

SOLIDS WORKSHEET 2 - NUTRIENT BALANCE

Modified January 14, 2014

Tract	Field No.	Acres			
			Soil Test P Value (Mehlich 3) 		
Step 1 . Crop or Crop Sequence/Rotation					
See Table 2.1 Options					
Step 2 . Realistic Yield (Average from 5-10 Years on a per acre basis)					
			N	P ₂ O ₅	K ₂ O
Step 3 . Plant Nutrients Needed or Allowed (lbs/ac)					
N	<u> </u> Table 2.1 Value for N	× <u> </u> Step 2	=	<u> </u>	
P	<u> </u> Table 2.1 Value for P	× <u> </u> Step 2	=	<u> </u>	
K	<u> </u> Table 2.1 Value for K	× <u> </u> Step 2	=	<u> </u>	
				P ₂ O ₅	
Step 4 . Adjusted P₂O₅ Application Rate According to Threshold					
P	<u> </u> Step 3 P ₂ O ₅	× <u> </u> Table 2.2 Value	=	<u> </u>	
			N	P ₂ O ₅	K ₂ O
Step 5 . Fertilizer Credits (lbs/ac)					
			N	P ₂ O ₅	K ₂ O
Step 6 . Plant Nutrients Needed Minus Credits (lbs/ac)					
N	<u> </u> Step 3 for N	- <u> </u> Step 5 for N	=	<u> </u>	
If Step 4 > 0:					
P	<u> </u> Step 4 for P	- <u> </u> Step 5 for P	=	<u> </u>	
If Step 4 = 0:					
	<u> </u> Step 3 for P	- <u> </u> Step 5 for P	=	<u> </u>	
K	<u> </u> Step 3 for K	- <u> </u> Step 5 for K	=	<u> </u>	
			N	P ₂ O ₅	K ₂ O
Step 7 . Nutrients in Manure (lbs/ton)					
Step 4 Values from Solids Worksheet 1 or use Lab Results					
			N	P ₂ O ₅	K ₂ O
Step 8 . Percent Nutrients Retained in System					
Enter Table 2.3 values or Enter zero if lab analysis is used					
			N	P ₂ O ₅	K ₂ O
Step 9 . Net Retained Nutrients in Manure (lbs/ton)					
Enter zero if lab analysis is used					
N	<u> </u> Step 7 for N	× <u> </u> Step 8 for N	=	<u> </u>	
P	<u> </u> Step 7 for P	× <u> </u> Step 8 for P	=	<u> </u>	
K	<u> </u> Step 7 for K	× <u> </u> Step 8 for K	=	<u> </u>	
			N	P ₂ O ₅	K ₂ O
Step 10 . Percent of Available Nutrients					
Enter Table 2.4 Value for N				80%	100%

	N	P ₂ O ₅	K ₂ O
Step 11 . Net Available Nutrients (lbs/ton)			
If Lab Results are used in Step 7:			
N	$\frac{\text{Step 7 for N}}{\text{Step 7 for N}} \times \frac{\text{Step 10 for N}}{\text{Step 10 for N}} =$		
P	$\frac{\text{Step 7 for P}}{\text{Step 7 for P}} \times \frac{\text{Step 10 for P}}{\text{Step 10 for P}} =$		
K	$\frac{\text{Step 7 for K}}{\text{Step 7 for K}} \times \frac{\text{Step 10 for K}}{\text{Step 10 for K}} =$		
If Solid Worksheet 1 Values are used in Step 8:			
N	$\frac{\text{Step 9 for N}}{\text{Step 9 for N}} \times \frac{\text{Step 10 for N}}{\text{Step 10 for N}} =$		
P	$\frac{\text{Step 9 for P}}{\text{Step 9 for P}} \times \frac{\text{Step 10 for P}}{\text{Step 10 for P}} =$		
K	$\frac{\text{Step 9 for K}}{\text{Step 9 for K}} \times \frac{\text{Step 10 for K}}{\text{Step 10 for K}} =$		
	N	P ₂ O ₅	K ₂ O
Step 12 . Application Rate (tons/ac)			
N	$\frac{\text{Step 6 for N}}{\text{Step 6 for N}} \div \frac{\text{Step 11 for N}}{\text{Step 11 for N}} =$		
P	$\frac{\text{Step 6 for P}}{\text{Step 6 for P}} \div \frac{\text{Step 11 for P}}{\text{Step 11 for P}} =$		
K	$\frac{\text{Step 6 for K}}{\text{Step 6 for K}} \div \frac{\text{Step 11 for K}}{\text{Step 11 for K}} =$		
	N	P ₂ O ₅	K ₂ O
Step 13 . Net Application Amount for All Nutrients (lbs/ac)			
N	$\frac{\text{Step 11 for N}}{\text{Step 11 for N}} \times \frac{\text{Application Rate}}{\text{Application Rate}} =$		
P	$\frac{\text{Step 11 for P}}{\text{Step 11 for P}} \times \frac{\text{Application Rate}}{\text{Application Rate}} =$		
K	$\frac{\text{Step 11 for K}}{\text{Step 11 for K}} \times \frac{\text{Application Rate}}{\text{Application Rate}} =$		
	N	P ₂ O ₅	K ₂ O
Step 14 . Nutrient Needs (negative) or Surpluses (positive) (lbs/ac)			
N	$\frac{\text{Step 13 for N}}{\text{Step 13 for N}} - \frac{\text{Step 6 for N}}{\text{Step 6 for N}} =$		
P	$\frac{\text{Step 13 for P}}{\text{Step 13 for P}} - \frac{\text{Step 6 for P}}{\text{Step 6 for P}} =$		
K	$\frac{\text{Step 13 for K}}{\text{Step 13 for K}} - \frac{\text{Step 6 for K}}{\text{Step 6 for K}} =$		
Step 15 . Balance			
Tons Available		Tons Applied in Field	
Step 3 from Solids Worksheet 1 or Balance from Previous Worksheet 2	-	Application Rate x Field Acres or to deplete supply in one field: Tons Available ÷ Num. of Acres = Uniform App. Rate (Be sure not to exceed 10 tons/acre)	= Balance

