

Review

Implementation of COVID-19 control measures: Effect on fertilizer supply and soil fertility in Africa

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The unexpected outbreak of novel COVID-19 in late 2019 and continual spread across the world has disrupted the agricultural value chain. The World Health Organization (WHO) prescribed border closure, lockdown, social distancing, wearing a mask, and handwashing to combat the pandemic. These control measures, especially the closure of borders, have affected the importation and supply of fertilizer for crop production. The current study presents potential expectations for the adverse effects of coronavirus pandemic on fertilizer supply and application, soil fertility, and crop yield. The study indicates that the effect of the COVID-19 pandemic has made the delivery of fertilizers to farmers very difficult. Hence, the application of fertilizer on time by farmers was problematic. It was also discovered that the COVID-19 control measure enforced can delay crop planting on time and the use of optimum quality and quantity of fertilizer. Therefore, crop yield will be affected and the quantity of crop produced will be reduced.

Key words: COVID-19 pandemic, fertilizer application, impact assessment, sustainable production, value chain

INTRODUCTION

In December 2019, an infectious disease outbreak known as COVID-19 was caused by Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) (Poudel et al., 2020). The COVID-19 was initially detected in the capital of China's Hubei province called Wuhan (Poudel et al., 2020). Yan et al. (2020) explained that the COVID-19 is highly contagious and transmittable from one person to another, and anyone infected with the novel coronavirus

can infect about six people on average. Due to the virus's fast spreading, the World Health Organization (WHO) announced the outbreak of COVID-19 as a global pandemic. The COVID-19 pandemic is still spreading across the world, affecting various sectors, including agriculture (Jámbor et al., 2020). Globally, agriculture is one of the world's significant sectors and the biggest industry in some parts of the world (Poudel et al., 2020).

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Agriculture plays a vital role in human development by ensuring sustainable crop production and food security. The Food and Agriculture Organization (FAO) reported that over 60% of the world's population depends on agriculture for survival (Zavatta et al., 2014). The various control measures such as the closure of borders, social distancing, partial or complete lockdown, wearing of nose mask as a result of the COVID-19 pandemic has affected the food supply chain. There is not enough adequate information on the impact of coronavirus on agriculture. Hence, a thorough investigation should be done on the impact of COVID-19 on agriculture since food is necessary for survival. We hypothesize that crop yield would be low since the usual quantity of fertilizer imported and supplied will not be the same as amid the COVID-19 pandemic; farmers will not be able to apply the right proportion of nutrients to meet crop nutrients requirement. Hence, this paper investigates the impact of COVID-19 on fertilizer importation and supply, its application on soil fertility and crop yield.

IMPACT OF COVID-19 ON FERTILIZER IMPORTATION AND SUPPLY CHAIN

The World Health Organization (WHO) came up with measures (travel ban, home confinement, closure of factories, social distancing) to combat the COVID-19 pandemic. Most countries in the world strictly implemented these control measures to control the rate of infection. The closure of borders as one of the control measures had negatively affected the agricultural value chain, most especially importation of fertilizer and supply to wholesalers, retailers, and farmers. The scheme of the effect of COVID-19 on agriculture inputs and the food supply chain is presented in Figure 1.

As the rate of COVID-19 infection increases and countries enforce control measures, agricultural production and productivity will continue to be affected by the novel coronavirus, which will negatively impact fertilizer production and distribution (Figure 2) (Willy et al., 2020). In extreme cases, the COVID-19 pandemic will affect the fertilizer supply chain and agrochemicals due to the shrinking capacity in the production of crucial chemical components for fertilizers in importation and inland transportation (Willy et al., 2020). One of the significant fertilizer producers and exporters in the world is China (Marlow, 2020). The international fertilizer trade in China has been affected drastically due to partial or complete lockdown in China. Experience from similar crises has shown that restriction of movement and closure of borders, including roads restrict farmers' access to input markets (FAO, 2020a). According to Food and Agriculture Organization (2020), processors and importers of agriculture inputs face reduced working shifts with lower output. Njugunah (2020) explained that the harm caused by the novel coronavirus had made

fertilizer distribution to farmers on time for application very difficult. The delay in subsequent fertilizer application to crops could yield losses as reported by Bindraban et al. (2020).

