



BCG

Impact of increasing fertilizer prices on maize production in Kenya

September 2022



Executive summary

- Fertilizer supply shocks started in 2020 due to multiple factors including COVID-19 related supply chain disruptions, high input prices (e.g., natural gas), lower production in Europe, and export restrictions from China. As a result, fertilizer prices increased globally, and in Kenya fertilizer prices increased by 50–60% (2020–2021).¹
- Maize production (accounts for roughly 85% of total cereal production in Kenya) in 2020–2021 dropped by an estimated 550,000 metric tons (MT)² due to fertilizer price increases (resulting in lower application rates), persistent failed rainfall (the most severe drought in 40 years), among other factors. Accounting for time from farm to mouth, this resulted in a price increase for 1 kg maize flour of 30–65% in 2022 (before the Government of Kenya - GoK subsidy announced in July 2022, which was later suspended in August 2022),³ and the release of all national maize reserves in May 2022.⁴
- As a result of the Ukraine-Russia conflict and sustained high energy prices, fertilizer prices in Kenya have risen further by approximately 70% nationally from 2021–2022.⁵
- The World Food Programme (WFP) and Boston Consulting Group (BCG) estimate that the fertilizer price increase of approximately 70% (2021–2022), keeping all other factors constant, could result in a further drop in maize yields in 2022 by an estimated 400,000 MT nationally, representing a decline of 12% compared to 2021 (or an estimated 22% decline if compared to average production between 2016–2020). This combined with the drop seen in 2020–2021 accounts for approximately 950,000 MT reduction in production of Maize over 2 years.
- The drop in 2021–2022 reflects the annual maize consumption of 4–5 million Kenyans per year⁶, the impact of which will not be seen until 2023 after the harvest cycles of 2022 and accounting for transportation and processing time for conversion to flour.
- Declining production due to rising fertilizer prices, drought and other factors is estimated to result in an additional 3 million people (total 4.1 million - approximately 30% higher than the previous assessment in February 2022) facing high levels of acute food insecurity⁷ especially in Arid and Semi-Arid lands (ASAL) by June 2022 in Kenya.
- Top 7 counties of Trans Nzoia, Uasin Gishu, Bungoma, Narok, Nakuru, Kakamega, and Nandi combined account for approximately 50% of the national volume of maize

¹IFPRI (2022), High fertilizer prices contribute to rising global food security concerns. Available [here](#).

²FAOSTAT database (2022).

³Business Daily (2022), State eases maize flour prices to Sh100 until elections. Available [here](#).

⁴Business Daily (2022), NCPB releases maize stocks to tame flour price. Available [here](#).

⁵Business Daily (2022), Kenya coffee output set to fall 10pc on fertilizer crunch. Available [here](#).

⁶KNBS (2019), Enhanced Food Balance Sheets for Kenya 2014–2018 results.

⁷FAO: Country brief, Kenya (2022), available [here](#); IPC acute food insecurity classification, available [here](#)



production and are expected to exhibit the largest production declines, ranging from 13% to 18%.

- The counties that report high levels of vulnerable populations—namely Mandera, Marsabit, Samburu, Turkana, Tana River, Isiolo, Wajir and Garissa (ASAL regions in Kenya)—remain the lowest maize producers and will likely be home to the most vulnerable populations given the impact of drought in these regions and dependence on other counties for food imports.
- There are multiple factors that impact maize yields such as rainfall, seed and soil quality, mechanization, and farmer training etc. Lack of rainfall, in particular, could further reduce yields by up to approximately 30%. Our approach, however, holds all factors constant to isolate the impact of fertilizer.
- Given market projections for fertilizer prices to continue to remain high in 2023 (less than 2022 but still about 1.5 times higher than the 2019-2020 average), depreciating currency (against US Dollar) and predicted below average rainfall in next season, to sustainably increase maize yields going forward, food-system actors will need to focus support on transforming agricultural productivity and efficiency and increasing resilience for smallholder farmers to climate change and external price shocks.



