

NUTRIENT RATIOS

Soil Science Factsheets

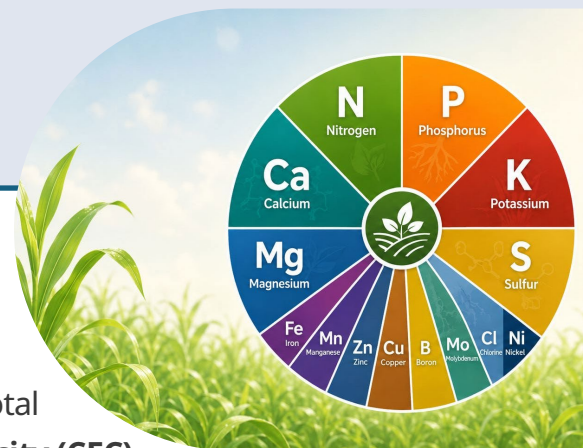
What are nutrient ratios?

Soils can hold a number of different nutrients on tiny negatively charged sites on clay and organic matter. The total number of these sites is called the **Cation Exchange Capacity (CEC)** of a soil. This matters for crop production because the soil can store these nutrients and release them later for crops to use. The higher the clay and organic matter content, the higher the CEC.

Base saturation shows what share (percentage) of the CEC is filled by specific nutrients, namely calcium, magnesium, potassium and sodium. Some advisors use **ratios** between these nutrients to guide nutrient application recommendations. In their view, soils may work best when these nutrients fall within certain ranges. This approach is called the **Base Cation Saturation Ratio**, or **BCSR**, also known as **soil balancing**. In simple terms, BCSR asks: Are these nutrients in the right balance? Common BCSR target ranges are about 60-75% calcium, 10-20% magnesium, and 2-5% potassium of the CEC.

What does science say

The idea of using nutrient ratios for fertilizer advice goes back to the 1940s. Firman Bear, a soil scientist at Rutgers University (New Jersey), proposed the idea of an “ideal” soil nutrient balance for alfalfa. However, later research by Bear’s coworkers did not clearly prove his nutrient ratio concept. Around the same time, William Albrecht, a soil scientist at the University of Missouri, also became linked to the idea of a “balanced” nutrient ratio for soils. Neal Kinsey, a soil fertility consultant, further helped to spread Albrecht’s concept. This is why the approach is also known as the **Albrecht-Kinsey method**.



Soil health and good crop production can occur across many nutrient ratios, as long as each nutrient is available in adequate amounts. Focusing too much on an “ideal” ratio can lead to oversupply of some nutrients.

Since then, **research worldwide has not found consistent evidence to support nutrient ratios as the main guide for fertilizer decisions.** Crops can grow well across a wide range of nutrient ratios as long as pH is suitable and nutrients are not deficient. There is also no consistent evidence that fixed nutrient ratios clearly improve soil health. In fact, BCSR can lead to costly, impractical, or even harmful nutrient application rates.

Therefore, most soil scientists, extension services and public recommendations use what is called the the **Sufficiency Level of Available Nutrients approach (SLAN)**. It asks: Is there enough of each nutrient for the crop?

For example, Ontario's *Soil Fertility Handbook* says base saturation ratios can help describe a soil, but they are not the main basis for fertilizer recommendations.

Ratios can still flag unusual conditions, such as very high sodium or very low calcium. But they should be treated as a warning sign, not as a fertilizer prescription.

Considerations

- A ratio can make soil nutrient concentrations look “wrong” even when nutrients are already high enough.
- One ideal ratio does not fit all soils, crops, or climates, and it does not show whether other key nutrients, such as nitrogen, phosphorus, are sufficient.
- Even an “ideal” ratio may not fix other problems limiting crop growth like drainage, compaction, salinity, or a lack of organic matter.

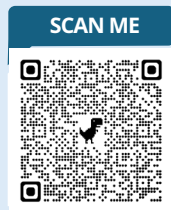


Nutrients alone may not ensure good crop growth. Here, small plants received the same fertilizer as larger plants but grew in compacted soil, which needs to be fixed first.

Tips for farmers

- Use nutrient ratios as background information, not as the main fertilizer guide.
- Focus first on soil test levels, crop needs, and pH. Make sure that all nutrients are supplied sufficiently; do not chase a certain ratio.
- If a crop does not perform well, make sure it is not limited by other issues like pH, drainage, compaction, drought, salinity, soil management, or disease.
- Before buying amendments to “balance” the soil, ask: Is there a real deficiency? Are recommendations based on local crop response data? Will it improve yield, crop quality, soil health, or profit?

Find more information:



Nutrient Management

[Nutrient Management, Tools and Programs](#)

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Other resources and references

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