IMPACT ON SOIL FERTILITY AND FERTILIZER APPLICATION

The fertilizer application to crops varies with the type of soil, soil fertility levels within soil types, available nutrients ratios, crop type, and climatic conditions (Bindraban et al., 2020). The COVID-19 pandemic impact on soil fertility is through human activities resulting from a delay in fertilizer application by farmers on time (Lal et al., 2020). Due to the closure of borders and lockdown due to the COVID-19 pandemic, securing foodstuffs has become more complex. Bren d'Amour et al. (2017) explained that agricultural land and human population availability, leading to conflicting interests for land use, have been the trend over the years. The impact of climate change on soils and biomass resulting from severe weather conditions such as tornados, droughts, and precipitation events was considered. Amid the COVID-19 pandemic, the need to further develop existing initiatives to increase agricultural input use efficiency, most especially fertilizer, through the adoption of innovations such as sensor and satellite technologies must be implemented. According to Lal et al. (2020), the central aspect of agriculture to be considered during the COVID-19 pandemic is the impact of mineral fertilization omissions on soils and the production function. They further explained that nitrogen (N) and phosphorus (P), known to be essential plant nutrients of crops, must be examined critically. Generally, sustainable nutrient management consists of fertilizer application to replace the number of nutrients removed by the crop harvest (Bren d'Amour et al., 2017). Soil scientists and agronomists have observed that "nutrient mining" systems are primarily associated with subsistence agriculture in tropical areas and sometimes also with extensive farming in Europe (Frossard et al., 2009). The closure of borders and lockdown may limit or prevent fertilizers' importation. The effect of coronavirus pandemic on fertilizer application and soil fertility is shown in Figure 3.

Nitrogen (N), Phosphorus (P), and Potassium (K) are the primary essential nutrients required by plants in large quantities for growth and productivity (Kwon et al., 2019). As shown in Figure 4, the world production of fertilizers containing nitrogen (N), phosphate (P_2O_5), and potassium (K_2O) amounted to 122.7, 50.8, and 40.4 Mt, respectively, while in 2016, the agricultural uses of these fertilizers were 110.2, 48.6 and 38.7 Mt sequentially. From Table 1, China is known as the largest exporter of P (5.32 Mt) and the second-largest exporter of N fertilizers, respectively (5.56 Mt) (Seleiman et al., 2020). Crop maturity and productivity are dependent on the availability of nutrients

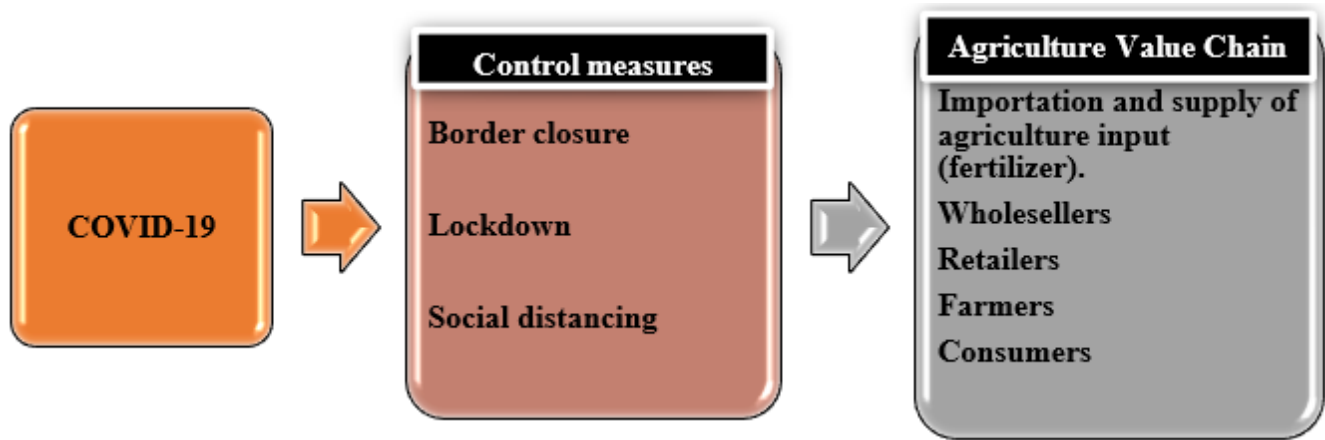


Figure 1. Scheme of COVID-19 effect on agriculture inputs and food supply chain.