Highlights maize production in numbers



70%

national fertilizer price increase
from 2021-2022



20-30%

reduction in maize yields of
fertilized fields from 2021-2022



~400,000 MT

reduction in national maize
production from 2021-2022,
on top of a ~550,000 MT decline
from 2020-2021



Equivalent to the annual maize
consumption of

4-5 million Kenyans from
declining production in 2021-2022

Top maize producers = 50% national production		Top vulnerable		
County	Change in production	County	% People in poverty	% Children aged 0-14
Trans Nzoia	-14%	Tana River	64%	48%
Uasin Gishu	-16%	Samburu	70%	49%
Bungoma	-18%	Turkana	64%	45%
Narok	-13%	Isiolo	68%	45%
Nakuru	-14%	Mandera	84%	55%
Kakamega	-15%	Marsabit	74%	47%
Nandi	-17%	Wajir	62%	50%
		Garissa	57%	46%



Introduction

Fertilizer prices have been rising since 2021, resulting from several supply and demand side factors putting pressure on global food systems. The Ukraine-Russia conflict only exacerbated this problem, with fertilizer prices reaching an all-time high in both the global and domestic markets in East Africa, raising concerns over 2022 cereal harvests and food insecurity in East Africa. To this end, the WFP conducted an assessment on the potential impact of the increase in fertilizer prices titled “**Estimated likely impact of increased fertilizer prices on Cereal production in Eastern Africa during 2022 cropping year.**”⁸

Following this research, the WFP, in conjunction with BCG, used an analytical approach to conduct further assessment on the forces expected to impact food systems in East Africa, starting with a county level analysis on Kenya maize production. This study supplements the existing country level early food insecurity warning systems and helps tailor mitigating interventions and is the first in a series of papers that present these findings, **highlighting the anticipated impact of fertilizer price increases on maize production at a county level in Kenya.**

Overview of Kenya

Agriculture plays a vital role in Kenya's economy, accounting for about 22% of gross domestic product (GDP)⁹ and employing up to 50% of the population.¹⁰ Maize is the main staple food crop in Kenya, grown both for consumption and as a cash crop. It accounts for roughly 85% of total cereal production in Kenya and approximately 1.5 million hectares of cultivated land.¹¹ More than 95% of the country's smallholder farmers are engaged in maize production, accounting for an estimated 85% of total maize produced.¹² The crop is estimated as supplying 30%–45% of the calories consumed by the average Kenyan.¹³

Impact of fertilizer price increases between 2020 and 2021

Global fertilizer prices increased by approximately 70% between 2020 and 2021 (prior to the Ukraine-Russia conflict) because of both supply- and demand-side forces (see Figure 1).

On the supply side, COVID-19 related disruptions and rising energy prices related to the production of key fertilizer ingredients (particularly ammonia for nitrogen-based fertilizers), resulted in rising prices. In Europe, the surging costs of natural gas caused producers of fertilizer to cut back production, unable to compete

⁸WFP (2022) Estimated Likely Impact of Increased Fertilizer Prices on Cereal Production in Eastern Africa During 2022 Cropping Year. Available [here](#).

⁹KNBS (2022), Quarterly GDP report.

¹⁰WBG (2022), World Development Indicators database.

¹¹KALRO (2022), Maize. Available [here](#).

¹²Kalro (2021), Maize trainer of trainers' manual. Available [here](#); University of Nairobi (2013), Determining the factors that affect maize production in Turbo constituency, Kenya. Available [here](#).

¹³FAOSTAT Database (2019). Available [here](#).



with markets with lower energy costs such as the US, Australia, and Trinidad and Tobago.¹⁴ In China, rising coal prices have led to a rationing of electricity usage, causing several fertilizer plants to decrease production. Citing the need to ensure domestic availability and food security, China, the second-largest global exporter of fertilizer, imposed a quota on fertilizer exports in October 2021, resulting in significant supply shortages pushing prices higher.¹⁵

Additionally, COVID-19 related bottlenecks in global value chains disrupted production and transportation of both fertilizers and fertilizer inputs.¹⁶

On the demand side, agriculture commodity prices (such as corn, soybean, and wheat) experienced price rise between 2020 and 2021. This incentivized farmers to increase both fertilizer application rates and crop acreage, resulting in strong demand. This coupled with limited supplies drove up prices significantly.¹⁷

Between 2020 and 2021, Kenya experienced a fertilizer price increase of 50–60%. This, along with consecutive failed rainfall seasons leading to the region's most severe drought in 40 years, contributed to a drop in maize production of approximately 550,000 MT.¹⁸ During this period, Kenya increased its imports of maize by



¹⁴ CARD (2021), Fertilizer markets: the clash between energy, ag, weather, profits, and policy. Available [here](#)

¹⁵IFPRI (2022), High fertilizer prices contribute to rising global food security concerns. Available [here](#).

