Manure Nutrients – Short Plan
Cut Your Costs & Protect Your Water

Cut Your Costs:

- 80% of farmers found they can **cut fertilizer costs** when using this type of manure plan.
- Manure can **save roughly $10 to $40 per acre*** in first-year N fertilizer when using this plan.
- The carry-over N can **save another $10 to $20 per acre*** in N fertilizer during the second cropping season after spreading manure.
- When soil tests show that more phosphorus is needed, added manure can often **save $5 to $20 per acre** in phosphorus fertilizer costs.
- This plan may help you **qualify for conservation program payments**, when combined with soil testing and accurate record-keeping practices.
- You can **double N fertilizer savings** by immediately incorporating manure.

* Calculations based on 20 tons/acre solid manure.

Protect Your Water:

- Follow this plan to **protect your well water and nearby surface waters**.
- Follow this plan to **meet state water quality rules** for N management and setbacks (if less than 300 animal units). Additional information is needed if you require a feedlot permit, or if you are over 300 animal units and do not use a commercial applicator.

Contents Include:

For more information go to www.pca.state.mn.us/publications/wq-f8-07.doc

1. Calibration:
Know your manure application rate

1st rate **-** My rate is _____ (tons or 1,000 gallons) at normal tractor speed.

2nd rate **-** My rate is _____ (tons or 1,000 gallons) at slow tractor speed.

Solid Manure:

Step 1: Weigh the spreader both empty and full. Subtract empty weight from full weight to determine tons of manure per load.

Step 2: See how many acres are covered by one load – multiply the distance traveled by the width of the spread.

Example: 800 feet traveled X 20 foot width = 16,000 square feet per load
16,000 square feet ÷ 43,560 square feet per acre = 0.37 acres per load
6 tons per load ÷ 0.37 acres per load = 16 tons/acre

****Alternative to step 2:*** See how many loads it takes to cover a field when going at a known tractor speed

Example: 30 loads X 6 tons/load = 180 tons applied
180 tons ÷ 11 acres = 16 tons/acre

Liquid Manure:

Step 1: Determine 1000's of gallons hauled per load by multiplying tank volume by 90%.

Step 2: Determine acres covered per load using the same procedures as in step 2 for solid manure.

WEIGHING YOUR SPREADER:

- Takes less than 20 minutes
- Contact your SWCD or NRCS office to find out how to get load cell scales and assistance.

Calibrating Manure Spreaders Using Scales

1. Determine Manure Weight (per load):

	Full weight	-	Empty weight	= Manure weight
Right front	_____		_____	
Left front	+_____		+_____	
Right rear	+_____		+_____	
Left rear	+_____		+_____	
Tongue*	+_____		+_____	
Total	=	-	=	= _____ lbs

(*Jack up tongue so weight is not on tractor)

Manure weight divided by 2,000 lbs/ton ÷ _____
or 8,400 lbs/1,000 gallons

Tons or 1000's gallons of manure per load = _____

2. Determine area covered:

Distance traveled by spreader _____ ft

Width of uniform spread pattern x _____ ft

Total area covered = _____ sq ft

Divide by square feet per acre ÷ 43,560 sq ft/acre

Acres covered per load = _____ acres

3. Determine application rate:

Tons or 1000's gallons of manure per load _____

Acres covered per load ÷ _____ acres

Tons or gallons/acre = _____

Example:

12,000 lbs

÷ 2,000 lbs/ton

= 6 tons/load

800 ft

x 20 ft

= 16,000 sq ft

÷ 43,560 sq ft/acre

= 0.37 acres/load

6 tons/load

÷ 0.37 acres/load

= 16 tons/acre

Description of spreader:

_____

_____

_____

Spreader setting:

_____

_____

_____

Tractor Make and Model:

_____

_____

_____

Tractor speed or gear setting:

_____

_____

_____

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2. Manure Analysis and Nutrient Availability

