**Nutrient Management Certification Calculation Review and Practice Sheet**

Please attempt to complete these calculations prior to attending Session IV. We will review many of these examples during the session. You will get the most benefit of Session IV calculations if you come prepared with questions.

The following conversion factors and units equivalencies will be useful to complete the fertilizer problems. You do not have to memorize these; they will be given at the exam.

* lb P = lb P2O5 × 0.44
* lb P2O5 = lb P × 2.29
* lb K = lb K2O × 0.83
* lb K2O = lb K × 1.21
* 1 ton = 2000 lb
* 1 ac = 43,560 ft2

Determining the amount of N, P, K in fertilizers

Example: You have a 50 lb bag of granular fertilizer with a label that reads 15-10-10. The grade is 15-10-10, which is the percentage by weight of N, P as P2O5, and K as K2O. This particular fertilizer contains 15% by weight N, 10% by weight P2O5, and 10% by weight K2O. We want to know the following:

1. *How many lbs of N are in the bag?*

Of the 50 lbs of fertilizer in the bag, we know that 15% of that is N.
50 lbs fertilizer × 15% = **7.5 lbs N**

(Note: You can also express % as a decimal because % is the number of parts in 100 parts. Therefore, 15% = 15 parts/100 parts = 0.15)

1. *How many lbs of P2O5 are in the bag?*

50 lbs fertilizer × 0.10 = **5 lbs P2O5**

1. *How many lbs of K2O are in the bag?*

50 lbs fertilizer × 0.10 = **5 lbs K2O**

1. *How many lbs of P are in the bag?*

Convert from P2O5 to P using conversion given above:
5 lb P2O5 × 0.44 = **2.2 lbs P**

1. How many lbs of K are in the bag?

Convert from K2O to K using conversion given above:
5 lb K2O × 0.83 = **4.2 lbs K**

Now try the following calculations:

1. How much N is in a 50 lb bag of 12-22-18?
2. How much P2O5 is in a 40 lb bag of 0-46-0?
3. How much K2O is in a 70 lb bag of 12-22-18?
4. How much N is in a 30 lb bag of 0-46-0?
5. How much N is in a ton of DAP (18-46-0)?
6. How much P is in a ton of DAP (18-46-0)?

What about liquid fertilizers? If we know the weight of the fertilizer, we can again calculate the amount of N, P2O5, and K2O (or K) in these fertilizers.

Example: Determine the amount of N, P2O5, and K2O in a 50 gal tank of 10-15-10 that weighs 12.0 lbs per gallon.

*Step 1: Determine the total mass (weight) of fertilizer in the tank?*

12 lbs fertilizer/gal × 50 gal tank = 600 lbs fertilizer (total amount of fertilizer)

*Step 2: Determine how much N, P2O5, and K2O are in this tank?*

N: 600 lbs fertilizer × 0.10 = **60 lbs N**P2O5: 600 lbs fertilizer × 0.15 = **90 lbs P2O5**K2O: 600 lbs fertilizer × 0.10 = **60 lbs K2O**

Now try to solve the following problems:

1. Determine the amount of N, P2O5, and K2O in a 50 gal tank of 12-15-4 that weighs 11 lbs per gallon.
2. Determine the amount of N, P2O5, and K2O in a 75 gal tank of 22-16-3 that weighs 10 lbs per gallon.

Calculating the amount of fertilizer needed to supply a certain amount of N, P2O5, or K2O.

When we calculate the amount of fertilizer needed to supply a certain amount of N, P2O5, or K2O we need to know:

1. How much N, P2O5, or K2O is needed per unit area (e.g., 1,000 square feet, acre, etc.)
2. The analysis (grade) of the fertilizer (e.g., 10-10-10, 0-46-0, etc.)
3. How much area we need to fertilize.
4. For manure applications, you need to know the amount of N that will be available during the growing season. Rule of thumb is 60%.

