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The Russia-Ukraine War's Impact on Global Fertilizer Markets

No Immediate Impact on Food Prices or Food Production

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Summary

Higher fertilizer prices and/or a shortage of fertilizer supply resulting from the war in Ukraine will not have an immediate impact on food prices and/or food production. Currently, the fertilizer market in the northern hemisphere is relatively quiet. All transoceanic flows for the upcoming northern hemisphere spring season have already taken place, and movements are now primarily at the local level: from the import ports and/or domestic production locations to farm fields.

The first crop-growing regions to be 'at risk' are India and Latin America. India is partially out of danger, but Latin America is highly exposed. Potash availability for soybean production might be compromised, as Belarus and Russia account for 40% of the world's potash production and exports. Consequently, Brazil's 2023 soybean harvest might be the first crop to experience direct negative impacts from Russia's war in Ukraine.

The good news is that Latin American markets don't need fertilizer in their fields until September – which means fertilizers need to arrive at Brazilian ports in July-August and there are still three months to work out a solution. A careful assessment of the 2023 cropping season, however, is necessary.

The Impact of the War on Nitrogen and Potash

There are three types of fertilizers that farmers must apply to ensure crop growth: nitrogen (N), phosphate (P), and potash (K). All three of these fertilizers are sold in global markets, and their production is geographically concentrated and dominated by a handful of miners (P and K) and a somewhat larger group of chemical companies (N). Russia and Belarus are a key mining and production region for potash, and Russia is a relevant source of nitrogen (*see Figure 1*). In addition to its role as a major producer of these two fertilizers, Russia also is a key supplier of the main raw material for nitrogen fertilizer: natural gas. This is mainly relevant for the EU and India, as their domestic nitrogen production depends highly on imported natural gas.

Russia's war in Ukraine and the subsequent sanctions have instantly cut off global markets from Russian and Ukrainian nitrogen and potash fertilizers. This is likely to result in an imbalance of supply and demand, with tightening global N and K supplies leading to upward pressure on prices and increased price volatility. This is already visible in today's markets. After a substantial price decline in global markets in the first two months of 2022, N prices are on the rise again. In contrast, K prices have not fallen since the start of 2022. This is mainly for two reasons. First, the K

market is supplied by only three major miners that sell directly to importers and thus have maximum control over price dynamics. Second, the combined K exports of Russia and Belarus amount to 40% of total global exports, and Belarus has been sanctioned since last year in response to the country's suppression of protests (*see Figure 1*).

Figure 1: Russia, Belarus, and Ukraine's share of global nitrogen and potash production and exports reveal vulnerability to war impacts

