

A system for fertilizer optimization for improving crop quality

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In order to evaluate and demonstrate yield and quality responses for crops to NPK-nutrient supply and determine optimal NPK-requirements, a computer system FOICQ (Fertilizer Optimization for Improving Crop Quality) was developed.

In the system a series of the functional relationships between NPK-contents in crops and yield and quality characteristics represented in Table 1 is inserted. Derived from different experimental data, these relationships are not only of statistical significance but also represent certain general regularities of plant physiology.

Table 1: Quality characteristics of crops involved in FOICQ system

Dry matter	Glucose	Malic acid
Pure protein	Fructose	Ascorbic acid
Crude protein	Reducing sugars	Calcium
Nonprotein N-compounds	Starch	Magnesium
Pure/crude Prot.ratio	Cell wall substances	Phosphor
Nitrate	Citric acid	Potassium

Based on these functional relationships, following benefits can be provided by FOICQ system.

- To optimize nutrient requirements which maximize crop yield or economical benefits subject to the special crop quality requested by consumers or processing industry. To operate optimization, requests on crop quality (e.g. certain concentrations of starch, protein, vitamine, nitrate and minerals in crop produce, can be used as input data. Depending on the different quality demands which are corresponding to direct consumption, storage or industrial processing purposes, optimal NPK-nutrient requirements can be calculated directly.
- To evaluate yield and quality responses to certain NPK-nutrients. As all 18 quality parameters contained in the system can be calculated integratively, it provides also a useful instrument for researchers and students in agricultural sciences to understand the complicated relations between plant growth and nutrient supply as well as for farmers or processing industries to evaluate crop produce quality.

- To demonstrate yield and quality responses to NPK-nutrients in two or three dimensional graphics. Through this possibility FOICQ facilitates better understanding the relationships between yield, quality and NPK-supply.

Three separate softwares, **CUMT** (Sequential Unconstrained Minimization Techniques) for the nonlinear optimization, **MAPICS** (Mathematical Pictures) for drawing two or three graphics from mathematical formulas and **BRSSQ** (Best Residual Sum of Squares) as a special multiple regression analysis procedure to facilitate establishing new relationships on data base, were developed and applied together in the FOICQ system. As an universal and convenient instrument, therefore, FOICQ can be applied for any crop.