



CCGA Changing Course in Global Agriculture

Kenya Agricultural Performance and Targets: Scenarios and Implications

EXECUTIVE SUMMARY

This policy brief describes simulated policy scenarios designed to achieve Kenya's agricultural performance goals and targets. The analysis was undertaken in response to a request by the Ministry of Agriculture, Livestock and Fisheries (MOALF) of Kenya to use the Threshold-21 (T21) model to assess the potential effectiveness of policies to achieve Kenya's agricultural targets and the Sustainable Development Goals (SDGs) 1 and 2, which are closely linked to the agricultural sector. Six policy scenarios are simulated over the years 2017 to 2030. Amongst others we analyzed scenarios with increased input subsidy, farmer training in sustainable ecological agriculture, expansion of irrigation technology and improved farmer organization for better access to markets and finance. An underlying assumption for all scenarios was a 10% increase in government budgetary allocation to agriculture as recommended in the Maputo declaration. Simulation results reveal that a combined policy of increased farmer trainings, irrigation expansion and support for farmers' organization triggers the greatest improvements towards achieving Kenya's agriculture performance targets. Compared to the base run this includes a reduction in poverty (SDG 1) and undernourishment (SDG 2) by more than 40% by 2030. At the same time simulation results indicate that Kenya's poverty and hunger targets might be overly ambitious to be achieved by 2030 under any of the policy scenarios assessed.

INTRODUCTION

Kenya aspires to become a middle-income country by 2030, offering all its citizens a high quality life. The Government of Kenya has set a target of 10% growth in GDP per annum, with agricultural GDP to grow by

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T21® is an integrated and dynamic planning tool developed by the Millennium Institute. For further information, see www.millennium-institute.org.

Cover Photo: Tea pickers in Kenya's Mount Kenya region. © Neil Palmer (CIAT).



7% per annum through 2030 (Kenya Vision 2030, 2007; SMTP, 2013). Kenya also aims to achieve the Sustainable Development Goals (SDGs) including eliminating poverty (SDG1) and hunger (SDG2) by 2030.

This analysis responds to a request by the Ministry of Agriculture, Livestock and Fisheries (MOALF) to assess the likelihood of achieving Kenya’s agricultural performance targets by testing the efficacy of various agricultural policies in achieving the SDGs that are directly linked to the agriculture sector, and by identifying alternative policies that could support achievement of these targets. For this analysis the Threshold 21 (T21) model is applied. T21 is an integrated simulation model, developed to test and analyze national policy options, and to explore systematically the consequences of policies on society, the economy and the environment over medium to long-run time horizons. T21 is based on System Dynamics methodology and macro-economic principles.

METHODOLOGY

Based on a multi-stakeholder consultation, six policy scenarios were identified and examined (Table 1). The performance indicators examined are: poverty (share of

population below poverty line), undernourishment (share of population undernourished), agricultural production (in terms of total value added), employment (share of labor force employed), yield (average for all crops) and crop production (value added for all crops). These indicators are used to assess the potential degree of attainment of targets for agricultural GDP growth and SDGs for ending poverty and hunger by year 2030.

RESULTS OF SCENARIO SIMULATIONS

Results for all six scenarios are depicted in Figures 1-3 for the period 2017 - 2030.

Figure 1 shows the simulated agricultural production (in value added terms) under the base run, input subsidy, farmers training, irrigation expansion, farmer’s organization and combined agriculture policy scenarios. Agricultural production is highest under the combined agriculture strategy due in part to the complimentary effects of the combined policies. These effects are synergistic, i.e., the net effect is greater than the sum of the parts. Agricultural production ranks second highest