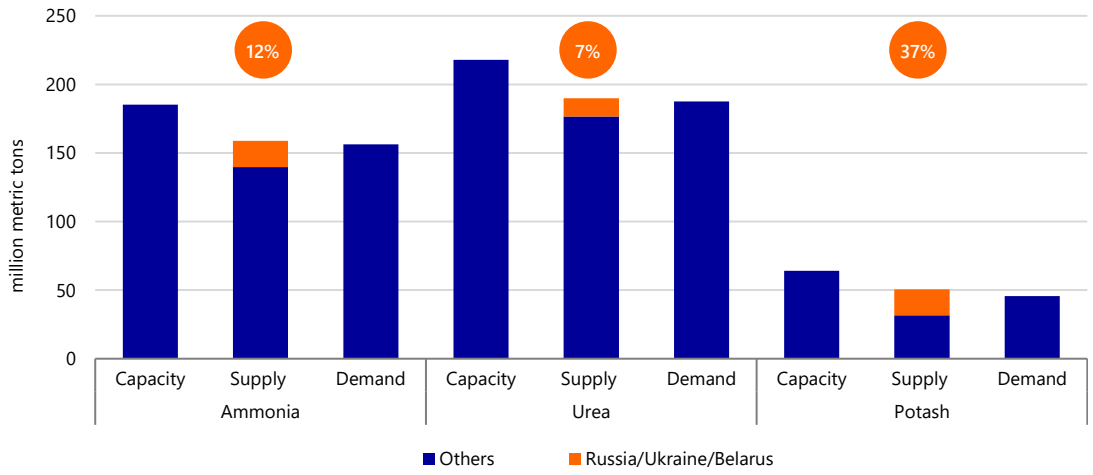
Nexus production and exports*		Ammonia	Urea	Ammonium Sulfate	Ammonium Nitrate	Calcium Ammonium Nitrate	Phosphate Rock	Phosphoric Acid	Mono-ammonium Phosphate	Di-ammonium Phosphate	Muriate of Potash
Belarus	Production	0.59%	0.68%	0.71%	1.19%	0.00%	0.00%	0.43%	0.04%	0.00%	17.48%
	Exports	0.13%	0.42%	0.06%	0.00%	0.00%	0.00%	0.00%	0.06%	0.00%	20.51%
Russia	Production	10.53%	5.33%	6.27%	25.44%	3.74%	8.43%	7.93%	9.67%	4.24%	19.01%
	Exports	22.71%	13.91%	2.54%	45.81%	4.14%	9.18%	0.00%	14.52%	8.24%	20.66%
Ukraine	Production	1.51%	1.74%	0.19%	3.32%	1.33%	0.00%	0.00%	0.01%	0.00%	0.00%
	Exports	0.91%	2.94%	0.05%	0.84%	1.80%	0.00%	0.00%	0.00%	0.00%	0.00%

*Countries/regions with greatest need for supply chain adjustment if trade is impacted***

Nitrogen			Phosphates		Potash
Ukraine, Belgium, Finland, Europe, Middle East & Africa	Brazil, Estonia, Peru, Europe, North America, Middle East & Africa	Brazil, Estonia, Latin America, Europe, Former Soviet Union, Middle East & Africa	Brazil, Estonia, Latin America, Europe, Former Soviet Union, Middle East & Africa	Belgium, Latin America, Europe, Former Soviet Union, North America	Brazil, US, Europe, Latin America, Middle East & Africa, Southeast Asia

*Production and export data 2020
**Trade data 2021 indicative
Source: IFA, CRU, Rabobank 2022

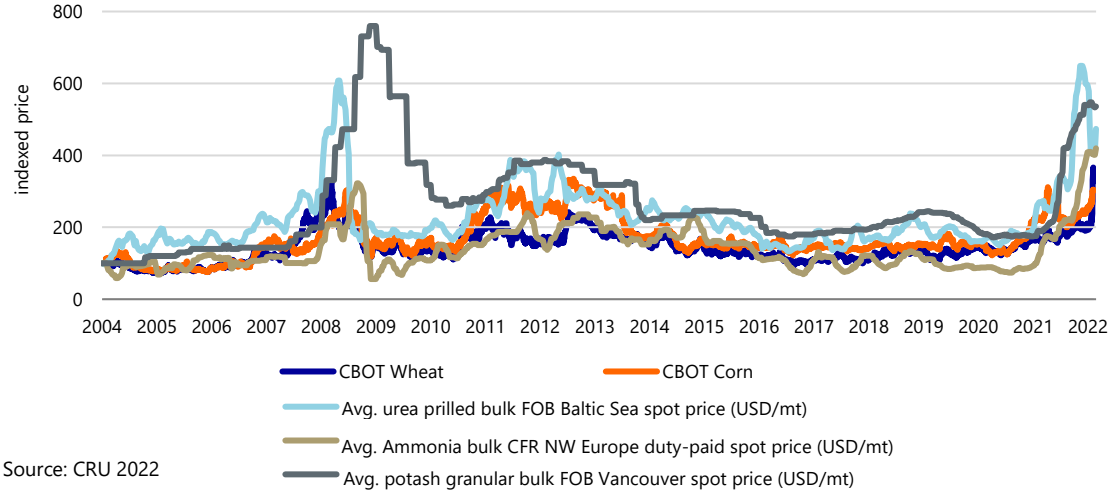
Figure 2: Russia, Ukraine, and Belarus's share of global fertilizer supply, 2022



Source: IFA, Rabobank 2022

Even before the war, Russia's threat to cut gas supplies to Europe in the fall of 2021 contributed to fertilizer cost price increases and uncertainty in the fertilizer market. Fertilizer prices tripled in the second half of 2021. The supply chain could absorb this fertilizer price increase because it coincided with a huge increase in agricultural commodity prices (*see Figure 3*).

