ₂ O ₅	1.266	51.53
Potash-K ₂ O	4.686	75.97

The nutrient content from animal waste management systems is highly variable. Waste analyses should be made to establish trends for the specific management system to determine the rates of application.

Annual manure production can vary depending on management.

Lagoons are anaerobic with volumes accounting for animal waste, minimum treatment, surface rainfall, 5-year sludge accumulation, and milking parlor washwater (if appropriate). Storage pond volumes account for animal waste, surface rainfall, and milking parlor washwater (if appropriate) for a 180 day storage period. No outside runoff is considered.

APPENDIX III: MANURE HANDLING AND SPREAD ACTIVITY

Table 4. Ammonia Nitrogen Available for Crop Use After Volatilization Losses ^{1/}

Application Method		Available N from Ammonia	
Wet		Soil Conditions	
	%	%	%
Injection	90	95	100
Irrigation	65	75	85
Other Surface Application			
<i>Days between application and incorporation</i>			
1-2	70	90	100
3-5	60	80	95
6+	50	70	90

Table 5. Organic Nitrogen Which Becomes Available for Crop Use ^{1/}

Application Method	Available Nitrogen from Organic Nitrogen
	%
Surface applied	65
Incorporate	75

^{1/} The forms of nitrogen which occur in manure or organic waste are: ammonia N (NH₃-N), organic N (ON), and nitrate/nitrite N (NO₃/NO₂). The nitrate/nitrite forms are usually <1% of the total N or below detection level. This form is usually ignored. Ammonia N & nitrate N are both readily available for plant use. Ammonia N is subject to volatilization, while nitrate is subject to leaching. Organic N becomes slowly available through mineralization. Total Kjeldahl Nitrogen (TKN) equals ammonia N plus organic N. Laboratories often report TKN as Total N.

Example: To determine available N using Tables 2 & 3:

Situation: Lagoon effluent irrigation on a warm dry soil

Lab analysis of effluent (reported on an as-is basis):*

TKN = 100 lbs/acre inch

Ammonia N (NH₃-N) = 70 lbs/acre inch

Solution: Organic N (ON) = TKN - NH₃-N

ON = 100 - 70 = 30 lbs/acre inch

Available N = (70 lbs NH₃-N/acre inch) (.65) + (30 lbs ON/acre inch) (.65) = 65 lbs/acre inch

* Results were converted to a wet basis (Some laboratories report results on a dry-weight basis).

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Table 6. Percent Nutrients Remaining After Handling and Spread Activity

Handling/Spread Activity	N (%)	P (%)	K (%)
Anaerobic Lagoon	20 – 35	35 – 50	50 – 65
Storage Pond	65 – 80	80 – 95	80 – 95
Sprinkler Application	50 – 75	90 – 95	90 – 95
Gated Pipe Application	50 – 70	90 – 95	90 – 95
Tank Wagon Spreading	50 – 70	90 – 95	90 – 95
Dry Litter Spreading	50 – 70	80 – 95	80 – 95

Table 7. Soil Limitations for Liquid Application of Animal Manures

Soil Property	Limiting Factor		
	(slight)	(moderate)	(severe)
(0 - 60 inch depth)	(slight)	(moderate)	(severe)
Available water capacity (in/in)	>0.10	0.05 - 0.10	<0.05
Permeability affecting surface water (in/hr)	0.6-2.0	0.2 - 0.6	<0.2
Permeability affecting ground water (in/hr)	0.6-2.0	2.0 - 6.0	>6.0
Depth to high water table (ft)	>4.0	2 - 4	<2.0
Slope (percent)	<8.0	8 - 15	>15.0
Depth to bedrock (ft.)	>4.0	2 - 4	<2.0