For more information about manure testing, go to http://www.extension.umn.edu/distribution/cropsystems/DC6423.html

Manure source _____
Date of analysis _____
Manure analysis
____ lbs Nitrogen
____ lbs P_2O_5
____ lbs K_2O

My application rate: _____

My application method is (circle):
Surface Applied Knife Injected Sweep Injected

How soon after application is manure incorporated?
Within 12 hours 12 hr to 4 days More than 4 days

Nutrients available for crop:

		N		P_2O_5	K_2O
A	Lab analysis	_____lbs		_____lbs	_____lbs
B	Rate of application (tons or 1000's gals per acre)	X _____		X _____	X _____
C	Total applied (A X B)	= _____ lbs N		= _____ lbs P_2O_5	= _____ lbs K_2O
D	Availability	*1st Year N X _____ % (table 1)	**2nd Year N X 25% (15% if swine)	X 80 %	X 90 %
	Total nutrients available to crop (C X D)	= _____ lbs 1st yr N*	= _____ lbs 2nd yr N**	= _____ lbs P_2O_5 (compare to tables 4 & 5)	= _____ lbs K_2O (compare to table 6)

*1st crop following manure additions **2nd crop following manure additions

3. Crop Nitrogen Needs

Complete each row that fits your crop/manure scenarios

		Crop N Needs					N Additions		
√ if applies:	**Crop Scenario**	**A.** N needs before credits (see table 2)	**B.** Legume credit (see table 3)	**C** **Crop N needs after legume credits (A – B)**	**D.** 2nd year manure N (see ** on previous page)	**E.** **Crop N needs after legume & 2nd yr manure credits (C – D)**	**F.** 1st year manure N (see * on previous page)	**G.** Starter nitrogen fertilizer	**H.** **Additional N fertilizer needs (E – F – G)**
	1st year corn after hay/alfalfa	_____ #	_____ #	_____ #	0 #	_____ #	_____#	_____#	_____ #
	2nd year corn after alfalfa (no manure before 1st yr corn)	_____ #	_____ #	_____ #	0 #	_____ #	_____#	_____#	_____ #
	2nd year corn after alfalfa (manure applied before 1st yr corn)	_____ #	_____ #	_____ #	_____ #	_____ #	_____#	_____#	_____ #
	Corn following corn - (no manure on previous year – no alfalfa 2 yrs ago)	_____ #	0 #	_____ #	0 #	_____ #	_____#	_____#	_____ #
	Corn following corn (manure on previous year corn – no alfalfa 2 yrs ago)	_____ #	0 #	_____ #	_____ #	_____ #	_____#	_____#	_____ #
	Corn following soybeans (manure or no manure on previous year)	_____ #	40 #	_____ #	0 #	_____ #	_____#	_____#	_____ #
	Other _____								
	Other _____								
	Example: 2nd yr corn after alfalfa (manure applied before 1st yr corn)	**180**	**75**	**105 lb**	**40 lb**	**65 lb**	**50 lb**	**15 lb**	**0#**