Example: You are told you need to apply 2 lbs of N per 1,000 square feet. You have a 30-0-0 fertilizer available for application. The area you need to fertilize is 150,000 square feet. How much fertilizer do you need to apply?

*Step 1. Determine the rate of fertilizer needed.*

This is given in the problem. We need to apply N at a rate of 2 lbs per 1,000 square feet

*Step 2. Determine the fertilizer analysis.*

This is also given in the problem. The analysis (or grade) is a 30-0-0, which means the fertilizer is 30% N by weight.

*Step 3. Calculate how much fertilizer you need per 1,000 square feet.*

Divide the fertilizer application rate (2 lb/1000 sq. ft) by 0.30 (30%):
2 lb N/1000 sq. ft × 0.30 = 6.66 lbs of fertilizer per 1,000 square feet.

*Step 4. Calculate how much fertilizer is needed to cover the required area.*

We need to fertilize a total of 150,000 square feet (given in the problem), which means that we multiply by the amount of fertilizer needed to apply 2 lb N to 1000 sq ft. by 150. (Note: 150 comes from dividing 150,000 sq ft/1000 sq ft):
6.66 lbs fertilizer/1000 sq. ft. × 150 = 1,000 lbs of fertilizer.

Now try the following problems:

1. You need to apply 2 lbs of N per 1,000 square feet. You have a 15-10-10 fertilizer available, and the total area to be fertilized is 3 acres. How much fertilizer will you need? (Hint: Don’t forget to convert sq. ft. to acres!)
2. You need to apply 60 lbs of N, 50 lbs of P2O5, and 65 lbs of K2O per acre. If DAP fertilizer (18-46-0) is used to supply the P recommendation, how many lbs per acre of urea (46-0-0) will be needed to meet the N recommendation? How much potassium oxide (0-0-60) will be needed to meet the K requirement? (Hint: Determine the amount of DAP needed first because it contains more than one element and is the only fertilizer that contains P. Then figure the amount of urea needed to supply the rest of the N requirement.)
3. An organic material that contains 4% total nitrogen is applied to the soil at a rate of 60 pounds per 1,000 square feet. The N recommendation is 4 lbs of available N per 1,000 square feet. If it is assumed that 60% of the N in the organic material (i.e. manure) will mineralize to available N for this crop (during this growing season), how many lbs per 1,000 square feet of ammonium sulfate (21-0-0) should be applied to meet the N recommendation? (Hint: solve for the manure N first and then calculate the ammonium sulfate needed to meet the rest of the N requirement.)
4. A 500-acre irrigated corn grower wants to apply 200 lb N/ac on his corn. He would like you to apply 2.5 tons/ac of poultry litter in the spring and then sidedress the remainder of the N using UAN (30-0-0). Litter analysis from the DDA shows it contains 3.6% N. How much UAN will be needed for this job? (Assume 50% of N available from poultry litter.)
5. A customer has 0.25 acres of turf that needs 1.2 lb N, 2 lb P2O5 and 2.5 lb K2O per 1000 sq ft. The following products are available: DAP (18-46-0), Muriate of Potash (0-0-60), & Ammonium sulfate. How much of each product must be applied to meet these needs?
6. What will be the analysis (grade) of this mixture? Fertilizer A: 1 gallon of 11-37-0 at 11.5 lb/gal; Fertilizer B: 1 gallon of 32-0-0 at 11.1 lb/gal; and water: 1 gallon at 8.35 lb/gal.

Calibrating fertilizer spreaders

Example: Your fertilizer spreader covers a swath with a width of 40 ft. After disengaging the drive train, a container is attached to the delivery chute and the spreader containing 18-15-15 is driven for 100 ft. The contents of the container are weighted and it contains 50 lbs. What is the N rate in lbs/ac?

*Step 1: Determine the calibration area.*

The effective width of the spreader is 40 ft and the spreader is driven 100 ft. Area = length × width. 40 ft × 100 ft = 4000 sq. ft.

