

# ESTIMATED LIKELY IMPACT OF INCREASED FERTILIZER PRICES ON CEREAL PRODUCTION IN EASTERN AFRICA DURING 2022 CROPPING YEAR



## Highlights

- The Russia-Ukraine conflict has driven up already high global agricultural commodity prices. Fertilizer prices have also reached all-time highs both in the global and domestic markets, casting a serious shadow on 2022 cereal harvests and food insecurity in the Eastern Africa Region.
- Fertilizers prices increased two-fold (more than doubled) from their levels a year ago in the region within two months the Ukraine Invasion. This unfortunately coincided with the 2022 main season crop planting that disrupted farming. There has also been a hike in fuel prices region-wide, rising by 17-75 percent in April 2022 year-on-year, the steepest increase observed in Burundi, Somalia, Kenya, Ethiopia, and South Sudan. This has impacted farmers ability to use farm machinery and transport and will further reduce their ability to grow sufficient crops this year.
- WFP estimates that be the cereal production during the 2022 cropping year could potentially decrease by 16% year-on-year because high fertilizer and fuel prices. The total 2022 cereal production will be about 37.8 million MT, down from 45.2 million in 2021. This represents about 7.2 M crop production
- There is a likelihood of the number of food insecure people in the region rising by nearly 6-7 million by the end of the year solely because of the reduced crop production because of the fertilizer price increase and attendant reduction in use.
- The cereal production estimates are conservative and could potentially be higher especially in Somalia, belg producing areas of Ethiopia and marginal agricultural areas in Kenya that have been worst affected by the ongoing drought conditions in the Eastern Horn of Africa.
- The highest decline in cereal production will be in Ethiopia (21%), Kenya (12%) and Sudan (16%) while marginal reduced in the rest of the countries given relatively low use of fertilizers by the latter. This implies that fertilizer price inflation will likely magnify food insecurity in these countries more than in the rest.
- Reduced domestic cereal availability will likely result in more food imports to bridge the gap putting additional pressure on already weaker local currency resulting in higher food inflation in the short run and adding to food security concerns in the region. Higher food prices combined with low household stocks will further compromise household purchasing, limiting physical and economic access to food. Affected farmers and majority of poor urban and rural households relying on markets will be the worst hit. There is a likelihood of the number of food insecure people in the region rising to more 100 m by the end of the year.

## Background: global and regional fertilizer price inflation

Global fertilizer prices have risen nearly 30% since the start of 2022, following last year's 80% surge<sup>1</sup> (Fig. 1), driven by a confluence of factors, including surging input costs, supply disruptions caused by sanctions (Belarus and Russia), and export restrictions (China). According to the World Bank, urea prices have surpassed their 2008 peaks, while phosphates and potash prices are inching closer to 2008 levels. Fertilizer prices are perfectly correlated with food prices in the long-run and can be shown in Fig. 1, both have climbed to even higher levels following Russia's invasion of Ukraine in February, hitting their highest levels yet in March<sup>2</sup>.

In the Eastern Africa region, fertilizer prices have soared in line with international trends, more than doubled in Kenya,

Fig. 1

### Real prices for food and fertilizer

Index based on constant USD prices. Base 100 = Average 2000-2020



Chart: David Laborde • Source: World Bank, U.S. Bureau of Labor Statistics

<sup>1</sup> <https://blogs.worldbank.org/opendata/fertilizer-prices-expected-remain-higher-longer>

<sup>2</sup> <https://www.ifpri.org/blog/high-fertilizer-prices-contribute-rising-global-food-security-concerns>

Uganda and Tanzania (Table 1). Given most countries in Eastern Africa import fertilizers from either

Kenya and Tanzania, its highly likely that fertilizer prices have increased even higher in those countries given price transmission and increased transport costs because of higher fuel prices. High prices inhibit access to fertilizers by farmers, disproportionately by small-holder farmers. This result in either non-optimal use which reduce yields or reduced area/acreages under cultivation. Fertilizer price spikes and concerns about availability therefore cast a shadow on this year's harvests, and thus risk keeping food prices high for the better part of the year.