Figure 3: In 2H 2021, fertilizer prices tripled, but the supply chain could absorb the price increase because it coincided with a huge increase in agricultural commodity prices



Source: CRU 2022

Thus, while fertilizer prices can rise in response to increasing food prices, the current high fertilizer prices and supply shortage were not the cause of the increase in food prices. In fact, fertilizer manufacturers will be incentivized by high fertilizer prices to increase output. And global fertilizer traders will adjust/overhaul trade flows to bring the increased supply to the most critical demand areas (mainly Latin America for now).

India and Brazil to Test the N and K Markets in the Next Few Months

The direct impact of the war on fertilizer markets will first be felt in the food production seasons in India and the southern hemisphere.

India is preparing to sow its kharif crop (mainly rice, corn, and cotton), which begins at the start of the monsoon in June. India depends heavily on imports of all three nutrients (N, P, and K). Last month, the country secured potash volumes through a contract with a Canadian supplier (Belarus's and Russia's biggest competitor). India also secured substantial volumes of N through tenders in the past three months. Thus, India's immediate needs have been met, but it is likely that it will need to take action again in the coming months.

Meanwhile, Brazil is preparing for its main soybean season, which starts in September. This means the country will enter the market in the coming months to secure fertilizers. As the most critical fertilizer for Brazil is potash – a crucial mineral nutrient in soybean farming – Brazilian importers will focus mainly on K, of which the country is the largest importer in the world. Brazil imports 40% of its potash from Russia and Belarus, which have a 36% share of global supply, but North American potash suppliers (who have a 50% global market share) are eager to increase supplies to Brazil. The most critical nutrient for wheat and corn in Latin America is nitrogen, but the global N fertilizer complex is more fragmented and thus more flexible, which will make it easier to find a solution in the next six months.

N Market Is Better Positioned to Absorb War Disruption than K Market

The more fragmented structure of the global N industry and the relatively small share of Russia and Ukraine in global urea production (7%) and exports (17%) provides the global N market with opportunities to mitigate the loss of Russian and Ukrainian supplies. China has significant production capacity that can be brought to market. So far, Chinese manufacturing has been excluded from export, as the Chinese government has significantly limited N exports in order to

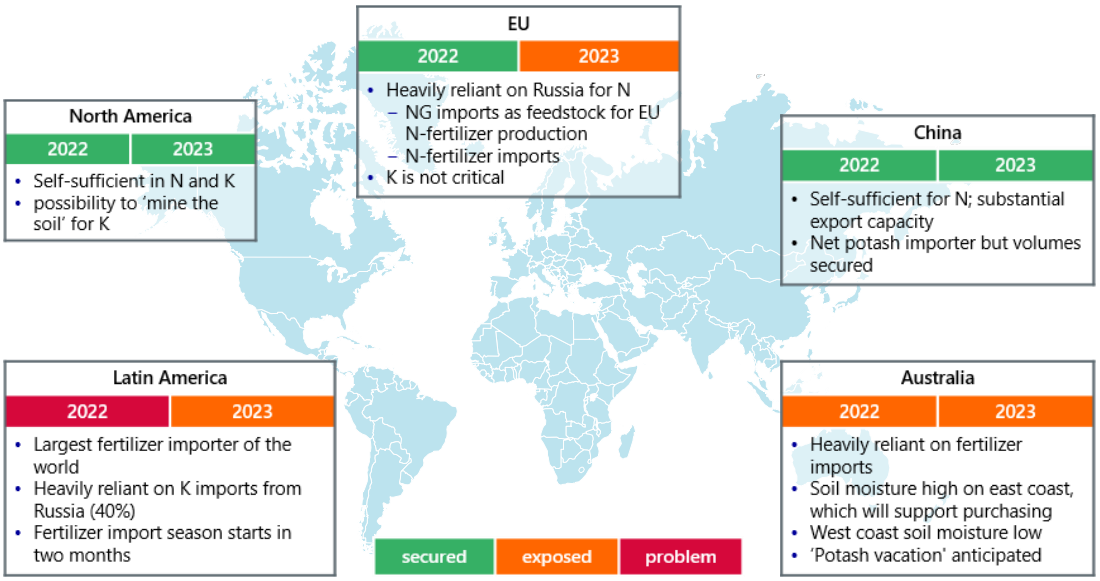
secure an adequate domestic supply. This volume might not reach the market in time for India's kharif cropping season, but it could fill the Russian supply gap in the run-up to the 2023 cropping season in the northern hemisphere. The Middle East and North Africa could help secure India's N supply for the kharif season in the coming months, albeit at a high price, which will directly eat into India's financial budget. Unlike other major producing regions, India does not export many agricultural commodities. Rather, it produces them for domestic consumption, and the sales price of staples is capped by the government.