Table 1: Description of all six examined policy scenarios

Policies	Description	Comments
1. Business as usual (BAU)/ Base run (BR)	Simulates past dynamics and trends of key indicators, and presents their likely future trajectories if policies and external influences remain unchanged.	The model is calibrated to fit historical data over the period (1980-2016).. The BAU scenario projects model variables over future time horizon (2017-2030) using unaltered policy and budgetary assumptions.
2. Irrigation expansion	Simulates the impact of increasing the share of agricultural expenditure for irrigation development (such as building dam capacity, installing irrigation equipment).	Irrigation of cultivated land increases the crop intensity index and the total cultivated area, resulting in increased production.
3. Farmer organization (Market and financial access)	Simulates the effects of increasing agricultural expenditure for the development of farmers’ organizations for expanded markets and access to finance.	Expanding markets and financial access decreases poverty, and also decreases food waste while improving food security, productivity and production indicators.
4. Input subsidy	Simulates the effects of increasing the share of agricultural expenditure for fertilizer subsidies above the BAU case.	Increased use of mineral fertilizer results in increased soil nutrients, yield, and production. It also causes unintended negative impacts such as increased nutrient discharge through leaching and runoff and damage to soil organic matter.
5. Sustainable agriculture training	Simulates the effects of increasing the share of agriculture expenditure for farmers’ training in sustainable agro-ecological farming over the BAU case. This includes practical field training in agro-ecology practices and natural fertilizer application as well as up-scaled extension outreach.	The utilization of natural fertilizer, conservation agriculture and biological insect control can increase soil nutrients and decrease crop losses from pest, thus increasing yields and production.
6. Combined agriculture strategy	This scenario combines irrigation expansion, training in sustainable agriculture, and farmers’ organization policies in order to assess their combined impacts.	This combined strategy achieves a synergistic effect, i.e., the impact is greater than the sum of the policy effects when simulated separately. This synergy is due to reinforcing linkages between the policies.

It is assumed for policy scenarios two to six that the total agricultural budget is raised to 10% of the total government budget.

Table 2: Parameter settings for BAU and policy scenarios

Variables	Policy Scenarios					
	Business run (BR)	Input Subsidy	Farmers Org.	Irrigation expansion	Sustainable Ag. Training	Combined Ag. Policy
Share of agriculture (ag.) budget (% of total gov. budget)	4	10	10	10	10	10
Share expenditure for input subsidy (% of ag. budget)	5.4	30	BR	BR	BR	BR
Share of expenditure for irrigation (% of ag. Budget)	0.5	BR	BR	30	BR	20
Share of expenditure for training (% of ag. Budget)	13.7	BR	BR	BR	30	20
Share of training expenditure for LEI practices (% training budget)	20	BR	BR	BR	60	60
Share of expenditure for farmer organization (% ag. budget)	3	BR	30	BR	BR	20

The settings for policy scenarios 2-6 are implemented at year 2017.

under the irrigation expansion policy, which combines both an increase of the crop intensity index and the area under cultivation. However, this policy scenario could eventually stagnate as it is limited by the availability of potentially irrigable land and water. Agricultural production is third highest under the farmers’ training scenario, which supports knowledge-based sustainable farming that increases productivity and production over a longer time horizon. The increased agricultural production associated with the farmer organization policy is due to improved access to markets and financial means. Finally, the smallest increase in agricultural production is achieved through investment in the input subsidy. This is attributed to the known adverse effects of chemical fertilizers on soil organic matter and natural soil fertility (Pedercini 2016).

Figure 2 shows the percentage changes of poverty (an indicator for SDG 1), undernourishment (an indicator for SDG 2), agricultural production, employment, yield and crop production at year 2030 when compared to BAU: All

scenarios indicate favorable changes in all the parameters, with the exception of the input subsidy scenario, which reduces employment based on fostered mechanized production. Furthermore, its minor contribution to SDGs 1 and SDG 2 is associated with long-term negative environmental effects and dependency on chemical fertilizer. On the positive side, investing in irrigation expansion triggers the most favorable impact for poverty and undernourishment reduction in comparison to all other scenarios. This is due to its positive impact on crop production achieved through increased crop area and cropping intensity. Investing in farmer organization generates the second most desirable change in poverty and undernourishment, underlining the relevance of strengthening access to markets and finance. Farmer training in sustainable ecological agriculture has a strong impact on average yield, and consequently on agricultural production. Combining investments in irrigation expansion, training in ecological agriculture, and strengthening farmer organizations’ access to markets and financial facilities in

Figure 1: Simulation results of real agricultural production (Ksh) under BAU and selected policy scenarios