APPENDIX IV: SOILS INFORMATION

Table 8. Crop Codes from Soil Test Reports for Crops Commonly Grown in MS

Crop Groups		
Group 1	Group 2	Group 3
Peanuts	Soybeans	Cotton
Rice	Corn (Grain)	Corn (Silage)
Pine Trees	Sorghum (Grain)	Sorghum (Silage)
Christmas Trees	Small Grain (Grain) ¹	Corn (Irrigated)
Perennial Winter Grass (Pasture) ⁹	Sunflower	Tomatoes (Commercial)
Perennial / Mixed Summer Grass (Pasture) ⁷	Pasture with Annual Legumes ⁵	Melons, Pumpkin, Cucumbers, Squash
Small Grain For Grazing ¹¹	Perennial Pasture Grass ⁶	Hybrid Bermudagrass ⁴
Annual Legumes / Ryegrass ³	Late Maturing Annual Legumes ⁶	Beans and Green Peas ¹³
	Perennial Winter Grass with Clover (Pasture) ¹⁰	Blue Berries (Commercial)
	Warm Season Annuals (Pasture) ¹²	Sweet Potatoes (Commercial)
	Mixed Grass (Hay) ⁸	Turnips (Commercial)
	Sweet Sorghum	Alfalfa
	Lespedeza (Hay)	Pecans Trees
	Johnsongrass (Hay)	Okra
	Forage Legumes ²	Southern Peas
	Sugar Cane	Sweet Corn

Sources: Mississippi State University Extension Service Soil Tests Recommendations Manual

¹ oats, wheat, rye, barley² white, red, or ball clovers, calay peas, vetch, for grazing, or green manure³ arrowleaf, crimson clovers, subterranean clover with small grain/ryegrass for grazing⁴ alecai, tif #44, callie, or coastal grasses, etc.⁵ bermuda, dallis, or bahia grasses with crimson, arrowleaf, ball, or subterranean clovers⁶ bermuda, dallis, or bahia grasses with white, red, arrowleaf, or subterranean clovers^{7, 8} bahia, bermuda, and dallis grasses⁹ fescue¹⁰ white, red, subterranean clovers with fescue grass¹¹ wheat, oats, annual rye¹² millet, forage sorghum, sudangrass, sorghum-sudangrass hybrids, johnsongrass¹³ lima and snap beans, green peas

Table 9. Potassium Levels (Groups 1 Crops)

<i>Level</i>	<i>CEC ≤ 7</i>	<i>CEC 7-14</i>	<i>CEC 14-25</i>	<i>CEC 25+</i>
Very Low	0-40	0-50	0-60	0-70
Low	41-80	51-110	61-130	71-150
Medium	81-120	111-160	131-180	151-200
High	121-210	161-280	181-315	301-350
Very High	210+	280+	315+	350+

Table 10. Potassium Levels (Groups 2 Crops)

<i>Level</i>	<i>CEC ≤ 7</i>	<i>CEC 7-14</i>	<i>CEC 14-25</i>	<i>CEC 25+</i>
Very Low	0-50	0-60	0-70	0-80
Low	51-110	61-140	71-160	81-180
Medium	111-160	141-180	161-210	181-240
High	161-280	191-335	211-370	241-420
Very High	280+	335+	370+	420+

Table 11. Potassium Levels (Groups 3 Crops)

<i>Level</i>	<i>CEC ≤ 7</i>	<i>CEC 7-14</i>	<i>CEC 14-25</i>	<i>CEC 25+</i>
Very Low	0-70	0-90	0-120	0-150
Low	71-150	91-190	121-240	151-260
Medium	151-200	191-240	241-290	261-320
High	201-350	241-420	291-510	321-560
Very High	350+	420+	510+	560+

Sources: Mississippi State University Extension Service Soil Tests Recommendations Manual

Table 12. Sulfur Levels

<i>Level</i>	<i>Range</i>
Very Low	0-60
Low	61-140
Medium	141-200
High	201-400
Very High	400+

Table 13. Phosphorus Levels

<i>Level</i>	<i>Range</i>
Very Low	0-18
Low	19-36
Medium	37-72
High	73-144
Very High	144+

Sources: Mississippi State University Extension Service Soil Tests Recommendations Manual