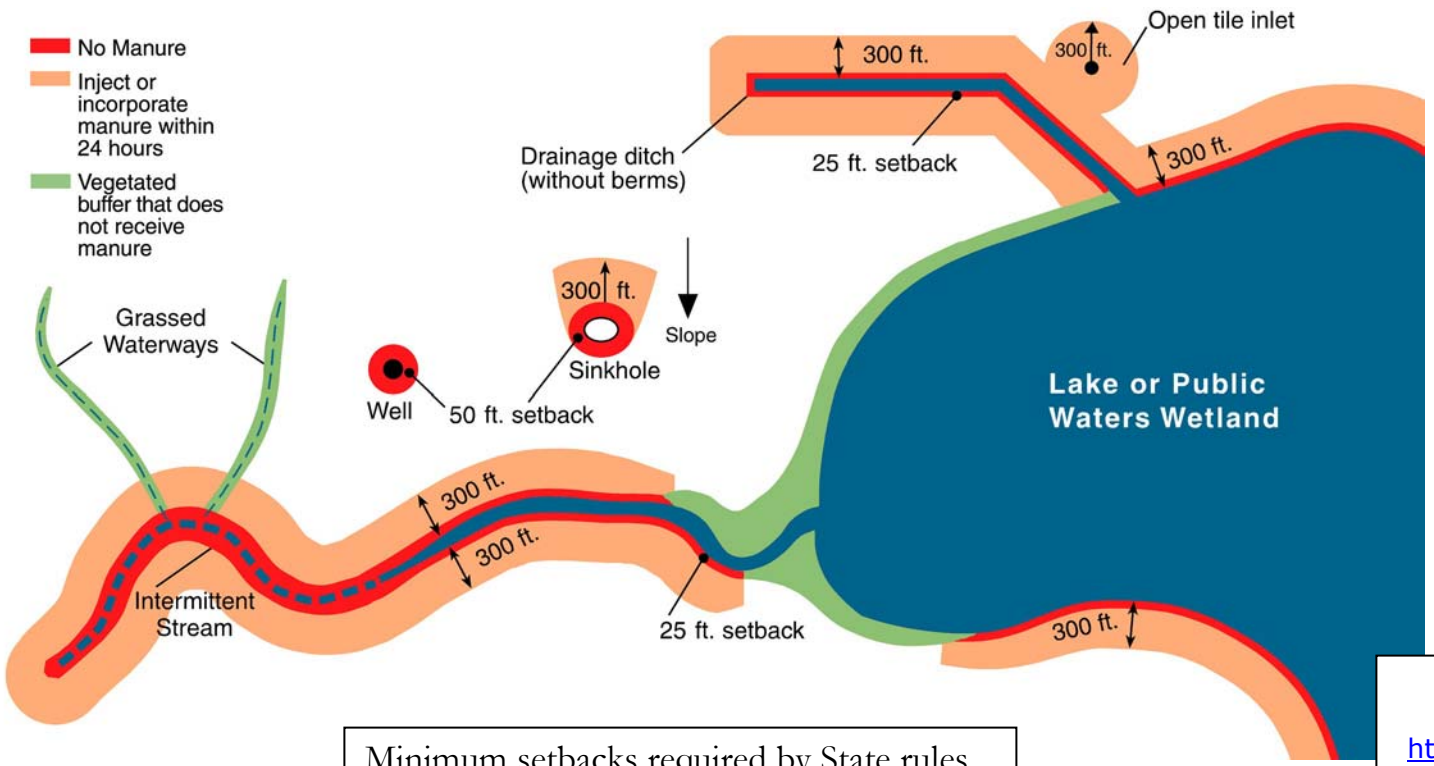
4. Environmental Setbacks

Lakes, streams, intermittent streams, wetlands (10+ acres), & drainage ditches without berms

- No manure can be applied within 25 feet of the above listed waters.
- Within 300 feet from above listed waters, all manure must be incorporated before 24 hours and before rain.
- No manure can be applied within 300 feet when the ground is frozen or snow-covered.

Open tile intakes

- Within 300 feet, all manure must be incorporated before 24 hours and before rain.



Wells, quarries, & sinkholes

- No manure within 50 feet.
- Near sinkholes, keep surface-applied manure 300 feet away if not immediately incorporated (upslope areas).

Minimum setbacks required by State rules. Local ordinances may be more restrictive.