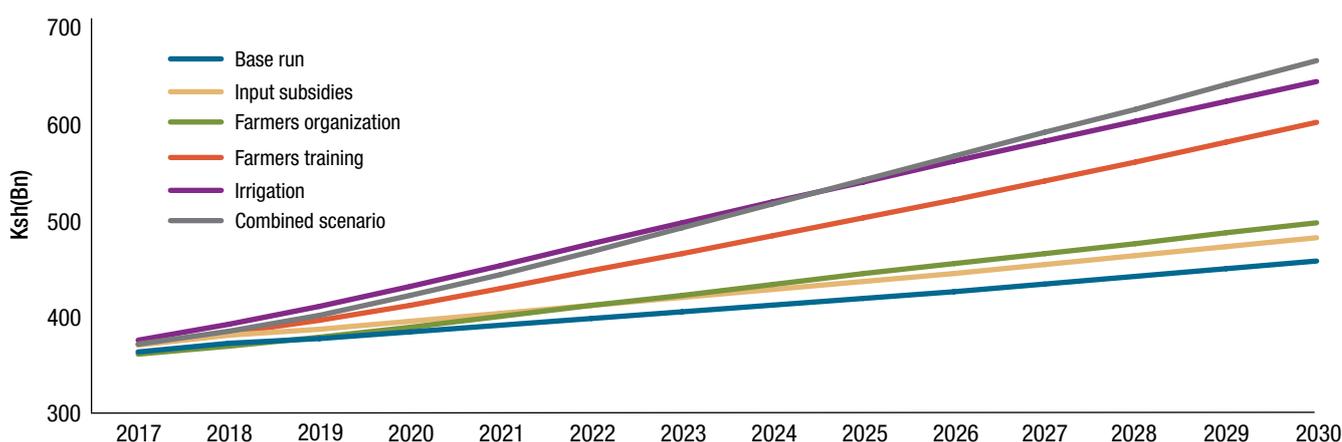
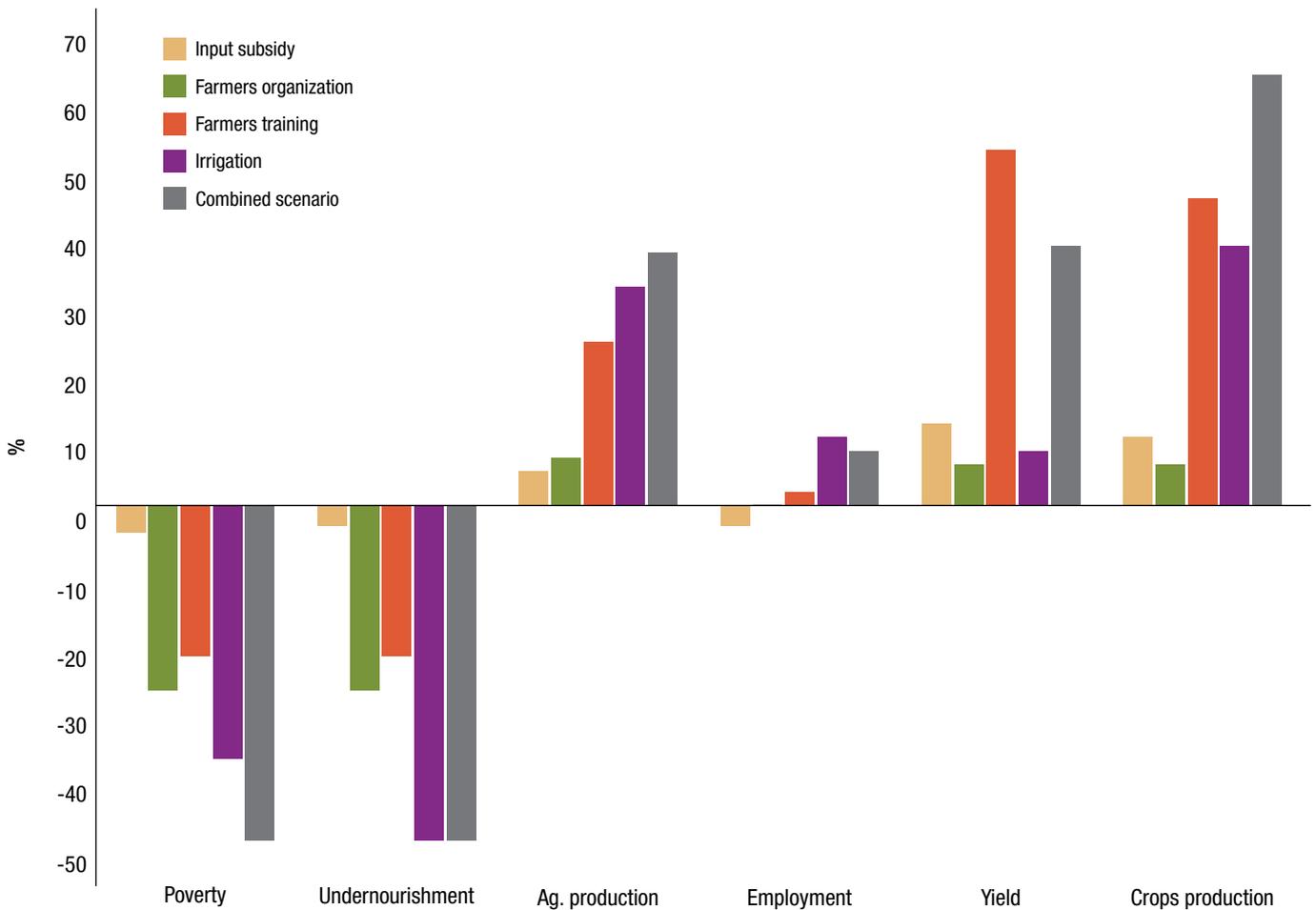


Figure 2: Percentage changes (compared to BAU) of key indicators under the policy scenarios in 2030



the combined agriculture strategy results in the greatest improvement among all the desirable indicators except in average yield. The relatively low average yield under the combined agriculture strategy policy scenario is associated with lower government expenditures invested in farmers’ training.

