

Nutrient Balance: Critical to Crop Production and Environmental Protection

People and plants both need balanced nutrition for normal growth and good health. People require a variety of foods, while plants need only 17 nutrients in the proper balance to grow. Carbon (C), hydrogen and oxygen are obtained from air and water. The remaining mineral nutrients are mostly supplied by the soil through the roots. When crops have the proper balance of nutrition, an added bonus is increased environmental protection.

Proper balance results in increased nutrient use efficiency.

While all 14 of the mineral nutrients are essential for plant growth, the relative amount needed varies greatly. For example, there may be one million times more nitrogen (N) in a plant than molybdenum, but they are both equally essential for the plant to thrive. Many examples exist which demonstrate that when only one of the nutrients is in short supply, none of the other nutrients can be properly used due to the poor growth and function of the deficient plant.

For example, it is commonly found that when N is balanced with phosphorus (P), potassium, and other essential nutrients, crop yields increase and so does N use efficiency. That means the crop uses more N and less is left in the soil as a potential pollutant. In a 40-year irrigated corn study in Kansas, properly balancing added N with P resulted in higher yields and less leftover nitrate-N ($\text{NO}_3\text{-N}$) in the soil when compared to adding N alone.

Another benefit of balanced nutrient use is increased water use efficiency by crops. Water use efficiency can improve as much as two-fold by simply supplying essential nutrients in the proper balance. Good nutrition promotes rapid ground cover and healthy plant canopies, which are efficient at using the available water; so healthy crops produce more grain for the same amount of water they use.

Growing higher yielding and more efficient crops by providing balanced nutrition helps to alleviate the detrimental effects of global warming. Increasing crop yields produce more food from the same area of land, storing more C in the soil. Balanced nutrition produces healthy crops, which quickly develop a canopy to protect the soil against rain and wind erosion. Extra surface residue left behind after harvest further protects against erosion and runoff.



Well-fertilized crops produce more yield from the same area, releasing fragile lands for other important uses, such as wildlife habitat and recreation. This is a critical point since arable land per person in the world is shrinking as the global population grows. With between 6 and 17% of greenhouse gas production attributed to clearing of forests and native lands for agriculture, intensification of production on current land can halt these additional emissions.

The balance between adequate food production and environmental protection must include higher crop yields. This is only possible through the proper use of plant nutrition and other best management practices.

FOR FURTHER READING:

- Burney, J.A., S.J. Davis, and D.B. Lobell. 2010. In Proceedings of National Academy of Science 107(26): 12052-12057.
- Foley, J.A. et al., 2011. Nature 478: 337-342.
- Schlegel, A.J., K.C. Dhuyvetter, and J.L. Havlin. 1996. Journal of Production Agriculture 9: 114-118.