APPENDIX V: CROPS INFORMATION

Cover Crop	lbs of nitrogen/acre	
	Potential	Expected
Crimson Clover	100	30-50
Hairy Vetch	150	50-70
Winter Peas	80	20-40
Arrowleaf Clover	100	30-50
Austrian Winter Pea	195	70-90
Ball Clover	90	30-50
Berseem Clover	105	30-50
Red Clover	110	50-70
Sub Clover	105	50-70
Soybeans	30	15-30
White Clover	130	50-70

Source: Mississippi State University Extension- CES Publication 1552; University of Florida Extension- Nitrogen Fixation and Inoculation of Forage Legume

Note: Potential nitrogen production will only be obtained when clover is in full bloom. Most cover crops are killed prior to full bloom resulting in much less nitrogen production. The values shown in the expected column should be used when clovers are killed prior to full bloom. Maximum amount of available nitrogen to a following crop that is provided by legumes at full bloom and small grain or ryegrass in the boot stage. These values should be reduced according to account for less than optimum growth or if grazed, they should be reduced by one-half.

Table 15. Crop Realistic Yield Potential and Nitrogen Recommendations

<i>Crop</i>	<i>Realistic Yields/Acre/Unit</i>	<i>Nitrogen Required</i>
Corn (Grain)	100-250 bu	1.3 lbs/acre
Corn (Silage)	12-18 tons	10 lbs/ton
Grain Sorghum	45-80 cwt ^A	2.3 lbs/cwt
Soybeans	25-55 bu	none ^B
Cotton (Uplands)	1-1½ bales	CEC ≤ 7 ^C 50-60 lbs/acre
		CEC 7-14 60-70 lbs/acre
Cotton (Delta)	2-3 bales	CEC 14-25 70-80 lbs/acre
Wheat (grain)	40-80 bu	2 lbs/bu
Rice	100-200 bu	150-180 lbs/bu
Peanuts	2,051 lbs	20 lbs/acre and a good Rhizobiu inoculant ^D
Ryegrass monocrop	4-5 ton	55 lbs/ton
Ryegrass over seeded	3-4 tons	60 lbs/ton
Sorghum/Sudan /Millets (warm season annuals)	4-8 tons	40 lbs/ton
Hybrid Bermuda	5-6 tons	46 lbs/ton
Bahiagrass/Bermuda	3-5 tons	40 lbs/ton
Tall Fescue	2-4 tons	40 lbs/ton
Dallisgrass	3-4 tons	50 lbs/ton
Oats/Wheat (forage)	2-4 tons	1 lb/ton
Eastern Gamagrass	6-8 tons	40 lbs/ton
Switchgrass	6-8 tons	40 lbs/ton

^A cwt: 100 weight

^B Soybeans can meet their own need for nitrogen but can require up to 3.7 lbs/bu of nitrogen.

^C Nitrogen recommendations for cotton are based on the soil Cation Exchange Capacity (CEC).

^D Peanuts can meet their own need for nitrogen if you apply the proper Rhizobiu inoculant, but a good starter fertilizer should be used.

Sources: Mississippi State University Extension Service Soil Tests Recommendations Manual; Mississippi State University Extension Service Agronomy Handbook

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Table 16. Nutrient Removal by Selected Crops

Crop	Unit Yield	Nutrient Removal		
		N	P ₂ O ₅	K ₂ O
lbs./acre/unit yield				
Alfalfa hay	1 ton	52	12	50
Bahiagrass hay	1 ton	25	7	42
Bermudagrass hay	1 ton	50	12	43
Clover hay	1 ton	40	10	40
Corn, grain	1 bu.	0.96	0.4	0.27
Corn, silage	1 ton (wet)	10	4	10
Cotton, lint & seed	1 bale	32	12	16
Oats, grain only	1 bu.	0.8	0.25	0.2
Oats, grain and straw	1 bu.	1.15	0.40	1.45
Pasture, bahia or bermuda	200 lbs. beef	6	5	1
Pasture, tall fescue	300 lbs. beef	9	7	1
Peanuts, nuts only	1 ton	70	11	16
Peanuts, nuts & vines	1 ton	120	15	93
Potatoes, sweet	1 bu.	0.13	0.06	0.32
Sorghum, grain	1 bu.	0.79	0.45	0.23
Sorghum, silage	1 ton (wet)	10.5	4.4	10
Soybean, grain	1 bu.	3.8	0.8	1.5
Ryegrass hay	1 ton	33	5.4	28
Tall Fescue hay	1 ton	40	9	48
Tomatoes, fruit	100 cwt.	4.2	0.8	8.6
Wheat, grain	1 bu.	1.17	0.6	0.33
Wheat, grain & straw	1 bu.	1.67	0.67	2.03

