Recommendation Calculations

Phosphorus recommendation

(Optimum P – Soil P) x C.E.C./2 = Pounds P_2O_5 to build

Divide by years to build

Total recommendation build + removal

%P calculations
Soils with Al over 300 ppm and % Ca less than 77%

$$\textbf{ppm p1} = \frac{\textbf{target \%P x .79 x soil test Al}}{\textbf{100}}$$

soils with Al less than 300 ppm and %Ca greater than 77%

$$\textbf{ppm p1} = \frac{\textbf{target \%P x.79/(CEC/10) x soil test Ca ppm}}{\textbf{100}}$$

Potassium recommendation

Building K levels in soils C.E.C. x ppm to build = pounds K2O required
Divide this value by number of years to build + crop removal

Determining sufficient level of K (K_{sl})
Fishers formula for corn 110 + (C.E.C. x 2.5) = K_{sl}
Fishers formula for beans 140 + (C.E.C. x 2.5) = K_{sl}

or

%K desired x C.E.C. x 390 = K_{sl} ppm

A Crop removal + (optimum %K – soil test %K) x C.E.C. x 9.36 = K recommendations
-Divide build portion by number of years to build

B (K_{sl}- soil test ppm) x 2 + crop removal (3 – 5) year build built in

Calcium Recommendations

%Ca desired x 400 x C.E.C. = lbs Ca
example .72 x 400 x C.E.C. = lbs calcium desired
lbs calcium desired – (Ca from soil report x 2) = required

High Mg adjustment

%Ca from report + %Mg from report – 10% Mg = %Ca target
%Ca target - %Ca on report = %Ca needed
C.E.C. x 400 x %Ca needed/100 = lbs calcium required

Magnesium Recommendations

(15% - % Mg saturation from report) x C.E.C. x 2.4 = pounds per acre to apply

Micronutrients

Boron 1 pound per acre raises soil test 1/10 of ppm after 12 months

Iron 2 pounds per acre raises soil test 1 ppm in 12 months

Manganese 10 pounds per acre raises soil test 5 ppm in 24 months

Copper 10 pounds per acre raises soil test level 6/10 ppm after 12 months

Zinc 1 pound per acre raises soil test 1.18 ppm after 24 months

Organic Matter Can Improve Your soil's water holding capacity ref. NRDC

1. There are 616.7 cubic meters of soil in an acre (area x depth = 43,560 ft/acre x 0.5 feet deep = 21780 cubic feet/acre = **616.74 cubic meters of soil/acre**).

2. Next, we convert volume to mass: multiplying 616.74 by a **bulk density of 1330 kg/cubic meter** (or 1.33 g/cm3) to get 820,264 kg (x 2.204623 lbs/kg = **1,808,322 lbs) of soil per acre**. We used an assumption for bulk density in this calculation; I will explain what that means later.

3. We want to know how much an increase of 1% organic matter would increase the water holding capacity of the soil. If an acre of soil is 820,264 kg, then **1% organic matter would be 8,202.6 kg/acre**. Now let's make

some more assumptions. First, we will ignore the amount of water held in the soil itself, and only calculate the water held in the additional organic matter. How much water does a kilogram of organic matter hold? If we make the assumption that organic matter holds 10 times its weight, or 82,026 kg (180,836 lbs) of water. There are 8.3454 lbs in a gallon, **so that is 21,668 gallons of water. The math in our commonly quoted fact checks out.**

As you can see, we used a lot of assumptions to make the math come out right. Let's talk about those assumptions, starting with bulk density.

Bulk density is a measure of soil compaction; it's the weight of the soil divided by its volume. Lower bulk density is better; a surface soil with higher than 1.4 bulk density is in bad shape. Bulk density varies a lot in real soils, depending on the soil's texture, which can be fine (clay), medium (silt), or coarse (sandy), but also the structure of the soil. A soil with good structure will have plenty of pore space, and a good mixture of continuous large and small pores. In this equation, we used the bulk density of a medium-textured soil with 50% pore space - 1.33 grams per cubic centimeter.