*Step 2: Determine the amount of N applied after the drive train was disengaged.*

The spreader dropped 50 lbs of 18-15-15 fertilizer. This fertilizer contains 18% N (0.18 lbs of N per lb fertilizer). 50 lb fertilizer × 0.18 = 9 lb N dropped in the container.

*Step 3: Determine the amount of N per acre applied based on the amount of N dropped in the 4000 sq. ft. calibration area.*

You applied 9 lb of N over the 4000 sq. ft. area. To determine the rate in lb/ac, convert the area from sq. ft. to acres. (9 lbs N/4000 sq. ft.) × (43,560 sq. ft./ac) = **98 lb N/ac**

Now try these problems:

1. A drop spreader has a 2-ft spread (application width). A 50 ft area is used for calibration of a 26-5-3 fertilizer. The desired rate of N application is 1 lb N/1000 sq ft. How many grams of fertilizer must be collected in the calibration area for this rate of 1 lb N/1000 sq ft?
2. A fertilizer spreader has an application width of 7 feet. A 100-foot long area is used for calibration of a 25-5-3 fertilizer. If 5 lbs of fertilizer is collected from this calibrations area, what is the rate of potassium that is being applied per acre with this fertilizer?
3. Nine 1 ft × 1 ft (1 sq ft) boxes are spread in a line with each box one foot apart. A spinner spreader is driven over the center box four different times spreading fertilizer. The fertilizer is collected from each box and weighed separately (grams). The weights in each box, from left to right are: 1.4, 2.4, 4.4, 6.7, 8.9, 6.8, 4.5, 2.2, and 1.1 grams. What is the effective width of this spreader? [Hint: it is the distance from center where the application rate is half the center pan (× 2) and the distance from the center of one box to the center of the next box is 2 ft.].
4. Calibrating a manure spreader using the tarp method provides the following information:
* Bucket + tarp (10 ft × 10 ft) weight = 3.5 lbs
* Manure + bucket + tarp = 18.2, 17.3, and 18.7 lbs for each of 3 passes. Average weight = 18.1 lbs

How much does the manure weigh? What is the average manure rate?

Conversions of soil test P results

You should be able to convert from soil test results analyzed by different extraction methods and in various units. The following conversion equations are useful (you don’t have to memorize these):

* lb/ac = ppm × 2
* ppm = lb/ac × 0.5
* FIV = ppm (Mehlich 3 P only) = mg/kg
* Mehlich 3P = Bray P1 × 1.25
* Bray P1 = Mehlich 3P × 0.80
* Mehlich 3P = Mehlich 1P × 2
* Mehlich 1P = Mehlich 3P × 0.5
* lb P = lb P2O5 × 0.44
* lb P2O5 = lb P × 2.29

Example: A soil test reports Mehlich 1 P as 200 lb/ac, what is the Mehlich 3 FIV value?

*Step 1: Convert from Mehlich 1 to Mehlich 3 P.*

200 lb/ac Mehlich 1 × 2 = 400 lb/ac Mehlich 3

*Step 2: Convert from lb/ac to FIV.*

400 lb/ac × 0.5 = **200 FIV Mehlich 3**

Now try the following problems:

1. Soil test reports 180 lb/ac Mehlich 3P. What is the FIV value.
2. Soil test reports 180 lb/ac Bray P1. What is the FIV value.
3. Soil test reports 180 ppm Mehlich 1P. What is the FIV value.
4. Soil test reports 120 ppm Bray P1. What is the FIV value.
5. Soil test reports 150 ppm Mehlich 3P. What is the FIV value.
6. Soil test reports 688 lb P2O5/ac as Mehlich 3P. What is the FIV value?
7. Soil test reports 150 FIV Mehlich 3. What is the value for Bray 1 in lb/ac?
8. Soil test reports 250 FIV Mehlich 3. What is the value for Mehlich 1 in mg/kg?