



## POLICY BRIEF

# Improving food security by reducing the maize yield gap in Ghana

### Maize in Ghana

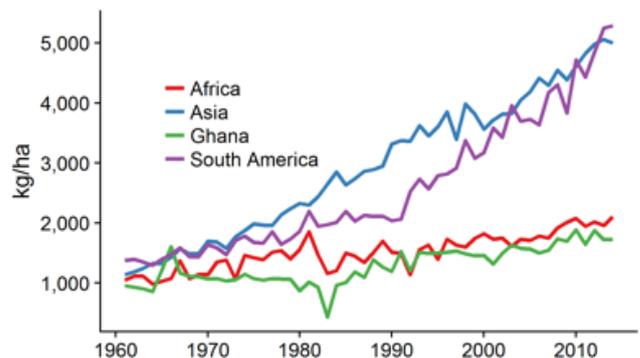
The prospect and context for agricultural growth in low income countries (LICs) have changed considerably over the last decade. An important question is how agricultural development, an important contributor to economic growth, employment and food security, can be best promoted. More specifically, insight is needed into how agricultural productivity can be raised at the level of households, farms, crops and farming communities. Still significant yield gaps, i.e. the difference between potential yield and yield which farmers actually obtain, are observed in the agricultural sector of LICs, which suggest possibilities for improving performance.

Maize is a very important staple and the most consumed cereal in Ghana. A lot of attention has been given to this crop by government. The crop has featured prominently in the agricultural policy documents of Ghana (FASDEP I&II, METASIP I&II). Maize, rice, cowpea, yam and cassava are staples highlighted by the policies to receive special attention. Maize is the most cultivated cereal in terms of volume and area under cultivation. Between 2010 and 2015, the average area under maize cultivation was about 1,064,000 ha (22% of cropland area). Over the same period, production levels averaged 1,788,667 tonnes. This volume and acreage cultivated are more than triple the next most cultivated cereal, i.e., rice (ISSER, 2016). The share of maize in total cereal production is over 50 percent (Ragasa, Chapoto & Kolavalli, 2014).

Maize is cultivated mostly by smallholder farmers and majority of this production is used for food consumption. However, in recent times, it has become a critical input for the poultry sector. The importance of maize for both food security and income in Ghana cannot be over emphasized.

Over the last two decades, the maize sector has seen a consistent increase in the level of output. However, the recorded increase in output has largely been attributed to increase in area under cultivation rather than increase in yield. This is despite the numerous interventions made by government in the sector and the improved varieties that have been introduced to farmers. Maize yields have marginally increased from about 1.2t/ha in 1990 to 1.7t/ha in 2014, representing a growth of only 20 kg/ha per year. The causes of low yields can be attributed to dependence on rainfall, low fertilizer use, poor agronomic practices, etc. Figure 1 shows the evolution of the maize yield per hectare for Ghana in comparison with other regions. There is considerable opportunities for further yield increase. Maize yield in Ghana is even lower than the African average and much lower than those achieved in regions, such as Asia and South America.

Figure 1: Maize yield for Ghana and selected regions.



Source: FAOSTAT [accessed 01-24-2017]