¹⁶ Bloomberg (September 2021 – Fertilizer prices soar as storms roil industry hub. Available [here](#)

¹⁷WBG Blogs (2021), Fertilizer prices expected to stay high over the remainder of 2021. Available [here](#).

¹⁸FAOSTAT database (2022).



approximately 200,000 MT, amounting to roughly US \$120 million in value imported (representing an approximately 80% increase in both volume and value imported from the previous year).¹⁹ The global state of the fertilizer industry, along with other shocks in climate specific to the region, have contributed to a consistent increase in fertilizer prices since 2020 that have impacted maize availability and prices.

Fertilizer prices are highly correlated with food prices in the long run and, as shown in Figure 1, prices have consistently risen since 2020. The current price increases are a part of the consistent pressure the fertilizer industry has faced since 2020.²⁰

The reduced production in 2021 has resulted in rising food prices in 2022, with the average price of a kilo of maize varied from KES 65-80 between February-July 2022, compared to the long term average of KES 40-60 (30-65% increase prior to the GoK's subsidy on maize flour).^{21,22} GoK was also forced to release all its national maize reserves in May 2022 to lower the price of maize.²³ GoK suspended the maize subsidy in August 2022, leading to some reports

showing prices of maize reverted to pre-subsidy levels.²⁴

Estimated impact of fertilizer price increases between 2021 and 2022

The Ukraine-Russia conflict resulted in additional shocks in the supply chain for fertilizers, with global fertilizer prices rising a further approximately 55% between 2021 and 2022. Several factors, including surging input costs, supply disruptions caused by sanctions on Russia and Belarus, and additional export restrictions by up to 34 countries,^{25,26} have resulted in a significant price increase.

The Ukraine-Russia conflict has resulted in the price for 50 kg fertilizer bags spiking by approximately 70% from KES 3,500 in 2021 to KES 6,000 in 2022.²⁷

While fertilizer use improves maize production yields by 50%–70%,²⁸ studies show that the cost of fertilizer, availability of alternatives to fertilizer, and weather patterns all have negative effects on fertilizer use.²⁹ An increase in the price of fertilizer results in reduced demand and use of fertilizer, in turn resulting in reduced crop yields.

¹⁹ UN Comtrade: Maize imported by Kenya, 2020-2021. Available [here](#).

²⁰WBG Blogs (2022), Fertilizer prices expected to remain higher for longer. Available [here](#).

²¹Business Daily (2022), State eases maize flour prices to Sh100 until elections. Available [here](#).

²² Reliefweb: Kenya 2022 long rains season assessment report (August 2022), available [here](#).

²³Business Daily (2022), NCPB releases maize stocks to tame flour price. Available [here](#).

²⁴ TukoKenya: Unga Crisis (August 2022), available [here](#); Nation: Govt. suspends Sh100 maize flour subsidy, available [here](#).

²⁵WBG Blogs (2022), Fertilizer prices expected to remain higher for longer. Available [here](#).

²⁶WBG (2022), Food Security Update July 15, 2022. Available [here](#).

²⁷Business Daily (2022), Kenya coffee output set to fall 10pc on fertilizer crunch. Available [here](#).

²⁸USAID: Maize Value Chain Analysis August 2015. Available [here](#).

²⁹Welime, A. M. (2014), Effect of fertilizer price subsidies on fertilizer use in Kabuyefwe location of Bungoma county, Kenya. Available [here](#).



Table 1: Estimated fertilizer price elasticity to use and crop production elasticities

% increase in fertilizer prices	% reduction in fertilizer use	% reduction in crop production
10	5.2	3.8
20	10.4	7.6
30	15.6	11.4
40	20.8	15.2
50	26.0	19.0
60	31.2	22.8
70	36.4	26.6
80	41.6	30.4
90	46.8	34.2
100	52.0	38.0

Note: Light-green shading reflects realized national fertilizer price increases for Kenya as of July 2022.

A 100% increase in fertilizer prices has been found to result in a 38% reduction in crop production. Holding other factors constant, an average fertilizer price increase of 10% would reduce fertilizer use by 5.2%, in turn leading to a decline in maize output of approximately 3.8% at a national level (refer Table 1).³⁰ Using county-level prices for fertilizer, the data can be adjusted to study declines in production.