Table 2.1 Crop Nutrient Removal Values in Pounds Per Unit Yield

Crop	Total N	P₂O₅	K₂O
Alfalfa Hay (Ton)	51	14	55
Barley Grain (Bushel)	0.99	0.41	0.32
Barley Straw (Ton)*	13	5.1	39
Bermudagrass - Hay (Ton)	37.6	8.7	33.6
Big Bluestem, Indiangrass, Little Bluestem, - Hay (Ton)	22	12	58
Bluegrass (Ton)*	30	12	46
Bromegrass (Ton)*	32	10	46
Corn Grain (Bushel)	0.9	0.4	0.35
Corn Silage (Ton)	9.7	3.6	8
Corn Stover (Ton)*	16	5.8	40
Eastern Gamagrass - Hay (Ton)	35	16.1	31.2
Fescue (Ton)*	37	12	54
Flax Grain (Bushel)*	2.5	0.7	0.6
Flax Straw (Bushel)*	0.7	0.16	2.2
Forage for Pastureland	10.5	3.6	15.9
Millet (Bushel)*	1.4	0.4	0.4
Oat Grain (Bushel)*	0.77	0.28	0.19
Oat Silage (Ton)*	9	11	45
Oat Straw (Ton)*	12	6.3	37
Orchardgrass (Ton)*	36	13	54
Other Cool Season Grass/Legume Hay (Ton)	35	12	53
Red Clover (Ton)*	45	12	42
Rye Grain (Bushel)*	1.4	0.46	0.31
Rye Straw (Ton)*	12	3	22
Ryegrass (Ton)*	43	12	43
Sorghum Grain (Bushel)	0.95	0.41	0.3
Sorghum Stover (Ton)*	28	8.3	42
Sorghum-Sudan (Ton)*	30	9.5	34
Soybean Grain (Bushel)*	3.8	0.84	1.3
Soybean Hay (Ton)*	45	11	25
Switchgrass (Ton)*	22	12	58
Timothy (Ton)*	25	11	42
Tobacco (Pound)	0.07	0.01	0.08
Vetch (Ton)*	57	15	49
Wheat Grain (Bushel)*	1.5	0.6	0.34
Wheat Silage (Ton)	44	4	20
Wheat Straw (Ton)*	14	3.3	24

* Value from Murrell, 2008.

Table 2.2 Phosphorus Threshold

STP	Application Rate Adjustment	Interpretation
< 400	0	Manure applications can be made based on crop nitrogen requirements
401-600	1	Phosphorus applications at rates not to exceed the estimated removal of phosphorus in the harvested plant biomass
601-800	0.5	Phosphorus applications at rates not to exceed 1/2 of the estimated removal of phosphorus in the harvested plant biomass
>800	-	Phosphorus applications are no longer allowed

Table 2.3 Percent of Original Nutrient Content of Manure Retained By Various Management Systems*

Management System	Beef			Dairy			Poultry			Swine		
	N	P	K	N	P	K	N	P	K	N	P	K
Open lot -cool humid region	70	80	70	85	95	95	-	-	-	70	80	70
Liquids & solids in a covered essentially watertight structure	85	95	95	85	95	95	-	-	-	85	95	95
Liquids & solids in a uncovered essentially watertight structure	75	90	90	75	90	90	-	-	-	75	90	90
Liquids & solids (diluted less than 50%) –waste storage pond	80	95	95	80	95	95	-	-	-	80	95	95
Manure with bedding in roofed storage	80	95	95	80	95	95	70	95	95	-	-	-
Manure with bedding in unroofed storage leachate lost	75	85	85	75	85	85	-	-	-	-	-	-
Manure stored in pits beneath slatted floor	85	95	95	85	95	95	90	95	85	85	95	95
Anaerobic lagoon or stored in waste storage pond diluted >50%	35	50	65	35	50	65	30	50	60	30	50	60

* Adapted from 1992 NRCS Agricultural Waste Management Field Handbook

Table 2.4 Percent of Nutrients from Manure Available to a Crop During the Year of Application in Comparison with Fertilizer Nutrients*

Nutrient and Application Type		Availability Coefficient	
		Poultry or Liquid	Other Manures
Nitrogen (N) Corn, Tobacco, Annual Grasses or Sorghum	<i>Spring Applied</i>		
	Incorporation: same day	75	60
	Incorporation: 2 days or less	65	50
	Incorporation: 3-4 days	55	45
	Incorporation: 5-6 days	50	40
	Incorporation: 7 days or more	45	35
	<i>Fall Applied</i>		
	Without cover crop	15	20
	With cover crop	50	40
	Pasture (Fall or early Spring)	80	60
Phosphate (P₂O₅)		80	80
Potash (K₂O)		100	100

*Note: Information from Table 2.3 or from a laboratory analysis will be used as a basis for Table 2.4. Table 2.4 Source: AGR-146 "Using Animal Manures as Nutrient Sources" 8/2000 University of Kentucky.