**Table 1: Fertilizer prices in LCU (50kg bag) & changes (y/o/y)**

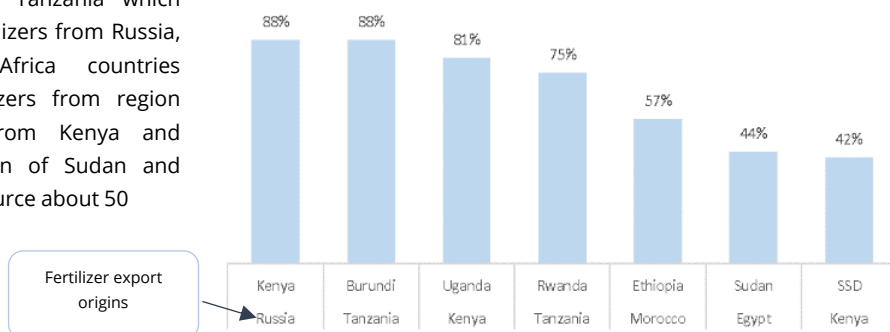
|          | Fertilizer prices in LCU |       | Price changes (2022/2021) |     |
|----------|--------------------------|-------|---------------------------|-----|
|          | DAF                      | CAN   | DAF                       | CAN |
|          | 2022                     | 2022  |                           |     |
| Kenya    | 5,850                    | 3,600 | 63%                       | 20% |
| Uganda   | 160                      | 130   | 113%                      | 94% |
| Sudan    | 50,000                   |       | 72%                       |     |
| Tanzania | 139,000                  |       | 85%                       |     |

It's on this backdrop that the analysis seeks to estimate the likely impact of increased fertilizer prices on cereal production in eastern Africa. The analysis uses existing estimated fertilizer price elasticities to fertilizer demand/use to estimate the cereal production reduction for 2022 cropping year. With 2021 FAO production estimates as a base, we then estimate the likely expected 2022 cereal production in Eastern Africa.

### Eastern Africa fertilizer origins<sup>3</sup>

Other than for Kenya and Tanzania which imports the bulk of their fertilizers from Russia, most of the Eastern Africa countries predominantly import fertilizers from region (exports and re-exports from Kenya and Tanzania) with the exception of Sudan and Ethiopia which respectively source about 50 percent of fertilizers from Egypt and Morocco respectively. Fertilizer manufacturing plants in

**Fig. 2: Fertilizer origins (source: COM trade)**



Kenya, Morocco and Egypt focus on blending imported components to deliver the required N, P, and K compounds required by farmers. Trade disruptions that have been occasioned by the Ukraine-Russia conflict resulted in either canceled or delayed deliveries of these inputs during the critical MAM seasonal planting window resulting in increased fertilizer prices. The region is therefore highly exposed to global fertilizer shocks and in particular the ongoing Ukraine conflict that led fertilizer export bans. China, Russia, Ukraine and Kyrgyzstan and South Korea have banned nitrogen based fertilizer exports for the most of 2022. Fertilizer prices are therefore expected to continue rising trends throughout the year.

### Fertilizer Consumption<sup>4</sup> trends (1961 to 2019) and <sup>5</sup> fertilizer use<sup>6</sup>

Ethiopia has the largest annual fertilizer consumption in the region (70,000 Mt) followed by Kenya (40,00 mt), Sudan (300,00 mt) and Uganda (100,00 mt). The yearly fertilizer demand for the rest of the countries is below 50,000 mt. The three top fertilizer consumers also lead the pack in per capita demand and use. Use of fertilizers<sup>7</sup>, is currently highest in Ethiopia (55.5%), Kenya (31.4%)<sup>9</sup> and Sudan (31.4%) but lower in the remaining countries (below 5 percent). This implies that Kenya,

<sup>3</sup> <https://comtrade.un.org/>

<sup>4</sup> Total fertilizer consumption is the sum of synthetic inputs of nitrogen, potassium and phosphorous, plus organic nitrogen inputs.

<sup>5</sup> fertilizer use calculated using the Living Standards Measurement Study Integrated Surveys on Agriculture: Ethiopia 2011/12, Uganda 2010/11. The rest are estimated based on simulations

<sup>6</sup> <https://link.springer.com/content/pdf/10.1007/978-3-030-42148-9.pdf>

