The Factual Base of the Inverse Yield-Nitrogen Law

O. W. Willcox

In a previous paper (8) an account was given of the soil fertility survey by field test that was executed in Germany during several years prior to World War II. When added to the already great mass of experimental data that has been accumulated during the past 40 years the results of this vast project, involving more than 27,000 replicated field tests with numerous kinds of crop plants under a wide variety of cultural conditions, would seem to leave very little room for doubt concerning the validity of the Mitscherlich effect law of the factors of plant growth.

This effect law, or law of yield, has become of first rate importance in agronomy and soil science, because through it have been established the parameters of a perertile soil, i.e., the quantities and proportions of the factors of plant growth required to enable plants to grow and yield up to the limit of their capacity (10); or, in the agrobiologic phrase, to deploy their full quantity of life. By deploying their full quantity of life is meant attainment of the maximum quantity of vegetable substance any kind of plant can produce when it is grown at the maximum agrobiologic density of stand on a unit area of perertile soil.

A working rule for application of the law of yield is provided by the Mitscherlich-Baule yield equation in the form

\[ \log (A-y) = \log A - 0.301 \times x \]

in which \( A \) is a determinable maximum yield of which a portion \( y \) has been produced by the action of a certain quantity of a growth factor or combination of growth factors \( x \). After the value of \( A \) in a particular situation has been found it is possible to calculate the yield \( y \) that should correspond to a certain amount of \( x \), and vice versa, the amount of \( x \) required to produce a certain yield \( y \).

The Mitscherlich law of yield, standing alone, is not a complete science of the power of plants for growth and yield because this law, of itself, provides no formula for ascertaining the limit (perultimate) quantity of life, \( Q \), that may be evoked from any kind of plant. That is to say, Mitscherlich's law of yield is silent as regards an upper limit on the value of \( A \). This upper limit \( Q \) on growth and yield is a specific character of each individual kind of plant. It is important to obtain a measure of yield because this law, of itself, provides no formula for ascertaining the amount of soil nitrogen metabolized and pounds of total dry substance produced. Column VI shows the perultimate yields of the crops in question that may be evoked from any kind of plant. This upper limit \( Q \) on growth and yield is a specific character of each individual kind of plant. It is important to obtain a measure of yield because this law, of itself, provides no formula for ascertaining the amount of soil nitrogen metabolized and pounds of total dry substance produced. Column VI shows the perultimate yields of the crops in question that may be evoked from any kind of plant. That is to say, Mitscherlich's law of yield is silent as regards an upper limit on the value of \( A \). This upper limit \( Q \) on growth and yield is a specific character of each individual kind of plant. It is important to obtain a measure of yield because this law, of itself, provides no formula for ascertaining the amount of soil nitrogen metabolized and pounds of total dry substance produced. Column VI shows the perultimate yields of the crops in question that may be evoked from any kind of plant.