WFP and BCG modelled the impact the increase in fertilizer prices would have at the county level in Kenya for 2022. Building on the estimated fertilizer price elasticity of use (described in Table 1) and using historic maize production levels, fertilizer application rates and price increases

between 2021 and 2022, we estimated the reduction in maize production at a county level. Data for the modelling was sourced from the following:

1. **The Ministry of Agriculture, Livestock, Fisheries and Co-operatives** for crop production data and fertilizer price changes per county³¹
2. **AfricaFertilizer.org** for fertilizer application rates per county³²
3. **Kenya National Bureau of Statistics (KNBS)** for demographic data per county

There are several additional factors that materially impact maize yields, such as rainfall, quality of seeds, the level of mechanization, and the type of farm practices employed.

The East African region is experiencing its most severe drought in 40 years. The failure of the March-May long rains, marked the 4th consecutive failure of the rain season since late 2020, exacerbating an already critical food security situation.³³ Research shows that extreme drought can reduce crop yields by over approximately 30%.³⁴ With the impact of inadequate rainfall well understood on maize yields, our approach focused on isolating the impact of fertilizer holding other factors constant. **However, we acknowledge changes in other factors can materially alter our predictions.**

³⁰WFP (2022) Estimated Likely Impact of Increased Fertilizer Prices on Cereal Production in Eastern Africa During 2022 Cropping Year. Available [here](#).

³¹Accessed from the Kilimo website. Available [here](#).

³²Accessed from the Vifaakenya website. Available [here](#).

³³ FAO country brief – Kenya (20220. Available [here](#)

³⁴ Li et al – Impact of rainfall on maize yields. Available [here](#)



Isolating the impact (assuming other factors constant) of the roughly 70% increase in fertilizer prices, we estimate that Kenya will experience a national **reduction in maize production of approximately 400,000 MT in 2022**, approaching a total of 2.9 million MT (compared with approximately 3.3 million MT in 2021), representing an estimate 12% decline (about 22% decline if compared to average production between 2016-2020) in national maize production from 2021.³⁵ **Over 2 years (2020-2022), this represents an estimated 950,000 MT decline.**

The gap in available maize in 2022 will need to be filled through imports, the value of which would be equivalent to approximately US \$180 million at a price of US \$450 per MT.^{36,37}

Considering a depreciating currency trend of the Kenyan Shilling against the US Dollar, this import value gap will continue to increase in the near future as imports become more expensive.³⁸

KNBS reported that the average consumption of maize per capita in Kenya from 2014 to 2018 was equal to approximately 64 kg.³⁹ Using this estimate and factoring in potential post-harvest maize losses of about 25%,^{40,41} the reduction in maize production is **equivalent to the**

annual consumption of 4–5 million Kenyans in a year.⁴² The impact on food consumption will likely be seen in 2023 after the long rain harvest cycle of 2022 ends in November/December, accounting for the transportation and processing of maize and shelf life of flour.

Trans Nzoia, Uasin Gishu, Bungoma, Narok, Nakuru, Kakamega, and Nandi, which combined account for 50% of national maize production, are expected to exhibit the largest production declines, ranging from **13% to 18%**. Kericho, Bomet, Kisii, Elgeyo-Marakwet, Vihiga, and Kiambu, which account for 12% of national maize production, are estimated to experience drops in maize production of between 12% to 16% (see Table 2).

ASAL counties with the highest levels of vulnerability⁴³ (such as **Mandera, Marsabit, Samburu, Turkana, Tana River, Isiolo, Wajir and Garissa**) are net buyers of staple crops, and the impact of drought in these counties has compounded food insecurity as a result of falling food affordability (high inflation) and availability. A decline in production in major maize producing counties can lead to scarcity of maize in vulnerable counties as well.

³⁵BCG analysis

³⁶Using 90 kg bag of Maize worth KES 4,807 from Warehouse Receipt System Council website and exchange rate of US \$1 to KES 118 as of June 10, 2022.

³⁷BCG analysis.

³⁸ Reliefweb: Global price watch (July 2022), available [here](#).

³⁹KNBS (2019), Enhanced Food Balance Sheets for Kenya 2014–2018 results.

⁴⁰FAO (2014), Food loss assessments: causes and solutions. Available [here](#).

⁴¹Post-harvest losses reduce the amount of produce that reaches consumers versus on-farm production levels.

⁴²BCG analysis.

