

1. A Mahan series soil typically contains the following concentration of adsorbed cations:

Cation	Concentration (cmol(+) kg ⁻¹)
Al ³⁺	1.0
Ca ²⁺	2.0
H ⁺	1.0
K ⁺	0.3
Mg ²⁺	0.6
Na ⁺	0.1

A) What is the CEC of this soil?

$$\text{CEC} = 1.0 + 2.0 + 1.0 + 0.3 + 0.6 + 0.1 = 5.0 \text{ cmol(+) kg}^{-1}$$

B) What is its percentage base saturation?

$$\% \text{ BS} = [(2.0 + 0.3 + 0.6 + 0.1) / 5.0] 100 \% = 60 \%$$

2. Given the below plate counts, what is the average number of CFUs per gram of this soil?

No. CFUs	Dilution
200	10 ⁻⁶
30	10 ⁻⁷

Expressing both measurements at the same dilution,

$$\text{Average CFU} = 0.5 \times (200 + 300) \times 10^6 = 2.50 \times 10^8 \text{ g}_{\text{soil}}^{-1}$$

3. Assuming you wanted to apply 120 lbs of N per acre and used a 12-12-12 fertilizer that cost \$ 400 per ton (2000 lbs), how much would it cost to fertilize a 2 acre garden?

You need

$$2 \text{ ac} \times (120 \# \text{ N ac}^{-1}) / (0.12 \times 2000 \# \text{ N ton}_{\text{fertilizer}}^{-1}) = 1 \text{ ton}_{\text{fertilizer}}$$

costing

$$\text{ton} \times \$ 400 \text{ ton}^{-1} = \$400$$

4. Continuing with the above scenario, how much P and K are applied along with the 120 lbs of N per acre? Conversion factors for P_2O_5 and K_2O are 0.44 and 0.83, respectively.

$$\# P \text{ ac}^{-1} = (0.5 \text{ ton}_{\text{fertilizer}} / \text{ac}) \times (0.12 \times 2000 \# P_2O_5 \text{ ton}_{\text{fertilizer}}^{-1}) \times 0.44 =$$
$$53 \# P \text{ ac}^{-1}$$

$$\# K \text{ ac}^{-1} = (0.5 \text{ ton}_{\text{fertilizer}} / \text{ac}) \times (0.12 \times 2000 \# K_2O \text{ ton}_{\text{fertilizer}}^{-1}) \times 0.83 =$$
$$100 \# K \text{ ac}^{-1}$$