Law of the Minimum Essential Elements for Plant Growth

Justus von Liebig's Law of the Minimum states that yield is proportional to the amount of the most limiting nutrient, whichever nutrient it may be. From this, it may be inferred that if the deficient nutrient is supplied, yields may be improved to the point that some other nutrient is needed in greater quantity than the soil can provide, and the Law of the Minimum would apply in turn to that nutrient.

Liebig made great contributions to the science of plant nutrition and soil fertility. As a result of millenia of practical experience of farmers manuring fields to improve fertility, many early chemists thought that the "principle of vegetation", the essential nutrients needed for plant growth, were organic in nature rather than mineral.

Liebig essentially debunked the humus theory and made a scientific case for plant requirements for mineral elements from the soil, carbon from CO2 in the air, and H and O2 from water.

Liebig thought that plants derived most of their nitrogen content from the air as well, which is somewhat correct for legumes, but not true for other plants.

Liebig developed the first mineral fertilizers applied to replentish nutrients removed from soils by crops and clearly saw mineral fertilizers as part of sustainable agricultural practices.

Justus von Liebig (1803-1873) was a German chemist who spent the early part of his accomplished career as a pioneer in organic chemistry. He turned to what is now called biochemistry about 1838, and first published on agricultural chemistry in 1840, and made numerous significant advances and engaged in extensive, fruitful debate with other researchers in the field.

Recent scholarship, beginning in 1950, has discovered the significance of the German agronomist Carl Sprengel (1787-1859) who conducted pioneering research that could be considered the start of agricultural chemistry, including disproving the humus theory and formulating the Law of the Minimum. His publications on these subjects predated Liebig's 1840 publication and therefore he has precedence for these discoveries.

It is uncertain that Liebig was unaware of Sprengel's work, so Liebig may be considered a propagandist and promulgator of these discoveries and, by virtue of his greater reputation, may have been unduly credited for the discoveries themselves.

The Association of German Agricultural Experimental Stations regularly acknowledges outstanding service or achievement to agricultural with the Sprengel-Liebig Medal, thereby honoring both scientists.

For more information on Liebig, see:

C.C. Gillispie (ed.-in-chief). 1981-1990. Dictionary of Scientific Biography. Vol 7. Scribner, N.Y•

C.A. Brown. 1942. "Justus von Liebig--Man and teacher." and "Liebig and the Law of the Minimum"in: Liebig and After Liebig: A century of progress in agricultural chemistry. Am. Assoc. Adv. Sci. The Science

van der Ploeg, R.R., W. Böhm, and M.B. Kirkham. 1999. "On the origin of the theory of mineral nutrition of plants and the Law of the Minimum." Soil Sci. Soc. Am. J. 63-1055-1062.

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