⁴³Defined by those with the highest proportion of individuals in the poorest wealth quintiles and highest proportion of children ages 0 to 14 years old as of the 2019 KNBS census.



Rainfall in the country is expected to have poor distribution, with delays and depressed rains anticipated in the later parts of 2022.⁴⁴ With the extended drought and erratic rainfall in the country, production is estimated to decline even further, though this has not been analyzed in our isolated focus on fertilizer prices in this report.

Overall, we assess that urban poor populations in each of these counties will be the hardest hit. Farmers will continue to produce enough for self-sufficiency, however rising food prices and reducing availability will impact those that do not have access to production means and cannot afford to buy maize at higher prices.

With GoK releasing all its strategic maize reserves to millers in May 2022 (as previously discussed)⁴⁵, the disruption of agricultural exports due to international sanctions, countries restricting their agricultural exports, a depreciating currency and falling foreign-exchange reserves in the country, replacing losses in production will be difficult for Kenya in 2023.

Together, these convergences of forces suggest a rising risk of food insecurity in Kenya, with counties showing higher proportions of vulnerable communities to be impacted the most.

⁴⁴ Ministry of Environment and Forestry: Seasonal weather forecast (2022), available [here](#).

⁴⁵Business Daily (2022), NCPB releases maize stocks to tame flour price. Available [here](#).

Table 2: Estimated maize reduction by county

County	Estimated maize production and changes for 2022 based on actual fertilizer price change (i.e. a 70% increase in prices)				Actual for 2019	
	Estimated maize production (2022) MT	Contribution by county (2022) %	Change in production (2021–2022) %	Absolute drop in production (2021–2022) MT	% People in poverty	% Children aged 0–14
Trans Nzoia	335,424	12%	-14%	53,844	37%	43%
Uasin Gishu	271,293	10%	-16%	49,874	63%	37%
Bungoma	98,070	7%	-18%	42,457	44%	44%
Narok	182,400	6%	-13%	26,788	73%	49%
Nakuru	159,338	6%	-14%	25,225	45%	38%
Kakamega	149,865	5%	-15%	26,279	52%	42%
Nandi	144,658	5%	-17%	29,684	27%	39%
Kisii	97,194	3%	-12%	12,689	35%	40%
Homa Bay	87,231	3%	-6%	6,059	70%	45%
Siaya	82,374	3%	-6%	5,553	66%	41%
Meru	75,354	3%	-9%	7,131	55%	35%
Migori	74,657	3%	-9%	7,098	30%	46%
Machakos	70,133	2%	-6%	4,494	3%	33%
Elgeyo-Marakwet	69,139	2%	-12%	9,863	44%	42%
Kericho	67,748	2%	-16%	12,580	43%	39%
Makueni	62,373	2%	-7%	4,353	75%	35%
Nyamira	54,429	2%	-11%	6,840	22%	39%
West Pokot	51,683	2%	-10%	5,946	0%	51%
Baringo	48,365	2%	-10%	5,217	2%	44%
Kisumu	47,175	2%	-7%	3,610	60%	39%
Busia	47,061	2%	-10%	5,454	62%	42%
Muranga	44,594	2%	-10%	4,682	60%	32%
Bomet	43,307	2%	-14%	7,128	55%	42%
Kwale	36,389	1%	-4%	1,440	21%	45%
Laikipia	35,937	1%	-10%	4,004	26%	38%
Kirinyaga	33,986	1%	-8%	3,049	70%	29%
Vihiga	30,620	1%	-12%	4,041	62%	39%
Kilifi	30,070	1%	-7%	2,126	39%	42%
Embu	27,900	1%	-6%	1,791	35%	31%
Nyeri	26,963	1%	-11%	3,375	71%	30%
Kiambu	26,650	1%	-12%	3,603	54%	31%
Lamu	25,882	1%	-4%	1,122	29%	39%
Kitui	25,793	1%	-5%	1,220	43%	39%
Kajiado	23,986	1%	-6%	1,564	67%	39%
Tharaka Nithi	23,097	1%	-4%	1,044	61%	33%
Nyandarua	18,571	1%	-10%	2,160	53%	36%
Taita Taveta	9,209	0%	-4%	408	69%	34%
Tana River	6,043	0%	-3%	187	64%	48%
Samburu	4,408	0%	-3%	157	70%	49%
Turkana	3,019	0%	-4%	115	64%	45%
Nairobi	640	0%	-10%	71	64%	30%
Isiolo	630	0%	-4%	23	68%	45%
Mandera	614	0%	-4%	24	84%	55%
Marsabit	535	0%	-3%	15	74%	47%
Mombasa	333	0%	-6%	21	69%	33%
Wajir	272	0%	0%	0	62%	50%
Garissa	173	0%	-5%	9	57%	46%
Total	2,855,585		-12%	394,415		