The challenge for Brazil to secure sufficient potash appears to be much greater. A strict ban on potash sales by Russia and Belarus could put downward pressure on yields and, consequently, on soybean output. This could, therefore, be the first case where the war in Ukraine directly depresses agricultural output through fertilizer shortages. The principal adverse impact will be on feed grains (soybeans), and, since China is the world's leading importer of soybeans, the pressure on their animal protein industry could increase in 2023. However, it is too early to tell if and how this will play out, so we need to monitor the dynamics closely.

2023 Cropping Season: Impacts Vary, but Careful Assessment Needed

Further down the road, the 2023 cropping season in the northern hemisphere could face some disruptions. There are four main cropping areas in the northern hemisphere: North America, Europe, the former Soviet Union, and China. Regional trade is still ongoing in each of these markets. But with the exception of the former Soviet Union, this regional trade no longer relies on fertilizers that must be shipped from Russia or Ukraine. However, the EU relies heavily on a 'special' N fertilizer: calcium ammonium nitrate (CAN). Instead of a global market, the CAN market is regional, and Russia and Ukraine account for almost 50% of global CAN exports. Moreover, domestic production of CAN relies on (Russian) natural gas.

Figure 1: Impacts on the 2022 and 2023 growing seasons of the EU, North America, Latin America, China, and Australia



Source: Rabobank 2022

Analysis of Farmers' Margins Reveals Farmer Flexibility

In general, high fertilizer prices are the result of high agricultural commodity prices. The consolidated global fertilizer industry is well positioned and experienced in 'stealing' margins from farmers when they have increased returns per acre due to high agricultural commodity prices. The fertilizer industry simply raises the fertilizer price. The supply of potash and phosphate is consolidated into a very small group of suppliers, and prices are settled through bilateral negotiations, as there is no central and transparent market. The nitrogen industry is more fragmented, but again it lacks a central marketplace.

The situation today is not typical. The war in Ukraine created an uncommon uncertainty in the agricultural industry: a potential fertilizer supply bottleneck. Could fertilizer prices increase to levels that outgrow the increased returns farmers get from higher agricultural commodity prices? If that happens, farmers will have an incentive to reduce their fertilizer application rates, which could result in lower yields. Or will there be enough fertilizer available for farmers when they start planting their crops? If not, they will also be forced to reduce the application of mineral fertilizers, which could again result in lower yields. In either case, fertilizer dynamics will have a negative impact on farming margins and yields. This, in turn, will tighten the grain supply and place risk on the food supply.

Nitrogen

Farmers in the northern hemisphere are about to plant their crops. Most fertilizer is already in the field, at the farm, or at the retailer. Therefore, the risk of fertilizer unavailability is low. For wheat farmers in the EU and corn farmers in the US who have not yet locked in (part of) their fertilizer prices, the increased revenue per acre more than offsets the increased nitrogen fertilizer prices.