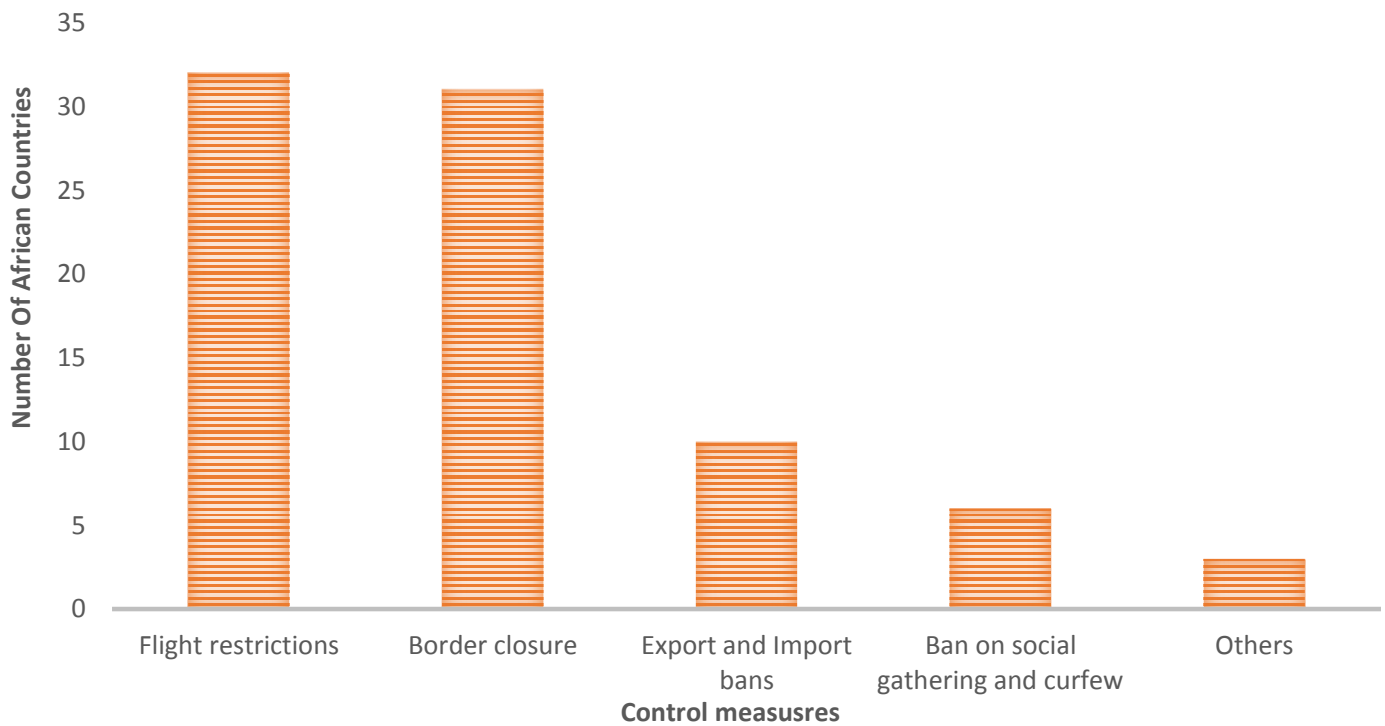


Figure 2. Effect of COVID-19 control measures on trade in goods in Africa.

in the soil for the crop or plant to uptake. Continuous cropping and harvesting lead to nutrients mining since the plant takes up nutrients from the soil. However, the correct quantity of nutrients applied on time improves soil fertility and increases crop yield. Most African countries import fertilizers from developed countries, especially from China. As a result of the novel COVID-19 pandemic and control measure enforced, fertilizers would not be exported in large quantities. Also, inadequate production and importation of fertilizers caused by COVID-19 logistic

constraints can cause unsatisfactory crop yields in Africa. In West and Central Africa, both ports and airports remain operational and close to non-essential travel for essential imports and exports. However, slowdowns were noted in some ports regarding loading, commodities, and unloading. Some of the reasons for the slowness found include precautionary measures and often screening checks placed on ships' crews. In most countries in the region, restrictions on internal travel to contain the spread of the virus and lockdowns in many cities affect the flow

