

## Shifting limitations in crop production in Ethiopia

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### ABSTRACT

At present many attempts are made to increase agricultural productivity worldwide. Typically, this is done by overcoming the production factor that is perceived to be most limiting actual yield levels. Yet, yield limiting factors are dynamic and change according to availability of production factors and yield levels. Moreover, crop production factors have strong interactions and may, to some extent, compensate other limitations. Limitations and interactions between the macro-nutrients (NPK) can be evaluated using the QUEFTS toolbox.

Basically, QUEFTS applies a 4 quadrant approach and each quadrant is successively addressed in different steps (Janssen et al., 1990) by which current limitations to yield levels can be identified. In this study the QUEFTS toolbox was applied for Ethiopia using a comprehensive fertilizer trial (>500 trials). Different limiting factors were found for different regions, but also for different yield levels. In general, at relatively low yield levels soil P levels were often limiting whereas at higher yield levels N became limiting. This has important implications for fertilizer recommendations given the intended yield increase.

Moreover, in some case other factors were apparently limiting current yield levels. Most likely, this was related to the availability of water. The options of extending QUEFTS with water interactions were explored. For water a similar approach was followed as for nutrients and consequently only steps 1 (applications vs potential uptake) and step 3 (actual uptake vs yield) were modified. Step 1 implies the relationship between water application and potential availability of water to crops. This step was quantified using a pedotransfer function for field capacity from data on sand, clay and saturated water content. Step 3 was solved by using minimum and maximum reported values on water productivity for different crops. Subsequently, interactions were calculated similarly to interactions between N, P and K.

In this presentation the results of applying the basic QUEFTS version on the results of the fertilizer trials in Ethiopia are shown. We will demonstrate that limitations are fluctuating throughout the season and for different cropping systems. Hence, there is no such thing as *the* limiting factor. Also, the concept of integrating water with nutrient management in the tool are discussed. Water and nutrient management should go side by side instead of the separate worlds they are currently operating in. Notably, a plant doesn't grow in a fertile soil without water, nor does it grow in a humid soil without nutrients.