<sup>7</sup> defined by the % of cultivating households using fertilisers

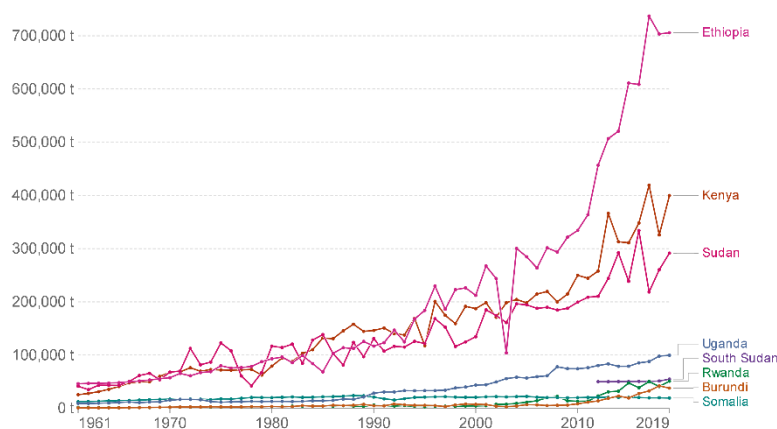
<sup>8</sup> <https://core.ac.uk/download/pdf/82596203.pdf>

<sup>9</sup> [https://www.researchgate.net/publication/284169235\\_Soil\\_Acidity\\_Management\\_by\\_Farmers\\_in\\_the\\_Kenya\\_Highlands/figures?lo=1](https://www.researchgate.net/publication/284169235_Soil_Acidity_Management_by_Farmers_in_the_Kenya_Highlands/figures?lo=1)

## Fertilizer Price Impact on 2022 cereal production in Eastern Africa

Ethiopia, and Sudan have the highest risk of fertilizer shortages and price hikes compared to their other counterparts in Eastern Africa.

**Fig. 3: Total Fertilizer consumption trends**



Source: Food and Agriculture Organization of the United Nations via the United States Department for Agriculture (USDA) OurWorldinData.org/fertilizers • CC BY

**Table 2: fertilizer use**

| Country  | Fertilizer use per capita (kg/year), 2019 | Fertilizer use (% of farmers using fertilizers) |
|----------|---|---|
| Kenya    | 7.61                                      | 31.4%   |
| Ethiopia | 6.3                                       | 55.5%   |
| Sudan    | 4.96                                      | 31.4%   |
| SSD      | 4.96                                      | 4.3%  |
| Rwanda   | 4.04                                      | 4.0%  |
| Burundi  | 3.29                                      | 3.0%  |
| Uganda   | 2.25                                      | 3.2%  |
| Somalia  | 1.25                                      | 1.5%  |

### Fuel price changes

Since the onset of the Ukraine crisis, there has been a hike in fuel prices region-wide except in Djibouti where they are relatively stable because of strict price controls. Fuel prices during the 2022 seasonal planting season were significantly elevated in Burundi, Somalia, Kenya, Ethiopia and South Sudan (Table 2). This has impacted farmers ability to use farm machinery and transport and will further reduce their ability to grow sufficient crops this year.

**Table 3: Fuel price changes 2022**

|             | month-o-month fuel price changes |        |        |        | year-on-year (y-o-y) fuel price changes |        |        |        |
|-------------|----------------------------------|--------|--------|--------|---|--------|--------|--------|
|             | Jan-22                           | Feb-22 | Mar-22 | Apr-22 | Jan-22                                  | Feb-22 | Mar-22 | Apr-22 |
| Burundi     |                                  | 6%     | 6%     | 30%    | 20%                                     | 26%    | 31%    | 75%    |
| Djibouti    | 0%                               | 0%     | 0%     | 0%     | 3%                                      | 3%     | 3%     | 3%     |
| Kenya       | 0%                               | 0%     | 4%     | 7%     | 21%                                     | 13%    | 10%    | 18%    |
| Somalia     | 1%                               | 2%     |        |        | 44%                                     | 37%    | 35%    | 39%    |
| South Sudan | 6%                               | 0%     | 7%     | 14%    | 2%                                      | 11%    | 3%     | 17%    |
| Uganda      |                                  | 3%     | 1%     | 2%     |   |        |        |        |
| RBN         | 2%                               | 3%     | 3%     | 7%     | 36%                                     | 33%    | 30%    | 39%    |

### Fertilizer price Impact on 2022 cereal production

Studies have shown that the cost of fertilizer, availability of alternatives to fertilizer and weather patterns have negative effects on fertilizer use. Studies have shown that applying a relatively small amount of mineral fertilizer can have a major impact on crop yields. Studies in Kenya, Uganda, Rwanda, Malawi and Ethiopia have shown that yields of maize, rice, cowpea and millet could be doubled through the judicious use of fertilizers<sup>1011</sup>. While fertilizer use improves maize production by 36%<sup>12</sup> to 45%<sup>13</sup> in Kenya, increased fertilizer prices reduce demand and use of fertilizers resulting in lower yields in cereal production. A 100% increase in fertilizer prices have been found to result in 37-38% decline in maize<sup>14</sup>