Figure 5: Estimated farmer margins based on five-year average prices, French wheat vs. US corn, calculated on March 18, 2022

France wheat farmer	*US Midwest corn farmer*
Average yield (2011-2021)=7 metric ton/ha	Yield (2011)=11 metric ton/ha
Standard N fertilizer application rate=300kg	Standard N fertilizer application rate=380kg
MATIF wheat price: • five-year average=EUR 200/metric ton • September 2022 futures price=326	CBOT corn price: • five-year average=USD 162/metric ton • September 2022 futures price=262
CRU urea price FCA France: • five-year average=306 EUR/metric ton • today's spot price=EUR 1,075	CRU urea FOB Midwest: • five-year average=(approx.) USD 270/metric ton • today's spot price=USD 935
Increased revenue/ha (326-200)*7=882	Increased revenue/ha (262-162)*11=1,100
Increased N costs/ha (1,075-306)*0.3=231	Increased N costs/ha (935-270)*0.38=252

Source: Knoema, CRU, Nature Food, USDA, Rabobank 2022

But this typical situation applies mainly to intensive farming systems with high yields per hectare (such as wheat in the EU and corn in the US). More extensive farming systems with low yields per hectare have less of an income buffer to offset the high fertilizer prices and are therefore more exposed to the margin pressure resulting from them. This is true for US Southern Plains wheat farmers. Details are not available, but we expect these farmers to decide to apply less N because of the high N prices. In addition, the drought in the region could negatively impact yields, making farmers even less inclined to apply expensive N fertilizer.

The global nitrogen fertilizer supply complex is more fragmented than that of other fertilizers, and Russia, Belarus, and Ukraine have a smaller share of the global nitrogen market. Consequently, production expansion and increased trade in nitrogen fertilizer from destinations other than Russia and Ukraine are likely. China, one of the largest potential exporters, may lift its export curtailments in 2H 2022, as the reasons behind these curtailments seem to have disappeared. The power crunch that occurred in China in the Chinese fall and winter of 2021/22 has been solved. Furthermore, oil production in the Middle East could increase, and, as a result, the production of natural gas as a by-product of oil drilling could also increase. Current high nitrogen fertilizer prices make it attractive to increase the production of nitrogen fertilizer rather than 'flaring' this natural gas. In the US, the shale gas industry is gearing up to increase output. This could increase nitrogen fertilizer production and export availability. CF Industries, the world's largest nitrogen fertilizer company, has built the world's largest nitrogen plant in Louisiana off the US Gulf Coast in order to monetize the US shale gas revolution in the nitrogen fertilizer export market.

Detailed information on nitrogen applications in Latin American corn and wheat production is not available. But of course nitrogen is the critical fertilizer for these crops. Again, there is time to convert the flexibility in the nitrogen fertilizer supply complex and in farmers' responses into a solution. Moreover, Brazil is more oriented toward soybeans than Europe and the US, and it imports comparatively less nitrogen fertilizer than potash. Farmers are likely to reduce potash application rates by about 15% and seek biofertilizers as an alternative. A lesson from the 2008 fertilizer price spike is that they can do this without reducing yields.

So while the situation is fragile and is likely to evolve over the next three months in ways we cannot predict, for now, we are confident that a supply solution for Latin American markets will be found in the next three months. As such, the fertilizer shortage's impact on yields will be mitigated.

Potash

From a farmer's perspective, the situation is different for potash. Whereas nitrogen fertilizers must be applied every year to prevent a decrease in yields, potash application can be postponed for up to three years without any impact on yields. Plants can live off the potash available in the soil to meet their needs. Farmers simply reduce applications and 'restore the soil' when potash prices are lower.

In 2008/09, farmers faced a situation similar to today. Agricultural commodity prices were high, and fertilizer prices had increased multiple times relative to agricultural commodity prices. US farmers responded by reducing fertilizer applications by 34% in the first year and by 4% in the second year. This had no impact on yields. We expect US farmers to act in the same way in today's situation: cutting back on expensive potash.

