Do fertiliser price spikes shrink maize harvests in Sub-Saharan Africa?

Pietro Sala

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Question. How far is the fertiliser-to-maize price ratio from its historical norm in 2026, how strongly did maize yields and nitrogen use in 14 Sub-Saharan African countries move with that ratio over 1990-2024, and was the response weaker in countries that spend more on input subsidies?

Short answer. Maize yields in these 14 countries have been lower in years when world fertiliser was dear relative to maize, but the link weakens once prices after planting are left out. A 10% higher world urea-to-maize price ratio goes with 1.2% lower yields in the same season (1990-2024), 0.7% lower with the ratio before planting and no clear change with the previous year's ratio. We read this as the ratio tracking world market conditions at least as much as fertiliser costs. In high-subsidy countries, recorded nitrogen use did not fall in high-price years, but this does not hold on 2005-2024 alone, and harvests show no consistent difference between the groups.

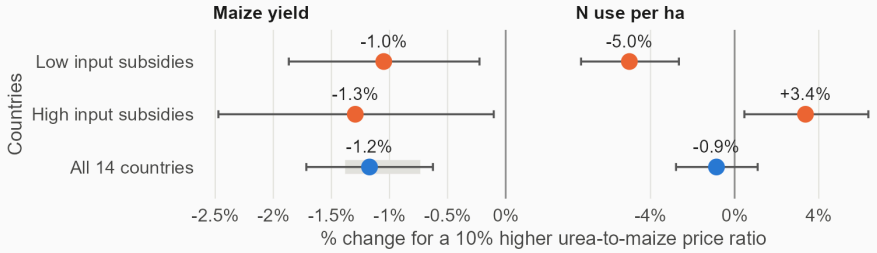
1. Data and method

We relate maize yields and nitrogen use to the world urea-to-maize price ratio, overall and by input-subsidy level. *Data.* World Bank Pink Sheet monthly prices of urea (Middle East) and maize (US Gulf), averaged into one ratio per crop year (October to September); FAOSTAT maize yield (QCL) and nitrogen use per hectare of cropland (RFN) for 14 Sub-Saharan African countries, 1990-2024 (487 country-years for yield, 484 for nitrogen); NOAA's December-February ONI; FAO MAFAP public expenditure. *Main model.* Log yield, or log nitrogen use, on the log ratio and the ONI, with country fixed effects and country-specific linear trends; the coefficient is an elasticity, reported as the % change for a 10% higher ratio. *Subsidy comparison.* The log ratio interacted with a high-subsidy indicator, with country and year fixed effects, so the difference between groups is net of everything common to all countries in a year; groups are a median split of MAFAP variable-input spending as a share of all public support to agriculture. *Inference.* Driscoll-Kraay standard errors, robust to correlation across countries within a year and over time; 90% intervals. Because the ratio is one world series, the effective sample is 35 crop years; a regression of the yearly cross-country averages with Newey-West errors and t critical values checks this. *Identification.* None for a causal effect: high-ratio years can differ in other ways, so all estimates are associations.

2. Results

Years with a 10% higher world fertiliser-to-maize price ratio have had 1.2% lower maize yields; no clear yield difference by input-subsidy level

14 Sub-Saharan African countries, 1990-2024. Change in the harvest and in N use when the urea-to-maize price ratio is 10% higher, in the same crop year.



Source: FAOSTAT QCL (2025-12-31) and RFN (2026-07-30); World Bank Pink Sheet; FAO MAFAP public expenditure (March 2026); NOAA ONI (accessed 2026-11-20). Country fixed effects and trends, ENSO control, Driscoll-Kraay 90% intervals. Grey bar: range when one country at a time is left out. Associations, not effects. Nitrogen: national use on all crops per ha of cropland.
Analysis: Mithril Metrics

