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Time : January 17 (Tue) 08.30 – 08.50 a.m
Title : **Global Yield Gap Analysis to Map Options for Sustainable Intensification**

Introduction

With a rapidly increasing global demand for food and limited options for opening up new agricultural land, the assessment of yield gaps is gaining importance. Yield gaps can be defined as the difference between crop yields currently achieved by farmers (the actual yield) and the yields that could potentially be achieved under ideal crop management, either with irrigation (the potential yield) or under rainfed conditions (the water-limited potential yield). Yield gaps can be assessed at different scales, from a field, village, climate zone or country up to a continent or the globe, and provide robust estimates of the untapped crop production potential on existing farmland, based on current climate and available soil and water resources.

The Global Yield Gap Atlas

Yield gap assessments that cover the whole world are appealing because of their consistent use of one method, hence intra-comparable results, and of global databases. However, global studies often lack local or regional agronomic rigour and relevance, since they rely on coarse weather, soil and cropping system data, and models that have not been tested for local conditions (Van Ittersum et al., 2013). Therefore, in contrast, the Global Yield Gap Atlas (GYGA, www.yieldgap.org) employs a bottom-up protocol that uses local data of weather, soils, cropping systems and farm yields to estimate yield gaps (Van Bussel et al., 2015). This protocol ensures that all most relevant locations and weather stations for analyses are selected and includes a method for upscaling local results to climate zone, country and continent. GYGA aims to provide yield gaps of all key agricultural commodities for all food producing countries. Recently, results for an initial 35 countries were presented covering, respectively, c.60%, 58%, and 35% of global rice, maize, and wheat production (Van Ittersum et al., 2016[a]).

Using information from the Global Yield Gap Atlas for sustainable intensification

Although yield gaps are interesting in their own right, they are intended for further use. In a recent paper Van Oort et al. (in press) show a method that utilises yield gaps to indicate where research and development investment might be most profitable, i.e. where and which crops should receive the highest priority for improvement of the global food supply through sustainable intensification. This targets primarily policy makers and R&D directors.

A second, more practical, way of using yield gap information for sustainable intensification is for targeting deployment of technologies, resources and extension services. Such use may primarily be useful for agricultural extension services, agribusinesses and NGOs. Here, the work of Silva et al. (2016) is relevant. They decomposed yield gaps in irrigated lowland rice in the Philippines into efficiency gaps, resource gaps and technology gaps; these gaps may be narrowed, respectively, by introduction of better use of resources in time and space; more resources and new technologies or skills. As an example we take the lack of crop mineral nutrition which has been found to contribute substantially to the present yield gaps in Sub-Saharan Africa (Sanchez et al., 2002); an example of a resource gap. The CGIAR CCAFS-Wageningen sponsored project 'Bringing CSA practices to scale: assessing their contributions to narrow nutrient and yield gaps' aims to narrow yield gaps of maize and legumes in Sub-Saharan Africa, by identifying and addressing crop nutrient gaps in a climate-smart manner. To this end, novel approaches are being developed, utilizing yield gap information from GYGA in combination with QUEFTS-based modelling approaches (Ezui et al., 2016), among others.

A last potential use of yield gaps may be to assess future food security or food self-sufficiency. For instance, Van Ittersum et al. (2016b) showed in a recent study that for Sub-Saharan Africa to maintain its current degree of food self-sufficiency by 2050, almost complete closure of yield gaps on existing agricultural is essential. This implies a huge trend break in annual yield progress. Earlier, Laborte et al. (2012) assessed rice yield gaps in Southeast Asia. They concluded that in Indonesia, Thailand and Vietnam, future rice self-sufficiency can be warranted by narrowing yield gaps but that in the Philippines, yields would need to be increased to the current theoretical potential. Whether such yield increases can be achieved remains to be examined.

References

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