

Balanced Fertilisation and the Law of the Minimum

By G. Dev

The importance of balanced fertilisation in increasing crop yields is recognised world-wide. Nutrient imbalance produces low yields, low fertiliser use efficiency, and low profits for farmers. It also results in further depletion of the most deficient nutrients in the soil. Once the critical level of any one plant nutrient is reached, crop yields will fall despite the fact large amounts of other nutrients are applied.

The idea of balanced fertilisation is not new. In fact, Justus von Liebig, a German chemist, defined the Law of the Minimum in 1867. He outlined

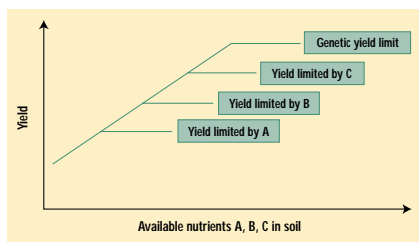


Figure 1. Schematic of von Liebig's Law of the Minimum.

the need to provide plants with a correct balance of nutrients. Liebig recognised that any one deficiency could limit growth and leave other available nutrients unused or poorly utilized by the plant. This concept is equally applicable in today's modern agriculture. Diagrammatically, the Law of the Minimum is shown in **Figure 1**. The process of balancing crop nutrients involves adjustment of fertiliser recommendations to a particular crop, soil, yield goal, fertiliser availability, or resource level of the farmer. This process can be achieved using response curves already established through well-conducted research.

The following example presents results from a long-term experiment (1979-90) on a maize-wheat sequence conducted at Punjab Agricultural University, Ludhiana. Wheat response curves to applied nitrogen (N), phosphorus (P), and potassium (K) are shown in **Figure 2**. The figure outlines the fertiliser combinations required to obtain a specific wheat yield. A balanced application of 120-80-40 kg/ha of N-P₂O₅-K₂O produced a yield of 4.7 t/ha.

However, in the event that a farmer fails to apply K due to a lack of funds or product availability, the yield benefit that would have accrued due to K is lost. Thus, extrapolating the curve to 0 kg K₂O/ha results in a lower expected yield of 4.4 t/ha. In this situation, the required fertiliser levels work out to be 112-72-0 kg/ha of N-P₂O₅-K₂O.

In an even more limiting example, if either P or K fertiliser is unavailable or no funds exist to purchase P and K, the expected yield for wheat will be reduced to 2.2 t/ha. As in the previous case, extrapolating the curves results in a fertiliser recommendation of 40-0-0 kg/ha of N-P₂O₅-K₂O.

This process of nutrient balancing can be performed to suit other situations involving different yield goals, resources of the farmer, etc. In fact, the principle of the Law of the Minimum can be applied to any factor that could

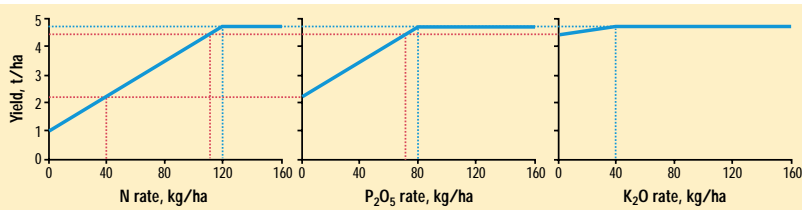


Figure 2. Balancing of nutrients applied to wheat in a long-term maize-wheat experiment (1979-90); 120-80-40 kg/ha of N-P₂O₅-K₂O gives a yield of 4.7 t/ha.

limit yield (water, farmer management, temperature, soil physical constraints, etc.). These types of limiting factors are found in every farmer's field. This lends credibility to the saying that "every field has something limiting yield." Liebig's Law of the Minimum focused only on plant nutrients, but the principle fits other conditions in cropped fields. No farmer or researcher has achieved the genetic yield potential (Figure 1) of any crop. Agricultural extension agencies should use this knowledge to assist farmers in adapting to different cropping situations and to focus on correcting limiting factors. This tool will enable farmers to obtain their highest yield, fertiliser use efficiency, and profit. **BCI**

Dr. Dev is Director, PPIC-India Programme, Gurgaon, Haryana, India - 122016.

U.S.A.: Potassium-Rich Foods May Reduce Risk of Stroke

Foods containing higher levels of potassium (K) and related nutrients may help reduce the risk of stroke, especially in people with high blood pressure. Bananas, tomatoes, spinach, and oranges are good sources of K in the diet.

An 8-year study of nearly 44,000 men in the health care field parallels the results of earlier, smaller studies. It found that men who ranked in the top fifth according to how much K they consumed had a 38 percent lower risk of stroke than those in the bottom fifth. The major difference in the diets of the top fifth and bottom fifth groups in the study was the amount of fruits and vegetables. The highest-K group had about nine servings per day, compared with four in the lowest.

"There is strong support for a stroke-preventive effect from diets rich in potassium, magnesium, and cereal fiber," said Dr. Alberto Ascherio, MD, a professor of nutrition and epidemiology at the Harvard School of Public Health, Boston, Massachusetts.

Researchers caution that K supplements should not be taken without a doctor's supervision because high levels of such products can be harmful, especially for people with kidney problems.

Potassium intake in the diet can be increased by substituting fruits, vegetables, and their natural juices for low-K processed foods and sodas.

BCI

Source: Circulation, 1998; 98:1198-1204, a journal of the American Heart Association, Inc.