ACHIEVEMENT OF AGRICULTURAL PERFORMANCE AND TARGETS

The 2030 agenda calls for total eradication of poverty and undernourishment. All the scenarios tested fall short of these aspirational goals, however some policies perform better than others. Figure 3 compares expected performance for SDG 1 (poverty) and SDG 2 (undernourishment) under the base run (BAU), input subsidy, farmer training, irrigation expansion, farmer organization and selected agriculture scenario at year 2030.

Attainment is measured as follows: the targets used here for SDGs 1 and 2, ie, poverty and undernourishment, are

both set to zero in accordance with the Agenda 2030 mandate. There is a gap between the values of the two indicators at year 2015 and the target values. Attainment is the percentage of the gap that is closed by year 2030.

All of the simulated policies make progress towards SDGs 1 and SDG 2. The input subsidy policy barely exceeds BAU due largely to its limited impact on poverty, poverty is tightly coupled to undernutrition. Farmer organization improves poverty, which has a favorable impact on undernutrition. Farmer agriculture sustainability training performs a few percent lower than the farmer organization policy, as the benefits of markets and credit are lacking. Irrigation expansion reaches 65 and 61 percent for poverty and undernourishment due to the effects on cropping intensity and area. The combined agriculture strategy generates the best results, reducing both poverty and undernourishment and reaching attainment levels of 72% and 69% for SDGs 1 and SDG 2. Furthermore, the impact of the selected agriculture policy is positive for every indicator considered in Figure 2.

DISCUSSION

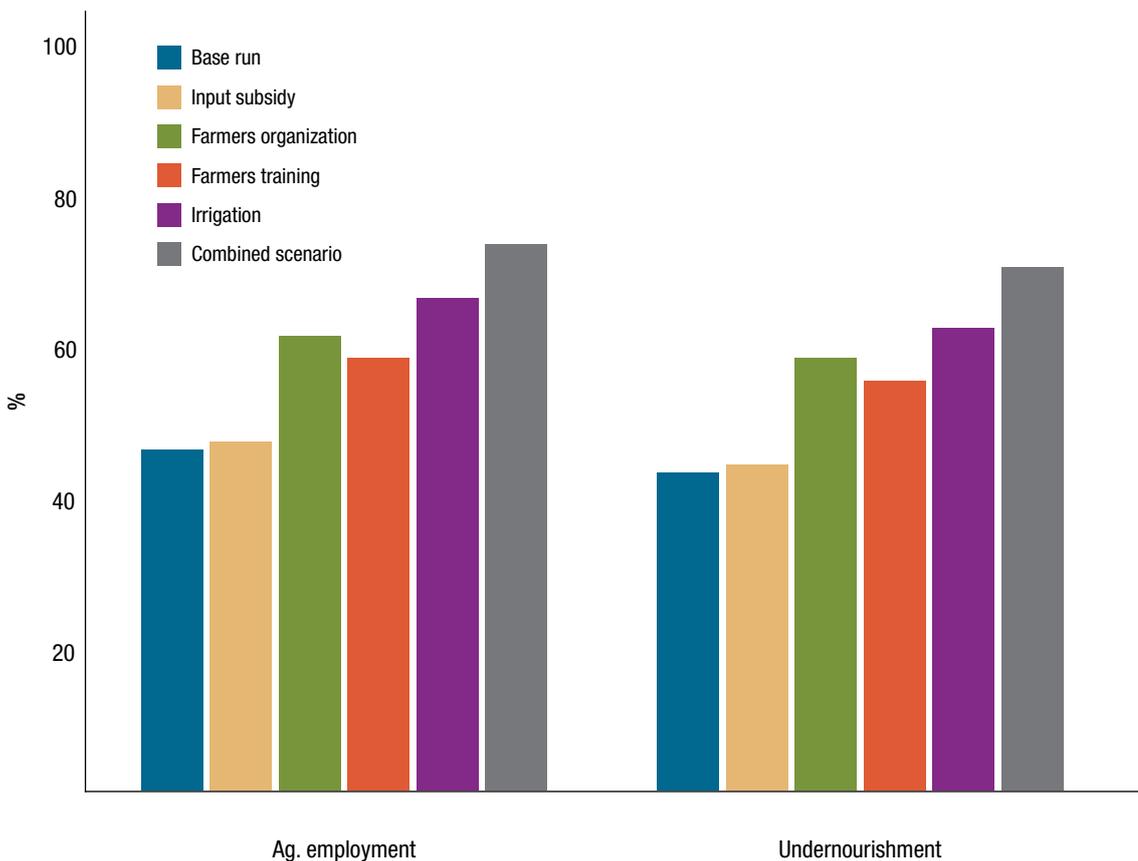
An underlining assumption in this analysis is that the Kenyan government increases the share of the agriculture budget to 10% of the total national budget as suggested by CAADP. The budget increase provides the funding for the investments under the five scenarios (excluding the base run). Hence, the need for additional financing or reallocation of the government budget to the agriculture sector is vital to bring the changes shown in the simulation results. The input subsidy and farmers organization policy scenarios produce similar results for agricultural production in different ways; the former by increasing productivity and production at the farm level, the later by unlocking market and financial barriers. The positive impact of the input subsidy policy on other indicators such as poverty and hunger is quite minimal compared to the farmer organizations’ policy scenario. Unlike the farmer organizations’ policy scenario, the input subsidy scenario has negative impacts on employment. The overall positive impact of the irrigation expansion policy is greater than the farmers training policy scenario except for crop yields. Both of these scenarios contribute to reduction of poverty and hunger. The overall contribution of the combined

