In the green: update on boron's role as an essential plant micronutrient

Susan Keefe

The roots of civilization

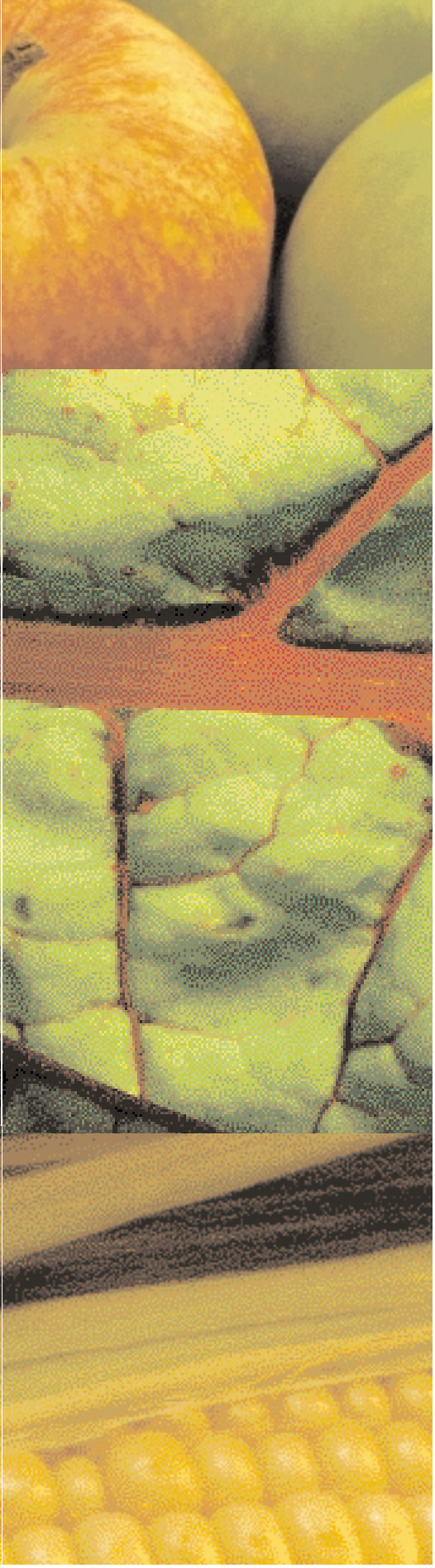
Animals and vegetables are alike in at least one important way: they both need minerals to survive. People didn't know about mineral nutrients when they first started growing crops more than 10,000 years ago. But they did know that planting seeds and harvesting crops raised their own survival rates.

Key to producing full-volume crop yields are the seven micronutrients: boron, copper, chlorine, iron, manganese, molybdenum and zinc.

With the advent of agriculture, the roots of civilization took hold. Figuring out what nutrients plants need to thrive has concerned us ever since.

When we knew of only four "elements," it was pretty clear that plants needed three of them - earth, water and air - to grow. With better science, the list grew longer. Nitrogen, phosphorous and potassium were identified as primary nutrients and, on the second tier, sulphur, magnesium and calcium.

But it has only been in the last 75 years that scientists and farmers discovered another section in agriculture's intricate chemical orchestra. Key to producing full-volume crop yields are seven micronutrients: boron, copper, chlorine, iron, manganese, molybdenum and zinc.



The fruits of knowledge

These seven elements are the unsung heroes of the plant world. Only trace amounts are needed, so we don't hear about them often. They perform at the cellular level, so we don't see them work. Nevertheless, they have an enormous impact on plants' - and thus everybody else on the planet's - survival.

Picture the world without even one of them:

Boron. Boron is integral to a plant's reproductive cycle; controlling flowering, pollen production, germination, and seed and fruit development. The mineral also acts as a fuel pump, aiding the transmission of sugars from older leaves to new growth areas and root systems. Fields of cotton, canola, clover and corn produce higher crop yields with boron supplements. Farmers get up to 13 bushels more soybeans per acre. In fact, boron makes almost every fruit, nut and vegetable crop healthier - and more marketable.

Take the boron bonus out of the system and what happens? Celery grows crooked. Carrots fork. Apple cores get corky. Table beets blacken. Peanuts develop hollow hearts. And cotton yields decrease. While these problems sound whimsical, the consequences are anything but for the farmer who cannot market the damaged crop, or indeed, for the global food supply.

The remaining essential micronutrients are:

Copper. Most recognizable in pennies and wires, copper's biggest role is as the micronutrient that makes the most fundamental chemical process in the world possible: photosynthesis. Chlorophyll - the material that makes plants look green and allows them to synthesize food from sunlight, air and water - contains copper.

Chlorine. You know it as a foundation of table salt. But chlorine is also a key in energy reactions in plants, specifically the chemical breakdown of water in the presence of sunlight. It also helps control water loss and suppresses disease and infections.

Iron. Learning how to smelt iron gave its inventors unbeatable weapons and ultimate dominion. Iron's power in the plant world lies in its ability to carry oxygen. It plays leading roles in plant respiration, photosynthesis and energy transfer.

Manganese. Manganese is used to make batteries and forge steel in modern industry. In plants, it functions primarily as part of the enzyme system. Manganese plays a direct role in photosynthesis by aiding chlorophyll synthesis.

Molybdenum. Molybdenum can be found in leather dyes, ceramic glazes, printing ink, X-ray tubes, light bulbs...and plants, where it works to foster protein synthesis, enzyme systems and nitrogen metabolism.

Zinc. Strong enough to keep iron and steel from rusting, gentle enough to soothe skin irritations - zinc is also a versatile player for the green team where it controls the production of important growth regulators which affect new growth and development.

Civilization has its roots in the fields of agriculture. Knowledge of the seven micronutrients - and increasingly sophisticated methods of determining micronutrient deficiency through soil testing and plant tissue analysis - promises to increase the yield through a very simple equation: sufficient minerals; more vegetables.

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