LIQUIDS WORKSHEET 2 - NUTRIENT BALANCE

Modified January 14, 2014

Tract	Field No.	Acres

Soil Test P Value (Mehlich 3) _____

	N	P_2O_5	K_2O
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)			
Step 3. Plant Nutrients Needed or Allowed (lbs/ac)			

N _____ (Table 2.1 Value for N) × _____ (Step 2) = _____

P _____ (Table 2.1 Value for P) × _____ (Step 2) = _____

K _____ (Table 2.1 Value for K) × _____ (Step 2) = _____

		P_2O_5	
Step 4. Adjusted P_2O_5 Application Rate According to Threshold			

P _____ (Step 3 P_2O_5) × _____ (Table 2.2 Value) = _____

	N	P_2O_5	K_2O
Step 5. Fertilizer Credits (lbs/ac)			
	N	**P_2O_5**	**K_2O**
Step 6. Plant Nutrients Needed Minus Credits (lbs/ac)			

N _____ (Step 3 for N) − _____ (Step 5 for N) = _____

If Step 4 > 0:

P _____ (Step 4 for P) − _____ (Step 5 for P) = _____

If Step 4 = 0:

_____ (Step 3 for P) − _____ (Step 5 for P) = _____

K _____ (Step 3 for K) − _____ (Step 5 for K) = _____

	N	P_2O_5	K_2O
Step 7. Nutrients in Manure (lbs./1,000 gallons)			
Step 4 Values from Liquids Worksheet 1 **or** use Lab Results			
	N	**P_2O_5**	**K_2O**
Step 8. Percent Nutrients Retained in System			
Enter Table 2.3 values **or** Enter zero if lab analysis is used			
	N	**P_2O_5**	**K_2O**
Step 9. Net Retained Nutrients in Manure (lbs./1,000 gallons)			
Enter zero if lab analysis is used			

N _____ (Step 7 for N) × _____ (Step 8 for N) = _____

P _____ (Step 7 for P) × _____ (Step 8 for P) = _____

K _____ (Step 7 for K) × _____ (Step 8 for K) = _____

	N	P_2O_5	K_2O
Step 10. Percent of Available Nutrients		80%	100%
Enter Table 2.4 Value for N			

	N	P_2O_5	K_2O

Step 11 . Net Available Nutrients (lbs./1,000 gallons)

If Lab Results are used in Step 7:

N _____ (Step 7 for N) × _____ (Step 10 for N) = _____

P _____ (Step 7 for P) × _____ (Step 10 for P) = _____

K _____ (Step 7 for K) × _____ (Step 10 for K) = _____

If Liquid Worksheet 1 Values are used in Step 8:

N _____ (Step 9 for N) × _____ (Step 10 for N) = _____

P _____ (Step 9 for P) × _____ (Step 10 for P) = _____

K _____ (Step 9 for K) × _____ (Step 10 for K) = _____

	N	P_2O_5	K_2O

Step 12 . Application Rate (1,000 gallons/ac)

N _____ (Step 6 for N) ÷ _____ (Step 11 for N) = _____

P _____ (Step 6 for P) ÷ _____ (Step 11 for P) = _____

K _____ (Step 6 for K) ÷ _____ (Step 11 for K) = _____

	N	P_2O_5	K_2O

Step 13 . Net Application Amount for All Nutrients (1,000 gallons/ac)

N _____ (Step 11 for N) × _____ (Application Rate) = _____

P _____ (Step 11 for P) × _____ (Application Rate) = _____

K _____ (Step 11 for K) × _____ (Application Rate) = _____

	N	P_2O_5	K_2O

Step 14 . Nutrient Needs (negative) or Surpluses (positive) (1,000 gallons/ac)

N _____ (Step 13 for N) – _____ (Step 6 for N) = _____

P _____ (Step 13 for P) – _____ (Step 6 for P) = _____

K _____ (Step 13 for K) – _____ (Step 6 for K) = _____

Step 15 . Balance

Tons Available _____ (Step 6 from Liquids Worksheet 1 or Balance from Previous Worksheet 2) **-** **Tons Applied in Field** _____ (Application Rate x Field Acres x 1,000 **or** to deplete supply in one field: Gallons Available ÷ Num. of Acres = Uniform App. Rate (Be sure not to exceed 13,000 gallons/acre)) **= Balance** _____

Table 2.1 Crop Nutrient Removal Values in Pounds Per Unit Yield

Crop	Total N	P_2O_5	K_2O
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*

	Beef			Dairy			Poultry			Swine		
Management System	**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)	***Spring Applied***		
Corn, Tobacco, Annual Grasses or Sorghum	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
	Fall Applied		
	Without cover crop	15	20
	With cover crop	50	40
	Small Grains (pre-plant)	50	40
	Pasture (Fall or early Spring)	80	60
Phosphate (P_2O_5)		80	80
Potash (K_2O)		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.