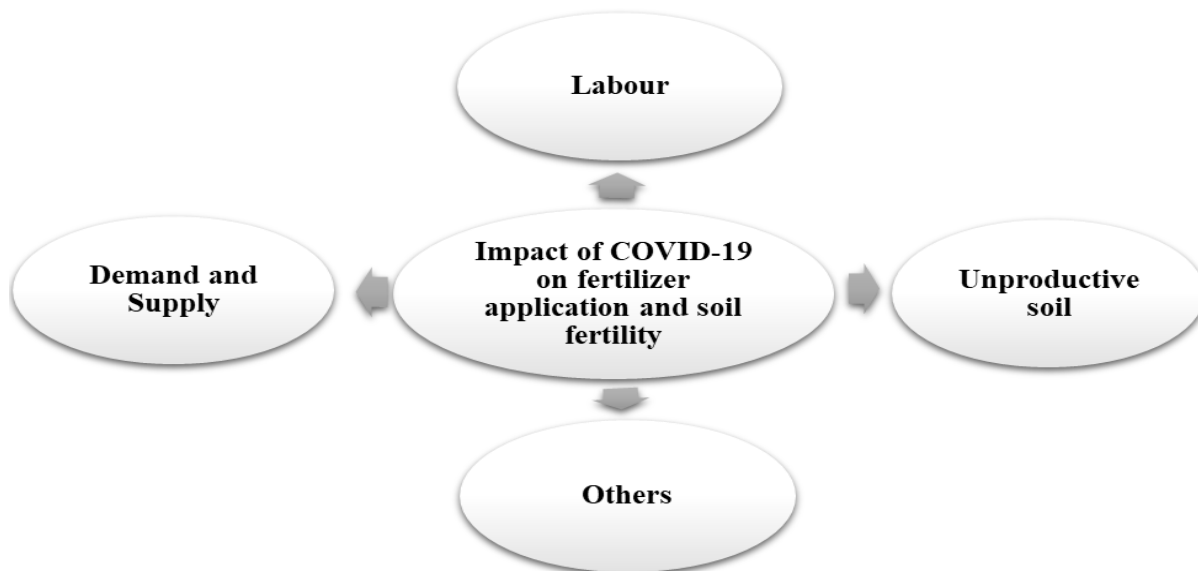


Figure 3. Scheme of coronavirus pandemic impact on fertilizer application and soil fertility.

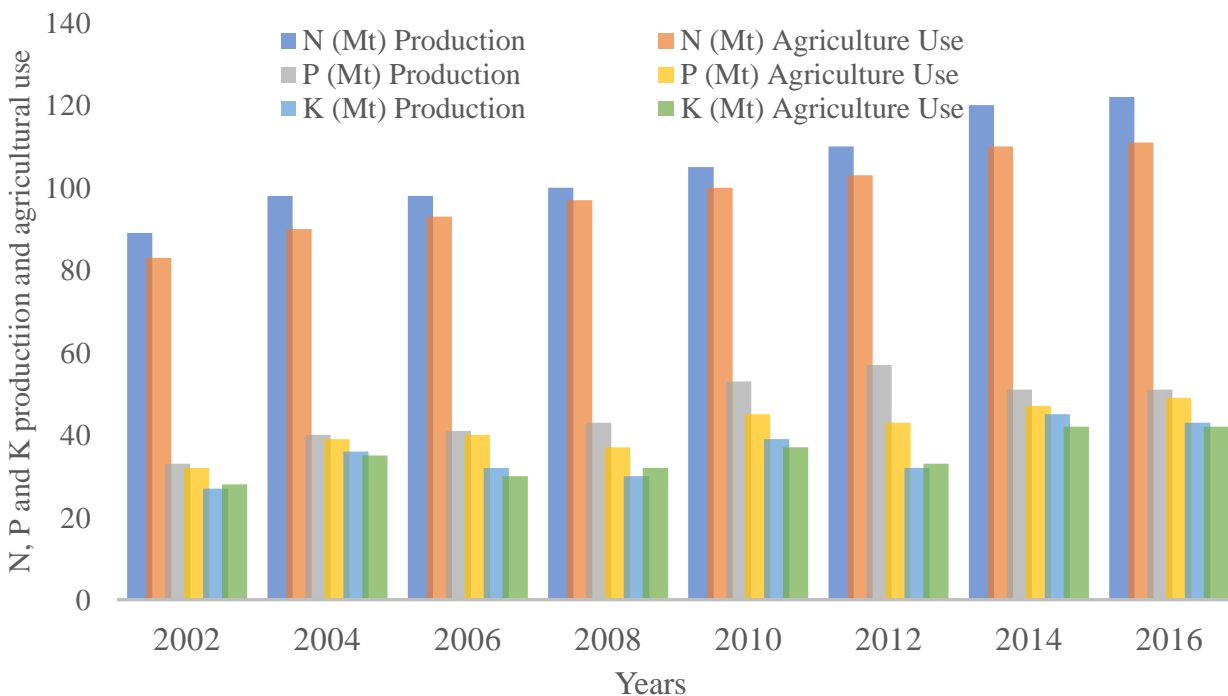


Figure 4. Primary nutrient (N, P, and K) production and agricultural use (FAOSTAT, 2020).

of food and products within countries (Table 2).