Note: County text color – Dark green counties represent the most productive counties, while orange counties represent the counties with the highest levels of vulnerability

Response option

Fertilizer prices are expected to see a decline in 2023 but will remain 1.5 times higher than the 2019-2020 average. Reduced demand, transition to organic fertilizers, and increasing output from Morocco and Canada⁴⁶ will lead to a declining trend in prices in 2023. However, this combined with depreciating currencies in the East Africa region would lead to continued higher prices of fertilizer in 2023 (compared to 2019-2020 average).

Accounting for sustained higher prices of fertilizer and predicted lower rainfall in the coming year, we expect production levels in 2023 to remain lower than 2019-2020 average. This will lead to continued food shortages in 2024, accounting for the time to reach consumers as a result of transportation & processing of maize, and shelf life of flour.

In response to the high prices, we expect market forces to adjust in the longer term (onwards 2025), increasing supply both locally in East Africa and globally. Solution to ongoing supply chain disruptions (e.g.,

export blockades and restrictions from Russia and China) will lead to further declines in prices, returning to slightly higher prices than 2019-2020 average (adjusted for inflation).

During the current crisis, both GoK and development agencies have responded with several interventions to provide urgent support to the most vulnerable.

GoK has responded with subsidies on fertilizers,⁴⁷ maize flour packets (issued on July 18th and removed on 13th August 2022),⁴⁸ and fuel (removed in September 2022)⁴⁹ and suspended levies and fees for maize imports between July and August 2022.⁵⁰ The new GoK administration has reintroduced a KES 3.5 billion subsidy (in place of the fuel and maize subsidy) for fertilizer with plans to roll out in September 2022 ahead of the next sowing season.⁵¹ Development partners such as the African Development Bank (AfDB) has provided a KES 7.5 billion loan to improve access to inputs,⁵² and the United States Agency for International Development (USAID) has pledged US \$255 million in humanitarian aid.⁵³ However the impact of

⁴⁶ Morocco World News(2022) Available Here and CNN Business(2022) Available [here](#)

⁴⁷The Kenyan Wall Street (2022), Government of Kenya Unveils KES 5.7 billion Fertilizer Subsidy. Available [here](#).

⁴⁸Business Daily (2022), State eases maize flour prices to KES 100 until elections. Available [here](#).

⁴⁹The Kenyan Wall Street (2022), Uhuru Signs Second Supplementary Bill Allocating KES 49.2 billion to the Fuel Subsidy Fund. Available [here](#).

⁵⁰The Kenyan Wall Street (2022), Kenya to Waive All Levies on Maize Imports WEF. Available [here](#).

⁵¹ TheStandard (2022): Govt. releases KES3.6 billion for subsidized fertilizer, available [here](#).

⁵²Business Daily (2022), Kenya gets KES 7.5bn AfDB loan for fertilizer, seeds. Available [here](#).

⁵³USAID (2022), The United States provides nearly US \$255 million in humanitarian and development assistance to meet emergency needs amid unprecedented drought, dire food crisis in Kenya. Available [here](#).

these would only be seen in the next harvest season in 2023.

The expected reduction in 2022 harvests coupled with a lack of national strategic grain reserves suggests the need for additional imports of maize to fill the gap in maize available for consumption, and continued support to the most vulnerable up **until the next harvest season in 2023**. Potential export bans in East Africa⁵⁴ will reduce availability of maize in the region, and increase prices of available imports, putting more pressure on the country's ability to purchase maize to fulfill the demand gap.

The WFP and BCG analysis identifies the highest in-need counties (based on the level of vulnerability and the lowest levels of maize production), namely Mandera, Marsabit, Samburu, Turkana, Tana River, Isiolo, Wajir and Garissa (ASAL counties in the country). Further targeting at the sub-county or ward level, including identification of impacts on urban poor populations, will likely be required to reflect the varied needs.