For more information on setbacks, see http://www.pca.state.mn.us/publications/feedlots-manureapplication.pdf

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5. Tables

Table 1. 1st year N availability from manure (%)

	Incorp. After 4 days	Incorp. ½ to 4 days	Incorp. Within ½ day	Sweep inject	Knife inject
Beef	25	45	60	60	50
Dairy	20	40	55	55	50
Swine	35	55	75	80	70
Poultry	45	55	70	NA	NA

Table 2. Crop N needs w/manure – before legume credit

	Medium or Low productivity soils	High Productivity soils
Corn	100-140	130-180
Alfalfa	0	0
Soybeans	0	0
Wheat	80-105	130-170
Grass-legume	60	60

Table 3. Legume N credits for corn (lbs)

	Good quality	Average quality
1st year after alfalfa	150	100
2nd year after alfalfa	75	50
Soybeans	40	40
1st year grass/legume hay	75	75
2nd year grass/legume hay	0	0
1st year after red clover	75	75
2nd year after red clover	35	35

Table 4. Phosphorus removal by crops

Crop	P_2O_5 removal	Crop	P_2O_5 removal
Alfalfa	10.8 lbs/ton	Oats	0.25 lbs/bu
Alsike clover	10.5 lbs/ton	Peas	0.01 lbs/lb
Barley grain	0.41 lbs/bu	Potatoes	0.14 lbs/cwt
Canola	1.3 lbs/cwt	Red clover	10.8 lbs/ton
Corn	0.34 lbs/bu	Rye	0.44 lbs/bu
Corn silage	3.8 lbs/ton	Soybeans	0.82 lbs/bu
Edible beans	0.01 lbs/lb	Sugar beats	2.2 lbs/tons
Grass hay or pasture	8.9 lbs/ton	Sweet corn	11 lbs/ton
Grass/legume	11.2 lbs/ton	Wheat	0.53 lbs/bu

Table 5. Crop P_2O_5 needs (lbs)

	6-10 Bray 4-7 Olsen	11-15 Bray 8-11 Olsen	16-20 Bray 12-15 Olsen	21+ Bray 16+ Olsen
Corn (175-200 bu) Broadcast	75	45	15	0
Corn (175-200 bu) Row	40	30	10-15	10-15
Alfalfa (6 ton)	65	40	15	0
Soybeans (50-60 bu)	60	35	15	0
Wheat (70-79 bu) Broadcast	50	25	0	0
Grass-legume (4 ton)	50	30	10	0

Table 6. Crop K_2O needs – based on soil test

	Soil test K in ppm		
	41-80	81-120	121-160
Corn (175-200 bu)	135	80	35
Alfalfa (6 ton)	195	105	15
Soybeans (50-60 bu)	60	30	0
Wheat (70-79 bu)	125	75	0
Grass-legume	135	80	25

Table 7. Mid-range rough estimates of typical manure nutrient content. Use actual manure nutrient analyses whenever possible.

Livestock Type		Liquid				Solid		
		N	P_2O_5	K_2O		N	P_2O_5	K_2O
		------ lb./1000 gal. ------				--------- lb./ton ---------		
Swine								
	Farrowing	15	12	11		14	6	4
	Nursery	25	19	22		13	8	4
	Gestation	25	25	24		9	7	5
	Finishing	58	44	40		16	9	5
Dairy								
	Cows	31	15	19		10	3	6
	Heifers	32	14	28		10	3	7
Beef	Cows	20	16	24		7	4	7
	Finishing Cattle	29	18	26		11	7	11
Poultry								
	Broilers	63	40	29		46	53	36
	Layers	57	52	33		34	51	26
	Tom Turkeys	53	40	29		40	50	30
	Hen Turkeys	60	38	32		40	50	30

For more information:

Go to http://www.pca.state.mn.us/hot/feedlot-management.html

Sources: Table 1. Manure Management in Minnesota, 2006; Table 2. Manure Management in Minnesota (draft), 2007; Table 3. Fertilizer recommendations for agronomic crops in Minnesota, 2001; Table 4. http://npk.nrcs.usda.gov; Table 5. Fertilizer recommendations for agronomic crops in Minnesota, 2001; Table 6. Fertilizer recommendations for agronomic crops in Minnesota, 2001; Table 7. Manure Characteristics, MWPS-18 Section 1, Midwest Plan Service, 2004