IMPACT ON CROP YIELD

Crop production and yield have been affected by the coronavirus pandemic due to the farmers' delay in

fertilizer application on time. The essential nutrients, including nitrogen and phosphorus, play a significant role in crop yield. However, nitrogen (N) often limits crop production the most, and fertilization of phosphorus (P) is known to increase the yield of crops in the last century (Gilbert, 2009; Olf et al., 2005). Continuous nitrogen and phosphorus fertilizers can cause nutrient losses to

Table 1. Ten countries of the highest nitrogen, phosphorus, and potassium export in the world.

Export quantity (Mt)					
Country	Nitrogen (N)	Country	Phosphorus Oxide (P ₂ O ₅)	Country	Potassium Oxide (K ₂ O)
Russian	6.49	China	5.32	Canada	11.49
China	5.59	China, ML	5.31	Russian	7.50
China, ML	5.46	Morocco	3.20	Belarus	6.53
Netherlands	2.17	Russian	2.78	Germany	2.58
Qatar	2.08	USA	2.53	Israel	2.21
USA	2.07	Saudi Arabia	1.26	Chile	0.99
Egypt	1.66	Belgium	0.46	Belgium	0.51
Belgium	1.62	Lithuania	0.41	Netherlands	0.49
Saudi Arabia	1.59	Israel	0.38	Spain	0.49
Oman	1.51	Mexico	0.33	China	0.30

Source: FAOSTAT (2020).

Table 2. Impact of COVID-19 control measures on market flows (WFP, 2020).

Country	Control measure (lockdown)
Benin	Movement restrictions in the sanitary zone in the south of the country
Burkina Faso	Restrictions have been imposed on twelve (12) cities and town
Cameroon	People cannot move from one region to the other.
Central Africa Republic	Restrictions between regions
Cote d'Ivoire	Lockdown took place at Abidjan
Gambia	People were not allowed to move from region to region; market activities weekly were banned.
Ghana	Movement restrictions between other regions locked down for some months.
Guinea	Movement restrictions between regions.
Liberia	Restriction on moving between regions.
Mali	Restrictions on movement between regions.
Mauritania	Weekly market actives were closed, the movement was also restricted.
Niger	Movement restrictions between regions.
Nigeria	There was a lockdown in Lagos, Abuja, Bauchi state, Plateau State.
Senegal	Restrictions on movement between regions markets closed.
Sierra Leone	Restrictions on moving from region to region.
Togo	Locked down in Lomé, Tsévié, Kpalimé, Sokodé

surface and subsurface water, contributing to environmental pollution in the form of nitrate leaching and eutrophication (Withers et al., 2003; Schoumans and Chardon, 2003). Low availability of fertilizer and application as a result of coronavirus pandemic restrictions can lead to improved farm management with consequentially reduced emissions of greenhouse gases (GHGs), including nitrous oxide (N₂O), ammonia (NH₃) emissions, and leaching of nitrate (NO₃) into waters, along with overall improved nitrogen use efficiency and less heavy metal accumulation in soils (Lal et al., 2020). Hence, the environmental impact would be reduced; crop production, yield, and food quality will increase with increasing safe planetary boundaries. Enforcement of

lockdowns in countries due to the COVID-19 pandemic has an impact on sustainable crop production. It has affected farmers, farm laborers, service providers, extension officers, input suppliers, processors, and other agricultural value chain actors by not performing their activities (FAO, 2020b). These constraints can manifest in a way that can lead to the failure to plant crops on time or use the optimum quality and quantity of inputs required, including fertilizers, pesticides, and seeds, to perform varied cultural practices and harvesting and post-harvest activities. As a result, the quantity of crop produced will be reduced, and consumers' demand cannot be met. According to FAO (2020), some farmers may experience temporary setbacks from which

production systems could recover relatively quickly, but there will be a long-lasting effect on more vulnerable smallholder farmers.

CONCLUSION

The novel COVID-19 pandemic has destroyed the agricultural sector in terms of fertilizer importation and supply, crop production, and yield. Agriculture is the backbone for most countries and the sector where the majority depends on survival. The importation and supply of fertilizer have been affected by the coronavirus pandemic, making fertilizer accessible by farmers for crop production. Farmers would not be able to apply an adequate amount of fertilizer to unproductive soil to improve soil fertility. Application of fertilizer on time by farmers to meet crop nutrient requirement amid COVID-19 pandemic will be delayed. COVID-19 control measure enforced can delay planting of crops on time and optimum quality and quantity of fertilizer. Hence, crop yield will be affected and the quantity of crop produced will be reduced.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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