APPENDIX VI: REGULATORY INFORMATION

Table 17. Land Application Pollutant Limits for Heavy Metals on Agricultural Land ^{1/}

Metal	Ceiling Concentration	Cumulative Pollutant	Annual
	Pollutant Limits	Loading Rate Limits	Loading
Metal Rate Limit	(mg/kg) ^{2/}	(kg/ha) ^{3/}	(kg/ha/yr.) ^{4/}
Arsenic	75	41	2
Cadmium	85	39	1.9
Copper	4300	1500	75
Lead	840	300	15
Mercury	57	17	0.85
Selenium	100	100	5
Zinc	7500	2800	140

^{1/} From 40 CFR Part 503.

^{2/} Dry weight basis; all sewage sludge samples (instantaneous values) must be below the ceiling concentration to be eligible for land application; applies to all sewage sludge that is land applied.

^{3/} Bulk sewage sludge.

^{4/} Applies only to sewage sludge sold or given away in a bag or other container (of 2,200 pounds or less) for application to the land.

Note: To convert to lbs./ac. multiply by 0.892.

MANURE APPLICATION SETBACK DISTANCES

Table 18. Setback Requirements: NRCS Standard

Feature	Setback Criteria	Setback (Feet)
Intermittent streams	All applications	50
Intermittent streams (<i>Winter Months Only</i>)	All applications	100
Perennial streams	All applications	150
Well	All applications	150

Source: Nutrient Management Standard 590

(http://efotg.nrcs.usda.gov/references/public/MS/Nutrient_Management.pdf)

On edges of the application field where runoff occurs to environmentally sensitive areas and to non-vegetated concentrated flow areas within the field, application distance must include a vegetated filter at least 50 feet wide that is established to permanent grasses (filter strip) with a stem density of at least 1 per square inch. If the filter incorporates a riparian forest buffer, in accordance with NRCS Conservation Practice Standard, Riparian Forest Buffer - Code 391A, the permanent grass filter strip may be 20 feet wide. The vegetated width must be located adjacent to the application field or concentrated flow area and be shaped so that flow from runoff is uniform (sheet flow) and does not concentrate. If good grazing management (i.e. rotational grazing) is not used on pasture land, the vegetative filter must be protected from over grazing with a fence.

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Table 19. Additional Setback Requirements: Poultry

Feature	Setback Criteria	Setback (Feet)
Property line	All applications	25
Un-owned (by applicant) occupied dwelling	All applications	150
Surface water	Applied upgradient, no permanent or insufficient vegetated setback	100
Open tile line intake structure	Applied upgradient, no permanent or insufficient vegetated setback	100
Sinkhole	Applied upgradient, no permanent or insufficient vegetated setback	100
Agricultural well head	Applied upgradient, no permanent or insufficient vegetated setback	100
Other conduits to surface waters of the state	Applied upgradient, no permanent or insufficient vegetated setback	100

Table 20. Additional Setback Requirements: Swine

Feature	Setback Criteria	Setback (Feet)
Property line	All applications	50
Un-owned (by applicant) occupied dwelling	All applications	300
Surface water	Applied upgradient, no permanent or insufficient vegetated setback	100
Open tile line intake structure	Applied upgradient, no permanent or insufficient vegetated setback	100
Sinkhole	Applied upgradient, no permanent or insufficient vegetated setback	100
Agricultural well head	Applied upgradient, no permanent or insufficient vegetated setback	100
Other conduits to surface waters of the state	Applied upgradient, no permanent or insufficient vegetated setback	100

Source: MS Swine General NPDES Permit (<http://www.deq.state.ms.us/>)

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