<sup>10</sup> Sileshi, G., B. Jama, B. Vanlauwe, W. Negassa, R. Harawa, A. Kiwia, and D. Kimani. 2019. Nutrient use efficiency and crop yield response to the combined application of cattle manure and fertilizer in sub-Saharan Africa. *Nutrient Cycling in Agroecosystems Journal*. <https://doi.org/10.1007/s10705-019-09974-3>

<sup>11</sup> Jama, B., D. Kimani, R. Harawa, A. Kiwia, and G.W. Sileshi. 2017. Maize yield response, nitrogen use efficiency and financial returns to fertilizer on smallholder farms in southern Africa. *Food Security* 9(3): 577– 593. <https://doi.org/10.1007/s12571-017-0674-2>

<sup>12</sup> <https://www.povertyactionlab.org/evaluation/rates-return-fertilizer-evidence-field-experiments-kenya>

<sup>13</sup>

[http://erepository.uonbi.ac.ke/bitstream/handle/11295/76320/Welime\\_Effect%20of%20Fertilizer%20Price%20Subsidies%20on%20Fertilizer%20Use%20in%20Kabuyefwe%20Location%20of%20Bungoma%20Countykenya.pdf?sequence=3](http://erepository.uonbi.ac.ke/bitstream/handle/11295/76320/Welime_Effect%20of%20Fertilizer%20Price%20Subsidies%20on%20Fertilizer%20Use%20in%20Kabuyefwe%20Location%20of%20Bungoma%20Countykenya.pdf?sequence=3)

<sup>14</sup> Maize requires heavy intake of nitrogen and phosphorus for a good crop. Continuous cropping heavily depletes soils of these nutrients, so that if replenishment through application of fertilisers is not possible, then yields and output would fall.

production<sup>15</sup> in Kenya. In other words, In the long run, holding other factors constant, an average fertiliser price increase by 10 per cent would reduce maize output by about 38 per cent<sup>16</sup>.

**Table 4: Estimated fertilizer price elasticity to use and crop production elasticities**

| Fertilizer Price elasticity of Demand/Use and Crop Yields |                               |                     |                                |
|---|-------------------------------|---------------------|--------------------------------|
| % increase in fertilizer prices                           | % reduction in fertilizer use | % of fertilizer use | % reduction in crop Production |
| 10  | 5.2                           | 94.8                | 3.8                            |
| 20  | 10.4                          | 89.6                | 7.6                            |
| 30  | 15.6                          | 84.4                | 11.4                           |
| 40  | 20.8                          | 79.2                | 15.2                           |
| 50  | 26                            | 74                  | 19.0                           |
| 60  | 31.2                          | 68.8                | 22.8                           |
| 70  | 36.4                          | 63.6                | 26.6                           |
| 80  | 41.6                          | 58.4                | 30.4                           |
| 90  | 46.8                          | 53.2                | 34.2                           |
| 100   | 52                            | 48                  | 38.0                           |

However, price elasticity to fertilizer demand is low especially for large scale farmers who have higher incomes<sup>17</sup> but higher for small holder farmers<sup>18</sup>. In Kenya high-potential areas, there is a price response elasticity of 0.52 (a 10 percent increase in fertilizer price leads to a 5.2 percent decline in application rates per acre<sup>19</sup>. Based on these assumptions, there is about 38% reduction in crop production on the scenario of 100% increase in fertilizer prices (Table 3). However, not all farmers use fertilizers. This calls for re-adjusting the cereal reduction estimates by the proportion of farmers that use fertilizers country by country. Table 4 provides the adjusted crop reduction estimates after accounting for fertilizer

use.

**Table 5: Estimated crop reduction adjusted for fertilizer use**

| Country  | % reduction in crop Production adjusted for fertilizer use |
|----------|--|
| Kenya    | 11.9%  |
| Ethiopia | 21.1%  |
| Sudan    | 11.9%  |
| SSD      | 1.6%   |
| Rwanda   | 1.5%   |
| Burundi  | 1.1%   |
| Uganda   | 1.2%   |
| Somalia  | 0.6%   |

In line with high demand and use of fertilizers, the highest cereal production decrease in 2022 is expected in Ethiopia (21.1%), Kenya (11.9%) and Sudan (11.9%) while relatively below 2 percent in the rest where both fertilizer consumption and use are relatively low.