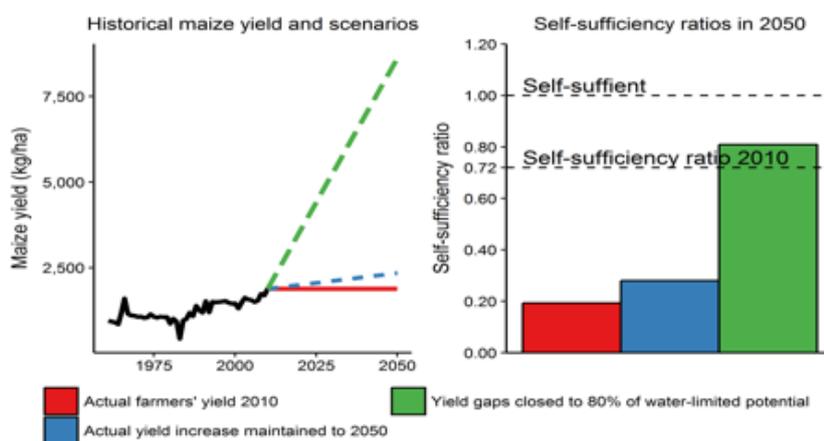
## URGENCY OF PRODUCTIVITY GROWTH

A key question with respect to food security, not only today, but also in the future is to which extent domestic production will be able to satisfy the expected growth in demand. Recent results from the Global Yield Gap Analysis (GYGA; [www.yieldgap.org](http://www.yieldgap.org)) project allow to make a projection of Ghana's self-sufficiency rate with respect to cereals (of which maize contributes over 50% in 2014 the largest share). Currently Ghana's cereal self-sufficiency ratio is 0.72, which means it depends on imports for its cereal needs. Figure 2 shows that the self-sufficiency ratio will dramatically worsen (ratio of 0.3) if maize yield keeps growing at the past rate of 16 kg/ha per year. A high dependency on cereal imports is a potential risk for food security.

A projected increase in population from 24 million to over 50 million between 2010 and 2050 and increasing consumption because of higher income per capita are the main causes for the low self-sufficiency ratio. An alternative scenario shows that if yield levels would reach 80% of potential yield, the self-sufficiency ratio would remain more or less the same as the present situation.

Sustaining present self-sufficiency level would require a maize yield increase of 5.2 tons/ha in comparison to present yield, implying yield growth of more than 130 kg/ha per year. Achieving this will require a tremendous effort from both the private and public sectors, including the policy realm, crop research stations and extension services.

**Fig 2: Maize yield scenarios and cereal self-sufficiency ratios in 2015**



Source: Van Ittersum, M. et al. (2016), *Can sub-Saharan Africa feed itself?*, *Proceedings of the National Academy of Sciences of the United States of America*, 113(52), 14964–14969. <https://doi.org/10.1073/pnas.1610359113>.

## KEY RESEARCH QUESTIONS

The required increase in today's and future cereals supply will need to come from two sources: either an increase in crop land or an increase in yields. As land is constrained an important contribution should come from crop yield increases. This will require the reduction or closure of the yield gap (the difference between potential crop yield and currently realized crop yields). As such understanding the yield gap (its measurement, explanatory factors) and how this is impacted by well-targeted agricultural policies and agronomic research and extension efforts is crucial.

Key research questions and focus points that need to be addressed to achieve the required future crop yield growth are:

- The identification of the main bio-physical, management and socio-economic factors that explain the observed yield gap in cereals (maize) production in selected regions, including Ghana;
- The provision of decision makers, farmers and other stakeholders with action and policy recommendations on how to reduce or close the yield gap taking into account the complex environment in which farmers operate;

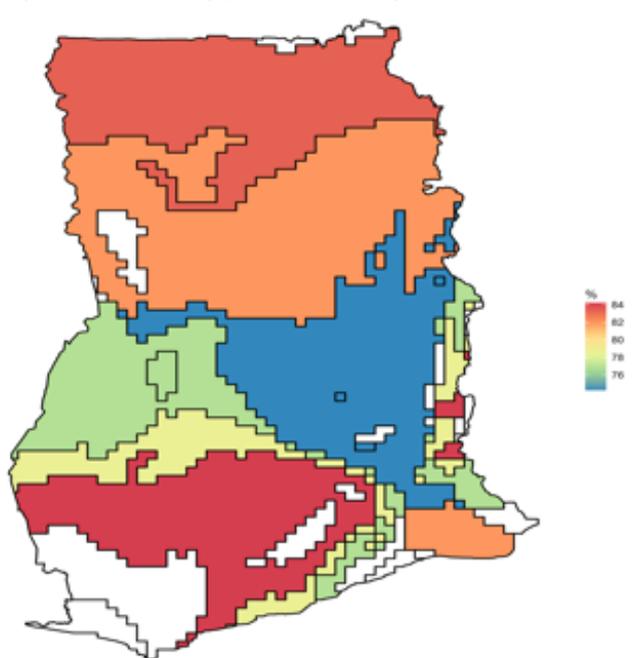
- The elaboration and application of a generic framework that combines agronomic and economic (or farm behavioral) approaches to the assessment of yield gaps and agricultural productivity.