- **Yields are lower when the ratio is high.** Same crop year: −1.2% (-1.7% to −0.6%) for a 10% higher ratio; on the 35 yearly averages: −1.2% (-1.7% to −0.6%).
- **The link weakens once prices after planting are left out.** Ratio in the six months before planting: −0.7% (-1.2% to −0.2%); previous crop year's ratio: −0.5% (-1.1% to +0.1%), not clear.
- **Nitrogen use does not fall with the ratio.** All countries: −0.9% (-2.8% to +1.1%), not clear; official figures only: +2.2% (+0.4% to +4.0%).
- **Subsidy groups: nitrogen held up, harvests show no consistent difference.** Nitrogen, high minus low subsidy: +5.2% (+0.3% to +10.4%); with each group's own trends, 2005-2024: +2.4% (-5.1% to +10.4%). Yield, high minus low: +0.4% (-1.0% to +1.8%); with group trends: −2.2% (-3.0% to −1.5%).

3. Robustness checks

- **The headline yield association is stable.** Leaving out one country at a time: −1.4% to −0.7%; without the 2008-09 crop years −0.9%; without 2021-22 −1.2%; in the 217 country-years with official nitrogen figures −1.5%; without Zimbabwe 2000-09 −0.9%.
- **Entering the two prices separately does not identify the channel.** −1.2% for a 10% higher urea price, +1.7% for a 10% higher maize price. Equal and opposite effects are what the ratio assumes, and the split uses log average prices, so it does not decompose the ratio exactly.
- **The subsidy yield difference changes sign across specifications.** Dropping Zimbabwe entirely: +1.7% (+0.2% to +3.2%); dropping only Zimbabwe 2000-09: +0.8% (-0.7% to +2.3%). The group-trend model rests on 20 years; its narrow interval should be read with care.
- **Scale check, not a forecast.** At the 2026 crop-year ratio (2.40, 1.86 times the 1990-2019 median), yields 4.6% (before-planting estimate) to 7.4% (same season) below a median year: about 2.8 to 4.6 million t of maize on 2024 output, assuming a constant elasticity.

4. What this means for policy

- **If the aim is to judge exposure to the 2026 spike,** the world ratio is a rough signal only. Farm-gate prices can diverge from world prices and were not used here; national price monitoring (FAO GIEWS for maize, AfricaFertilizer.org for fertiliser) is the closer signal.
- **If input subsidies are meant to keep fertiliser flowing during spikes,** recorded nitrogen use in high-subsidy countries held up over 1990-2024, though not on 2005-2024 alone. This may partly reflect programmes scaled up during spikes, which we did not test; for scale, Malawi's variable-input spending went from 44% to 51% of all public support to agriculture between the 2007 and 2009 budget years (+76% in real terms). If the aim is to protect harvests, these data show no consistent yield difference. The trade-off is the budget share such programmes take against a yield gain the data cannot confirm.
- **If the aim is to plan food needs,** the scale check is a guide for seasons planted at 2026 prices, not an estimate of 2026 losses: most southern African 2026 harvests were planted before the spike.

5. Caveats

- **Associations, not effects.** The ratio is one world series, and high-ratio years can differ in other ways (energy, freight, the dollar). Prices are US Gulf maize and Middle East urea; farm-gate ratios, which in landlocked countries can differ widely, are not observed.
- **The nitrogen data cannot settle why yields fall.** Nitrogen is national use on all crops per hectare of cropland, 55% of the figures are FAO estimates, and on official figures alone nitrogen use rises with the ratio (+2.2%). The timing pattern, not the nitrogen result, is our main reason to doubt a pure fertiliser-cost channel.
- **The subsidy comparison is indicative only.** Groups are fixed over time, based on MAFAP spending from 2004 (Ghana from 2016), and applied to earlier years; the median split separates countries with similar shares (Ghana and Benin). MAFAP counts only on-budget spending, and its variable-input category also covers seed, energy and credit. El Niño is measured in December-February, which fits southern Africa's season better than West Africa's. With one world price series and about 20 checks at 90%, results whose intervals barely exclude zero are suggestive.

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Data and code

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- Code: GitHub, Mithril-Metrics

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