In addition to the fertilizer impacts on crops, parts of the region (Eastern Horn of Africa) are facing a fourth consecutive drought that has affected crop production particularly in Southern Ethiopia, marginal agricultural areas of Kenya, Somalia and parts of Karamoja and Northern Uganda. Although the main March-April-May season is still on course, poor seasonal rainfall performance has increased prospects of below average crop production this year in the belt producing areas of Ethiopia, marginal agricultural areas of Kenya and Somalia. Its therefore notable that the cereal production estimates are conservative and could potentially be higher especially in Somalia that has been worst affected by drought conditions.

<sup>15</sup> <https://www.sciencedirect.com/science/article/pii/S0308521X16304942>

<sup>16</sup> <https://isdsnet.com/ijds-v2n2-7.pdf>

<sup>17</sup> <https://isdsnet.com/ijds-v2n2-7.pdf>

<sup>18</sup> Assuming that farmers are highly price sensitive

<sup>19</sup>

[https://documents1.worldbank.org/curated/en/304221468001788072/930107812\\_2014082520300800/additional/634310PUB0Yes0061512B09780821387450.pdf](https://documents1.worldbank.org/curated/en/304221468001788072/930107812_2014082520300800/additional/634310PUB0Yes0061512B09780821387450.pdf)

The 2022 cereal production has been estimated assuming at least 100% increase in fertilizer prices and about 52% reduction in fertilizer use in all the countries, discounting for proportion of farmers using fertilizers. Holding other factors constant, the total 2022 cereal production in the Eastern Africa will be about 37.8 million MT, down from 45.2 million in 2021, which represents 16 percent decrease. The highest decline in cereal production will be in Ethiopia (21%), Kenya (12%) and Sudan (12%).

**Table 6: Estimated cereal production (million mt)**

| Country               | Wheat      |            | Rice       |            | Coarse grains |             | Total Cereals |             |                   |
|-----------------------|------------|------------|------------|------------|---------------|-------------|---------------|-------------|-------------------|
|                       | 2021 (FAO) | 2022 est.  | 2021 (FAO) | 2022 est.  | 2021 (FAO)    | 2022 est.   | 2021          | 2022 est    | Change: 2022/2021 |
| Burundi               |            |            | 0.1        | 0.1        | 0.3           | 0.3         | 0.4           | 0.4         | -1%               |
| Ethiopia              | 5.5        | 4.3        | 0.1        | 0.1        | 24.2          | 19.1        | 29.8          | 23.5        | -21%              |
| Kenya                 | 0.3        | 0.2        | 0.1        | 0.1        | 3.4           | 3.0         | 3.7           | 3.3         | -12%              |
| Rwanda                | 0.0        | 0.0        | 0.8        | 0.8        | 0.6           | 0.6         | 1.4           | 1.4         | -2%               |
| Somalia               |            |            | 0.0        | 0.0        | 0.1           | 0.1         | 0.1           | 0.1         | -1%               |
| South Sudan           |            |            |            |            | 0.8           | 0.8         | 0.8           | 0.8         | -2%               |
| Sudan                 | 0.6        | 0.5        | 0.0        | 0.0        | 4.8           | 4.2         | 5.4           | 4.8         | -12%              |
| Uganda                | 0.0        | 0.0        | 0.1        | 0.1        | 3.4           | 3.3         | 3.5           | 3.5         | -1%               |
| <b>Total (RBN/EA)</b> | <b>6.4</b> | <b>5.1</b> | <b>1.3</b> | <b>1.2</b> | <b>37.6</b>   | <b>31.4</b> | <b>45.2</b>   | <b>37.8</b> | <b>-16%</b>       |

### Implications of reduced cereal production on food insecurity

Reduced domestic cereal availability will likely result in more food imports to bridge the gap putting additional pressure on already weaker local currency resulting in higher food inflation in the short run and adding to food security concerns in the region

Higher food prices combined with low household stocks will further compromise household purchasing, limiting physical and economic access to food by majority

Directly affected farmers and majority of poor urban and rural households relying on markets will be the worst hit. There is a likelihood of the

number of food insecure people in the region rising by nearly 6-7 million by the end of the year solely because of the reduced crop production because of the fertilizer price increase and attendant reduction in use.

| Indicators                     | Unit   | Value            |
|--------------------------------|--|------------------|
| estimated cereal reduction     | mt   | 7,400,000        |
| estimated cereal reduction     | kg   | 7,400,000,000    |
| Per capita cereal consumption  | kg/per person/yeay   | 72               |
| <b>Estimated Food Insecure</b> | <b>Number of farmers that will limit cereal consumption to quarter ration once a day</b> | <b>6,400,000</b> |



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