To sustainably increase maize yields going forward and to decrease the impact of global shocks on local systems, food system actors will need to focus on **transforming and improving both agricultural productivity and the resilience of farmers**. This can be achieved through the following methods:

Increasing productivity and resilience of farmers:

- **Enhancing soil systems:** Promoting soil filtration and retention to reduce reliance on rainfall, and increasing soil nutrition through organic fertilizers, reducing dependence on synthetic fertilizers for productivity and soil health.
- **Promoting healthy cropping systems:** Increasing crop yields through a combination of using drought and heat resistant seed varieties and crops that require lesser fertilizers and water (e.g., millet and sorghum in Kenya), crop rotation and cover crops.
- **Using integrated systems:** Using practices such as agroforestry and natural grazing patterns as alternatives to synthetic fertilizer – promoting crop nutrition while using practices that are healthier for the environment. Other examples such as integrated pest management can also help reduce post-harvest loss.

Increasing efficiency of current production:

- **Enhancing supply chain networks:** Considering the concentration of crop production in the Rift valley region, investments in strengthening supply chain networks including implementing efficient handling and transport solutions, distributing key inputs

⁵⁴ BusinessDaily: New maize shock as Tanzania freezes export permits (September 2022), available [here](#); TheEastAfrican: Ugandan farmers, millers seek

ban on maize exports (September 2022), available [here](#).

including hybrid seeds and fertilizer, extension services to promote knowledge access for smallholder farmers, and organized markets to set farm gate prices and control food inflation are required to increase affordability and access of food especially in ASAL regions of the country.

- **Transitioning to whole and alternative grain products:** Transitioning to wholegrain products instead of refined flour can also help increase the total volume of food available by up to 25%⁵⁵ while increasing the nutritional quality of food. Substituting primary grains (ex. Maize) with local, climate resilient grains (ex. sorghum, millet) can increase resilience and contribute to a healthier diet due to the inherent nutritional quality of these grains. This transition can help increase resilience against climate

change and reduce dependence on synthetic inputs while promoting healthier ecosystems.

Actors looking to mitigate the crisis in 2023 harvests with such initiatives have a **short 5-month window (between September 2022 and January 2023)** to ensure farmers receive the necessary support before the next harvest cycle. This support should be targeted at the largest-producing counties (i.e., Trans Nzoia, Uasin Gishu, Bungoma, Narok, Nakuru, Kakamega and Nandi) to have the greatest effect on maize yields. To achieve this transformation, it is critical to bring the full range of players (private sector, GoK, donors and funders) together across the entire value chain (farmers, input providers, aggregators and millers) to contribute toward a well-functioning ecosystem.

⁵⁵ Expert interviews and BCG insights

We would like to acknowledge the contributions of George Njoroge, Olive Wahome, Allan Kute and Claudia AhPoe

For more information, contact:

WFP Team

Michael Dunford michael.dunford@wfp.org
Regional Director for Eastern Africa

Lauren Landis lauren.landis@wfp.org
Representative and Country Director for Kenya

Arif Husain arif.husain@wfp.org
Chief Economist and Director of RAM

Siddharth Krishnaswamy siddharth.krishnaswamy@wfp.org
Head of RAM for Eastern Africa

Cinzia Monetta cinzia.monetta@wfp.org
Food Security Analyst for Eastern Africa

BCG Team

Mills Schenck Schenck.Mills@bcg.com
*Managing Director and Partner
BCG Nairobi*

Chris Mitchell Mitchell.Chris@bcg.com
*Managing Director and Partner
BCG Nairobi*

Akshay Pant Pant.Akshay@bcg.com
*Project Leader
BCG Nairobi*

Tom Magara Magara.Tom@bcg.com
*Project Leader
BCG Nairobi*

Carol Njiru-Wijenje NjiruWijenje.Carol@bcg.com
*Consultant
BCG Nairobi*

Raghav Gupta Gupta.Raghav@bcg.com
*Consultant
BCG Nairobi*

Daphine Kinyua Kinyua.Daphine@bcg.com
*Business Analyst
BCG Nairobi*



Abbreviations

BCG	Boston Consulting Group
GDP	Gross Domestic Product
GoK	Government of Kenya
KES	Kenya shillings
Kg	Kilogram
KNBS	Kenya National Bureau of Statistics
MT	Metric Tons
USAID	United States Agency for International Development
WBG	World Bank Group
WFP	World Food Programme