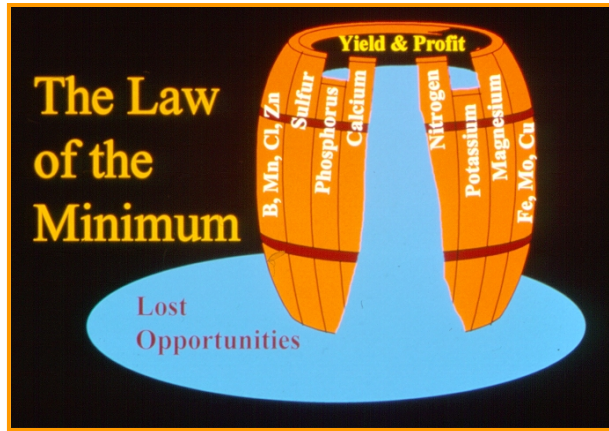


# Balance All Nutrients for Optimum Forage Production

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While reviewing some educational materials from the Potash & Phosphorus Institute recently, I ran across an old poster entitled, “**The Law of the Minimum.**” It portrayed an old keg with several short slats labeled as different soil nutrients. Water was gushing over the shortest slat and the pool of water flowing out was labeled as “lost opportunities.”



When it comes to forage production, any nutrient in short supply could certainly result in a “lost opportunity” to get maximum yield and profit. For this reason, forage managers need to give close attention to soil fertility and make sure all nutrients are adequate to meet the needs of that particular forage. It makes little sense to invest in improved forage varieties and then allow a nutrient deficiency to rob the genetic potential of the forage.

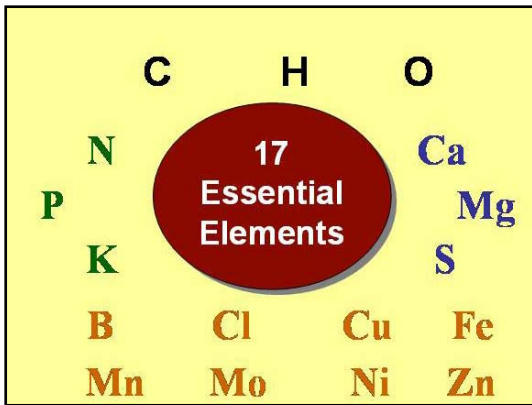
Each nutrient plays a specific role. Some like nitrogen, phosphorus and potassium are considered major or primary nutrients meaning they must be available in large quantities to obtain good plant growth. Others like calcium, magnesium and sulfur are considered

macro or secondary nutrients. Like the major nutrients, these secondary nutrients are essential for optimum plant growth but are required in smaller amounts. If deficient, they usually do not limit plant growth as profoundly as a deficiency of one of the major elements. Micronutrients are a third nutrient category and include manganese, iron, boron, copper, molybdenum, chloride, zinc and nickel. These nutrients usually do not significantly reduce yields, but can be important in seed production and animal health and nutrition.

Mineral Nutrients	
<b>Primary Nutrients</b>	<b>Micronutrients</b>
Nitrogen (N)	Boron (B)
Phosphorus (P)	Chloride (Cl)
Potassium (K)	Copper (Cu)
	Iron (Fe)
<b>Secondary</b>	Manganese (Mn)
Calcium (Ca)	Molybdenum (Mo)
Magnesium (Mg)	Nickel (Ni)
Sulfur (S)	Zinc (Zn)

As mentioned previously, each nutrient has a specific role or plant function. **Nitrogen** is an important component of chlorophyll, which is essential for plant photosynthesis and growth. **Phosphorus** enhances plant metabolism and is critical for seed and fruit formation. It is also needed for optimum root growth. **Potassium** encourages root growth, strengthens stalks and aids in the transport of sugars and starches inside the plant. It also improves plant disease and cold tolerance. **Calcium** improves disease resistance in

the plant and is an essential component of animal bone tissue. **Magnesium** is key for proper plant metabolism and is important for proper enzyme function within the plant. In addition, it serves a major role in the prevention of grass tetany. **Sulfur** enhances nitrogen uptake and utilization efficiency in plants. **Boron** promotes the plant's reproduction process and seed formation while **manganese** influences plant metabolism and enzyme function. Certain micronutrients like **copper** are important perhaps more so for animal health reasons than for plant nutrition and growth.



The key point is that all nutrients play an important role. If any one is deficient, producers are losing opportunities to capture the full genetic benefit of existing and improved forage varieties. Forage managers should soil test regularly and supply all needed nutrients to ensure maximum production and profit.

*(Pictures/charts contained in this article are courtesy of the Potash and Phosphate Institute/Foundation for Agronomic Research.)*