### CALCULATING MANURE APPLICATION RATES

### Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ School: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_ / 30

### *Scenario: You have a field you want to plant into feed barley. Your yield goal is 80 bu/acre. Last year the field was in field peas. The organic matter in the soil is 3-4% which would be considered medium. A soil test was done on the field and showed you had 12 ppm in the top foot of soil.*

### STEP 1: D****etermine the N recommendations for the crop to be grown from Table 1.****

### **Nitrogen Recommendation: \_\_\_\_\_\_\_\_\_\_\_\_\_ (3 pts)**

### ****STEP 2: Subtract the 12 ppm of soil test N from the Nitrogen Recommendation (Step 1).****

### **Nitrogen Recommendation minus soil N: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3pts)**

**STEP 3: Determine the N remaining from last year’s manure application and subtract it from the N recommendation (step 2.)**

Manure takes time to decompose. Micro-organisms must convert it into a useable form. Of the manure that was applied last year part of it was broken down and used by last year’s pea crop and part of it has yet to become available and released for this year’s barley crop. To determine the amount of N that will come available this year, you must know the previous year’s manure application rate and nutrient content along with the what percentage would be available in the second-year.

Last year 6 tons/ac of steer manure was applied to this field. Use table 3 to determine the total

Nitrogen applied in last year’s manure? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3 pts)

Now use the percentages below to determine how much of last year’s manure will be available this year.

**The following percentages are for second-year nitrogen availability for the various types of manure:**

Swine = 15%;

Dairy = 25%;

Beef = 25%; and

Poultry = 25%.

N Percentage available this year from last year’s manure application: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3pts)

Finally use the adjusted nitrogen recommendation for this year’s barley crop (Minus the soil test N step 2) and subtract the Nitrogen credit from last year’s manure application.

### Adjusted Nitrogen Recommendation minus the available N from last year’s manure application: \_\_\_\_\_\_\_\_\_\_ (3pts)

**STEP 4:** **Determine the available N of the manure.**

The manure applied this year will be steer manure broadcast on using a manure spreader and then disked in (incorporated) within 4 days of the application. Nitrogen availability is calculated by multiplying the nitrogen content of the manure (Table 3) by the percent availability (table 5)

Nitrogen content of steer manure: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3pts)

X % Available during the first year: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (3pts)

= Available Nitrogen in the manure: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / Ton (3pts)

### STEP 5: ****Calculate the manure application rate.****

### Now to determine the manure application rate divide the adjusted nitrogen recommendation for the crop (Bottom of step 3) by the amount of nitrogen available from the applied manure (step 4).

**Manure Application Rate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tons/acre (6 pts)**

**Table 1: Nitrogen fertilizer recommendations as a function of previous crop, anticipated yield goals, and organic matter level.**

**Next Year’s Crop**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Field planted to | | Alfalfa-good | | Alfalfa-fair,  fallow legume, grass, hay | | Alfalfa-poor, small grains, soybeans | | Edible beans, field peas | | Group 1  Alsike clover, birdsfoot trefoil, grass/legume hay, grass/legume pasture, fallow, red clover  **Previous Year’s Crop** | | Group 2  barley, buckwheat, canola, corn, grass hay, grass pasture, oats, potatoes, rye, sorghum-sudan, sugarbeets, sunflowers, sweet corn, vegetables, wheat | | P2O5  removal |
| OM Level | | OM Level | | OM Level | | OM Level | | OM Level | | OM Level | |
| Yield Goal | | Low | Med/High | Low | Med/High | Low | Med/High | Low | Med/High | Low | Med/High | Low | Med/High |
| bu/acre | | Pounds/acre | | | | | | | | | | | | lbs/acre |
| Corn | < 100 | 0 | 0 | 0 | 0 | 60 | 30 | 70 | 50 | 25 | 0 | 100 | 70 | *34* |
| 100-124 | 0 | 0 | 30 | 0 | 90 | 60 | 100 | 80 | 55 | 25 | 130 | 100 | *34* |
| 125-149 | 0 | 0 | 60 | 30 | 120 | 90 | 130 | 110 | 85 | 55 | 160 | 130 | *42.5* |
| 150-174 | 30 | 0 | 90 | 60 | 150 | 120 | 160 | 140 | 115 | 85 | 190 | 160 | *51* |
| 175-199 | 50 | 30 | 110 | 80 | 170 | 140 | 180 | 160 | 135 | 105 | 210 | 180 | *60* |
| 200+ | 70 | 50 | 130 | 100 | 190 | 160 | 200 | 180 | 155 | 125 | 230 | 200 | *68* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Wheat | 40-49 | 0 | 0 | 10 | 0 | 60 | 40 | 70 | 50 | 30 | 0 | 80 | 60 | *21* |
| 50-59 | 30 | 0 | 35 | 15 | 85 | 65 | 95 | 75 | 55 | 35 | 105 | 85 | *26* |
| 60-69 | 55 | 35 | 60 | 40 | 110 | 90 | 120 | 110 | 80 | 60 | 130 | 110 | *32* |
| 70-79 | 80 | 60 | 85 | 65 | 135 | 115 | 145 | 125 | 105 | 85 | 155 | 135 | *37* |
| 80+ | 95 | 75 | 100 | 80 | 150 | 130 | 160 | 140 | 120 | 100 | 170 | 150 | *42* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Barley | < 50 | 0 | 0 | 0 | 0 | 30 | 0 | 40 | 0 | 0 | 0 | 50 | 30 | *18* |
| 50-59 | 0 | 0 | 0 | 0 | 50 | 30 | 60 | 40 | 20 | 0 | 70 | 50 | *18* |
| 60-69 | 10 | 0 | 15 | 0 | 65 | 45 | 75 | 55 | 35 | 15 | 85 | 65 | 22 |
| 70-79 | 25 | 0 | 30 | 10 | 80 | 60 | 90 | 70 | 50 | 30 | 100 | 80 | *26* |
| 80-89 | 40 | 20 | 45 | 25 | 95 | 75 | 105 | 85 | 65 | 45 | 115 | 95 | *30* |
| 90-99 | 55 | 35 | 60 | 40 | 110 | 90 | 120 | 100 | 80 | 60 | 130 | 110 | *33* |
| 100+ | 70 | 50 | 75 | 55 | 125 | 105 | 135 | 115 | 95 | 75 | 145 | 125 | *37* |