For Brazil, the US farmers' response is important. The uncertainty of potash availability for Brazil's upcoming crop is what worries farmers the most, as they are highly exposed to fertilizer nonavailability risks because of the war in Ukraine, and this could put pressure on their margins.

Brazil is the largest importer of fertilizer in the world and is most reliant on supplies from Russia, Belarus, and Ukraine. The most critical fertilizer is potash. Soybean fields do not need nitrogen fertilizers, as soybeans are able to live off of the nitrogen in the air. This makes potash the most important fertilizer in Brazilian agriculture. As soybean acreage expanded and harvests improved, Brazil became the world's biggest and most attractive market for potash, estimated at about 12m metric tons. For its supply, Brazil relies mainly on two production regions: Canada and Belarus/Russia. A third region, Israel, is a much smaller supplier. Belarus and Russia have about a 40% share of Brazil's market. The current situation threatens to cut off Brazilian farmers from this supply source. Hence, Brazilian soybean farmers are concerned because their margins are at risk if there isn't enough potash available to secure yields.

Simply put, in the worst case, Brazil has about three months to find an alternative to the 5m metric tons of potash that may not arrive from Belarus and Russia in the coming months. The most likely solution is a combination of three partial solutions: 1) import more potash from Canada and Israel, 2) reduce application rates, and 3) find alternatives to mineral fertilizers.

Zooming in on solution one: This is where the response of North American farmers, particularly US farmers, becomes relevant. At 10m metric tons, North America is also a large potash market. A 35% reduction in potash applications in North America would make 3.5m metric tons available to be shipped to other destinations. This comes on top of potential increases in production that are already envisioned by Canadian miners. Nutrien, the world's largest potash producer, has already announced its intention to increase production. And Mosaic, the second largest company, will leverage its strong position in Brazilian fertilizer blending to help debottleneck potash supply chain risks in Brazil. The Israeli company ICL has limited opportunities to increase production (because it has a different production system), but it generally has a relatively large stock that it can use to benefit from the high prices in Brazil.

Regarding solution two: Brazilian farmers, like their counterparts in the US, also reduced potash application rates in 2008/09 – by 13% in the first year and by 10% in the second year – with no negative impact on yields. It is likely that they will do the same in the current market environment. And then there is the opportunity to replace mineral fertilizers with biofertilizers. It is uncertain what the potential is, but it is expected to be rather limited.

So it's not a hopeless situation, thanks to the flexibility of the potash supply complex, the flexibility of farmers' responses, and the time Brazil has to find a solution. However, the situation is fragile, and we have to allow for the unexpected. Therefore, we will be monitoring the situation closely in the coming months. But today we are cautiously optimistic that the impact could be smaller than currently feared.

India and Africa Are Perhaps Most Vulnerable

These regions are highly dependent on fertilizer imports but do not benefit from high agricultural commodity prices. The Indian government subsidizes Indian farmers with low fertilizer prices and caps grain sales prices to keep food inflation in check. This means that the government budget for fertilizer subsidies is rising significantly in the current environment.

African farmers may not be able to afford fertilizers and, as a result, may see their production decrease.

Figure 6: Short- and long-term responses of farmers in the US, the EU, and Brazil

Short term (2022 and 2023)

- Survive the initial period of uncertainty and market disruption driven by emotional decision-making.
- Potential demand destruction (lower fertilizer application per hectare) due to:

1) Price

US corn N application	30% reduction in N reduces yields ~10%	Not likely to happen.
EU wheat N application	35% reduction in N reduces yields ~20%	Not likely to happen.

2) Availability

Brazil soybean, wheat, and corn K application	The opportunity cost of reducing the K application rate is higher due to poorer soil. There appear to be no concerns about the price.	1. Increase volumes from other sources. 2. Apply biofertilizer as an alternative to mineral fertilizers. 3. Lower application rate.

Long term

- Speed up changes in farming practices.
- Precision agriculture in row crop farming.
- EU Farm to Fork Strategy expected to gain momentum.

Source: Rabobank 2022

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