## MAIZE YIELD GAPS IN GHANA

Within the Global Yield Gap Atlas (GYGA, [www.yieldgap.org](http://www.yieldgap.org)), estimates of potential yield and yield gaps for nine major food crops in a large number of countries, including maize in Ghana are already determined and mapped (Figure 2) (Van Ittersum et al. 2013, Grassini et al. 2015). Yield potential is the biophysical maximum yield of a crop (without limitations from nutrients, pests and diseases) and is calculated using crop simulation models. For rainfed crops the water-limited yield potential is calculated, taking into account constraints of water supply. Figure 3 presents a map of the relative yield gap in Ghana using estimations for water-limited potential yield and information on actual yield from national statistics and local experts. Potential maize yield ranges from over 11 tons/ha in the South to below 7 tons/ha in the Centre of Ghana.

According to the GYGA-project actual farmers' yield lies often below 1.3 and 1.8 tons/ha resulting in yield gaps of between 74 and 84 percent. Hence, there is large scope to increase maize yield in the future. (fig.3).

Figure 3: Maize yield gaps in Ghana by region



Source: Global Yield Gap Atlas (GYGA), [www.yieldgap.org](http://www.yieldgap.org). Bold lines indicate the location of case-study regions (see box).

## EXPECTED RESEARCH RESULTS AND RELEVANCE FOR STAKEHOLDERS.

The research of the IMAGINE aims to generate results that are:

- Relevant for policy makers by providing insights into drivers of agricultural performance and how these are linked to policy and donor interventions.
- Helping farmers and rural communities and provide them insights and education on how productivity can be improved in the target region (using on-farm demos and active dissemination and extension actions to share practical knowledge).
- Contributing to capacity development at the level of socio-economic and agronomic research, policy making level, and other stakeholders in the supply chain

The results of the research will be discussed with policy makers and stakeholders in a Policy Roundtable workshop. The aim of this workshop is to share and discuss results and lessons learned, which policy makers and international donors can use to better target their agricultural and food security initiatives.

## Box IMAGINE project

The IMAGINE project: This project uses a framework that integrates agronomic and economic approaches to assess the yield gap and analyze agricultural performance at the plot and farm level. Based on production ecological concepts and economic production theory, three different gaps are distinguished that bridge four yield estimates.

In the project the yield gap is estimated and explained at two different levels. Nationally representative farm level surveys are analyzed with econometric estimation techniques to assess the impact of economic and infrastructural constraints at the national and sub-regional level. This is deepened by means of an in-depth investigation of farm and plot level production data that will be gathered via surveys in selected regions in Ghana and Ethiopia. For Ghana, case studies are done in Nkoranza and Savelugu Municipalities. Nkoranza is located in the Brong Ahafo region which is in the transition zone, meaning that it is characterized by patches of Savannah and forest plots and it has a minor and a major rainy season. Around 82% of the households in Nkoranza are engaged in agriculture with about 99% of them involved in crop cultivation. Savelugu is located in the Northern region, which is a Savannah zone with a single rainy season.

The Northern region has the greatest proportion of grain production within the country. Roughly 90% of the households in Savelugu are engaged in agriculture with about 97% of them involved in crop farming. Results from the Global Yield Gap Atlas indicate an average actual yield of 1.8 and 1.5 ton/ha in respectively Nkoranza and Savelugu. Here the average yield gap for Nkoranza and Savelugu was estimated at 6.1 and 6.6 ton/ha respectively. Based on this the project will identify promising technological improvements and policy interventions, that will be assessed in on-farm experiments and policy and stakeholder workshops.

IMAGINE is implemented in Ghana by Wageningen University & Research, University of Ghana, College of Basic and Applied Sciences, and Institute of Statistical, Social and Economic Research.

<sup>1</sup> ISSER, (2016). The state of the Ghanaian economy in 2015. Institute of Statistical Social and Economic Research (ISSER), University of Ghana, Legon, Ghana.

<sup>2</sup> Ragasa, C., Chapoto, A., & Kolavalli, S., (2014). Maize Productivity in Ghana. GSSP Policy. Note 5. Washington, D.C.: International Food Policy Research Institute (IFPRI). <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/128263>

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