**Table 3: Nutrient content of stored manure\***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  |  |  | | --- | --- | --- | | **N** | **P2O5** | **K2O** | | **pounds/1000 gallons** | | | | |  |  |  | | --- | --- | --- | | **N** | **P2O5** | **K2O** | | **pounds/ton** | | | |
| |  |  | | --- | --- | | **Swine\*\*** | Farrowing | |  | Nursery | |  | Gestation | |  | Finishing | | |  |  |  | | --- | --- | --- | | 27 | 27 | 15 | | 34 | 25 | 18 | | 40 | 42 | 18 | | 53 | 39 | 29 | | |  |  |  | | --- | --- | --- | | - | - | - | | - | - | - | | 22 | 27 | 14 | | 22 | 22 | 17 | |
| |  |  | | --- | --- | | **Dairy\*\*** | Cows | |  | Heifers | | |  |  |  | | --- | --- | --- | | 25 | 15 | 27 | | - | - | - | | |  |  |  | | --- | --- | --- | | 11 | 7 | 9 | | 13 | 12 | 19 | |
| |  |  | | --- | --- | | **Beef\*\*** | Cows | |  | Steers | | |  |  |  | | --- | --- | --- | | - | - | - | | - | - | - | | |  |  |  | | --- | --- | --- | | 15 | 10 | 9 | | 14 | 9 | 14 | |
| |  |  | | --- | --- | | **Poultry** | Turkeys\*\* | |  | Broiler\*\*\* | |  | Layer\*\*\* | | |  |  |  | | --- | --- | --- | | - | - | - | | - | - | - | | - | - | - | | |  |  |  | | --- | --- | --- | | 44 | 63 | 34 | | 59 | 63 | 40 | | 39 | 57 | 30 | |

\*Values do not include collection of runoff from storage facility.  
\*\*Source: [*Manure Management in Minnesota*, Minnesota Extension Publication, Schmitt, M.](http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-management-basics/manure-management-in-minnesota/)  
\*\*\*Source: Poultry Water Quality Handbook. Poultry Water Quality Consortium Chattanooga, TN.  
Source: MWPS Livestock Waste Facilities Handbook MWPS-18-3

**Table 5: Manure nitrogen first-year availability as affected by manure application method and manure type (Schmitt, 1999).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **No incorporation** | **Incorporated in less than 4 days** | **Incorporated in less than 12 hours** | **Sweep injected or Covering disk** | **Knife injected** |
|  | **Percent of nitrogen available to crop for first growing season** | | | | |
| **Dairy** | 20 | 40 | 55 | 55 | 50 |
| **Swine** | 35 | 55 | 75 | 80 | 70 |
| **Beef** | 25 | 45 | 60 | 60 | 50 |
| **Poultry** | 45 | 55 | 70 |  |  |

Source: [*Manure Management in Minnesota*](http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-management-basics/manure-management-in-minnesota/), Minnesota Extension Publication, Schmitt, M.