agriculture policy is the highest for all indicators except crop yield, which is only exceeded by the farmers training policy scenario.

From the model assumptions in Table 1 and the model results shown in Figures 1, 2 and 3, the best results are observed in the combined agricultural strategy scenario. This suggests that the government should selectively intervene in farmers training in sustainable agriculture, irrigation expansion, and farmers’ organization to narrow the gap observed in achieving targets. However, government policies that either increase expenditure for input subsidy or increase expenditure for arbitrary (untested) combinations of policies could result in negative impacts or delay the achievement of targets.

Some policies could show unfavorable results in the longer run, for example the irrigation expansion scenario could stabilize (instead of increase) beyond 2030 as it is limited by the availability of suitable land and water. This scenario could also increase the water stress index and adversely impact other sectors in the long run. Rainfall is expected to increase through 2030 and beyond in Kenya. This is addressed in the model; however, unpredictable

Figure 3: Expected performance from scenarios compared to SDG1 (eradicate poverty) and SDG2 (eradicate undernourishment) by 2030 (100% equals the full achievement of the SDG)



droughts or floods could bring adverse impacts on key socio-economic indicators and negatively influence the achievement of SDG targets. On the other hand, non-agricultural government policy interventions such as increasing infrastructure such as road networks and increasing small scale photovoltaic energy could create synergies with the agriculture policies and boost the production and productivity that support the achievement of SDG targets.

RECOMMENDATIONS

Based on the T21-Kenya model findings, the following recommendations are made:

1. Strengthen irrigation expansion schemes for small-scale farmers to increase crop and agricultural production consequently improving food & nutrition security and reducing poverty.
2. Provide intensive training in sustainable agriculture to small holders to transform Kenyan agriculture to sustainable production modes at scale. This would involve training of trainers, field demonstrations, and communications to accelerate farmer adoption of sustainable practices and to encourage farmer-to-farmer exchanges.
3. Increase support for farmer organization for better market and financial access and input acquisition. This

would help increase farmers' savings, improve food and nutrition security and reduce poverty.

4. Increased use of chemical fertilizer could improve productivity and production in the immediate term but may damage soil organic matter and natural soil fertility in the long run. This implies the need to exercise caution with regard to providing subsidies for chemical fertilizer. Natural fertilizers, including green manure and compost, should be emphasized for sustainable crop production.
5. The government should emphasize combinations of selected policies. A recommended combination is the joint increase of expenditure (as a share of agriculture budget) for irrigation expansion, farmer's training in sustainable agriculture and strengthening farmer organizations' access to improved market and financial facilities. Based on simulations with the T21-Kenya model, this leads to the best results for the achievement of the targets at the national level. However, implementation of these results at county level should consider the different resources, agro-ecologies, and farming systems of the county. County-specific T21-type models should be developed and applied for addressing county-specific resource allocation and policy decisions.
6. Increase the overall agricultural budget to 10% of total government budget, as recommended by the Comprehensive Africa Agriculture Development Programme to provide support for the recommendations listed above.

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