1. SUMMARY

1.1 Research

Micronutrients are essential for plant growth and animal and human health. They are required in relatively small amounts. Therefore they are also called trace elements. Micronutrient availability in soils is very variable: from extreme deficiency to sometimes abundant availability and even toxicity. To correct shortages, micronutrient fertilization is common. Its success is variable, depending on soil characteristics. Imbalances in micronutrient management may lead to reduced yield, poor crop quality and finally inadequate animal or human intake of micronutrients through staple food. Although soil-testing is widely adopted to determine soil micronutrient status for fertilizer recommendation, results are far from satisfying. Thus far, soil-testing programs are generally based on empirical relationships with a weak correlation between micronutrient advice and crop response. Often high safety margins are used. This results in relatively high applications levels, with as a consequence loading of soils with heavy metals e.g. copper and zinc or extra leaching of e.g. selenium. There is an urgent need to improve soil-testing programs and fertilizer application strategies i) to obtain healthier feed and food with minimum use of micronutrient fertilizer and ii) for optimal crop production.

We want to tackle the problem of quantification and prediction of micronutrient availability, behavior in soil and uptake by the plant with a new universal approach to be used in arable, vegetable and dairy farming for optimal fertilizer application strategies. It is based on modern knowledge and mechanistic modeling of soil chemical and fertilizer behavior in combination with multi-nutrient extraction and non-invasive measurement techniques. This forms the basis of an accurate, cost-effective and environmental friendly evaluation system for optimum micronutrient use in cropping systems with minimal environmental disturbance. Preliminary results show promising perspectives in measuring, understanding and predicting (true) micronutrient availability.

We aim to develop (researchers), validate (researchers and users) and commercialize (users) a universal innovative approach to evaluate and predict micronutrient availability in soils and the required amount and type of micronutrient in order to match crop demand. This study will focus on copper (Cu) and selenium (Se) in grassland and manganese (Mn) and boron (B) in arable (horticulture) land. The new approach that will be developed can be extended later to other micronutrients. The result is a new recommendation system. It will replace the various unreliable systems used now. It will allow farmers to make a transition to micronutrient precision fertilization, which leads to a better feed and food quality and reduces losses to the environment (e.g. groundwater). The universal innovative approach will benefit farmers as well as the environment.

1.2 Utilization

The urgency of a new standard for universal soil-testing and fertilizer advice program for micronutrients is widely felt. The approach of sophisticated measurements combined with advanced modeling can become the new standard. The leading horticultural and agricultural laboratory in the Netherlands (Blgg), micronutrient fertilizer companies (AkzoNobel and Triferto) and dairy and arable farmers boards (PZ and PA) foresee a high demand for such a method, to fulfill society's demand for healthy and high quality feed and food with minimum environmental risks. Today's aged empirical soil-testing does not fit to this target, because it is strongly regionalized, which hampers business in other countries, farm types and lacks an advice for some elements as for instance Se. This research project is needed to overcome these problems and to fulfill society's demand. It will give answers to the questions: how much? when? how to distribute? and which type micronutrient fertilizer is needed?

Blgg, AkzoNobel, Triferto, PZ and PA support this project. Together they will invest 319 k€ in the development of the new soil-testing system for micronutrients and its implementation in a fertilizer advice program to get it on the market. Replacement of the present unreliable soil-testing and fertilizer advice program will increase soil analysis numbers for the soil analyzing labs and will enlarge market share of the fertilizer companies, further enhanced by their resulting development of fertilizer formulations. Implementation by Blgg will start along with this research project by parallel engineering to minimize the time before the new indicator is launched on the market. AkzoNobel will start due course of this project to develop new fertilizer formulations. Gradually the findings of the research project will be embedded in a new fertilizer recommendation system that will be developed in close cooperation with the Soil Quality Department of Wageningen University (WU) (project leader of the proposed research project) and the Nutrient Management Institute (NMI) (a nutrient management consultancy company belonging to Blgg). The dissemination (extension) of project results to farmers is in the hands of NMI. On a European scale it may give a boost to Blgg's activities in Belgium, Denmark, Germany and Spain, AkzoNobel's activities world wide and Triferto's activities in Western Europe.