



Fertilizer Production in Africa as a Way to Minimise Fertilizer Importation Cost

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Abstract

Sub-Saharan Africa (SSA) is a region that is often divided for different types of analysis based on social, economic, cultural, political and historical sub-regional characteristics. For a more productive division for discussion in this paper, SSA is considered as comprised of six distinct regions: East Africa, Sudan-Sahel, West Africa, the Central Africa, Southern Africa and the Islands of the Indian Ocean. Subsistence farming dominates the farming system in SSA. There is little application of technology, particularly with food crops, leading to low agricultural productivity. Consequently, health of African soils has become a constant challenge for farmers and agriculturists in the continent and conflicting interests in the exploitation of soil resources by various stakeholders has led to mismanagement; and in some cases degradation of soils. In this paper also, soil productivity maintenance remains a major environmental issue in countries of SSA, low soil fertility inevitably leads to low agricultural productivity and agricultural development is fundamentally affected by productivity status of land resources. Poor soil management and the fragile nature of tropical soils generally account for heavy nutrient losses through soil erosion and leaching of soil nutrient with adverse effects on environmental quality. In view of this, the paper discusses fertilizer assessment in SSA, production and utilization and how it affects the environment. The growing contrast between the productive roles played by fertilizer in other regions of the world and the very limited use of fertilizer in SSA calls for increased use of fertilizer in SSA if they must experience the green revolution as obtained in other regions of the world.

Subject Areas

Economic System

Keywords

Fertilizer Assessment, Sub-Sahara Africa, Production,

Use and Environmental Quality

1. Introduction

Sub-Saharan Africa (SSA) has the world's fastest growing populations, estimated at 2.7% a year, compared to 2% and 2.2% a year in Asia and Latin America respectively (UNEP, 2022) [1]. At the same time the per capita food production index shows a decline from 1.0 in 1961 to 0.82 in 2002 while the index in Asia and Latin America increased from 1.0 in 1961 to 1.82 and 1.25 respectively. The population is unevenly distributed with semi-arid areas not as densely populated as some of more fertile areas (Lelo & Makenzi, 2020) [2]. The country with the largest population is Nigeria with 136.5 million. It is followed by Ethiopia with 68.6 million and the Democratic Republic of Congo with 53.2 million (Lelo & Makenzi, 2020) [2].

Cash crops tend to be better developed than food crops (UNEP, 2022) [1]. Farm sizes tend to be small and decline over time (Nagayets, 2021) [3]. Average farm size in four SSA countries (Kenya, Uganda, Tanzania and Malawi) was about 1.55 ha (Ellis, 2021) [4]. Generally, the average size of land holdings declined from 1.5 hectares in 1970 to 0.5 hectares in 1990 (Nagayets, 2021) [3]. The decline of farm size partially reflects the exhaustion of land frontiers in most SSA countries. It is important therefore to take into account the peculiar needs and concerns of farmers engaged in these various farming systems when developing agricultural technologies or during extension delivery.

Sub-Saharan Africa's rural economy remains strongly based on agriculture relative to other regions. Agriculture in SSA (excluding South Africa) employed 62% of the population and generated 27% of the GDP of these countries in 2005. These agricultural production systems are largely based on smallholder farms. Small holder farms, defined as being two ha or less, represent 80% of all farms in SSA, and contribute up to 90% of the production in some SSA countries (Wiggins, 2022) [5]. A large percentage of these small holders are women, responsible for key components of house hold production such as weeding, harvesting and processing. Further, women often independently grow non-cereal crops for income and are increasingly heading rural households due to male urban migration. As in other regions, SSA agricultural households have varying levels of diversification in income sources beyond agriculture—though agriculture remains the dominant source of livelihood in poorer countries and poor regions within less poor countries. Generally, this paper seeks to discuss Fertilizer Production in Africa as a Way to Minimise Fertilizer Importation Cost. This article will constitute soil fertility decline trends, role of fertilizers in Sub-Saharan Africa Agricultural Production, fertilizer production in Sub-Saharan Africa, Fertilizer Supply, Demand and Balance in Africa, and Fertilizer Exports, Imports and Cross-Border Trade.

2. Soil Fertility Decline Trends in Sub-Saharan Africa

Health of African soils has become a constant challenge for farmers and agriculturists in the continent. Conflicting interests in the exploitation of soil resources by various stakeholders has led to mismanagement; and in some cases degradation of soils. As shown in **Figure 1** and **Figure 2**, in recent decades, unsustainable land cultivation practices (e.g. inadequate replacement of soil nutrients taken up by crops) have led to accelerated depletion of the natural soil base available for food production (Hossner & Juo, 2023) [6]. Soil productivity maintenance remains a major environmental issue in countries of SSA (Oyetunji *et al.*, 2021) [7]. Low soil fertility inevitably leads to low agricultural productivity, since agricultural development is fundamentally affected by productivity status of land resources. Poor soil management and the fragile nature of tropical soils generally account for heavy nutrient losses through soil erosion and nutrient leaching in soils (Hossner & Juo, 2023) [6]. In countries of SSA, unsuitable soil management activities including deforestation, indiscriminate vegetation removal, overgrazing and use of marginal lands for agricultural purposes often precedes eventual degradation of soil resources and environmental damage.

Poor cultivation practices have resulted in decrease of soil fertility, reduction of soil organic matter (SOM), and increase in occurrence of acidified soils (Aihou *et al.*, 2022) [8]. Decline in soil fertility as a result of land degradation decreases farmland productivity. Escalating rates of soil nutrient mining makes nutrient losses highly variable in agricultural areas of sub-humid and humid savannas of West Africa, where they range from moderate to severe loss of nutrients. Smaling (2023) [9] estimated that annual net nutrient depletion rates per hectare exceeded 30 kg N and 20 kg K in arable soils of several countries in SSA.

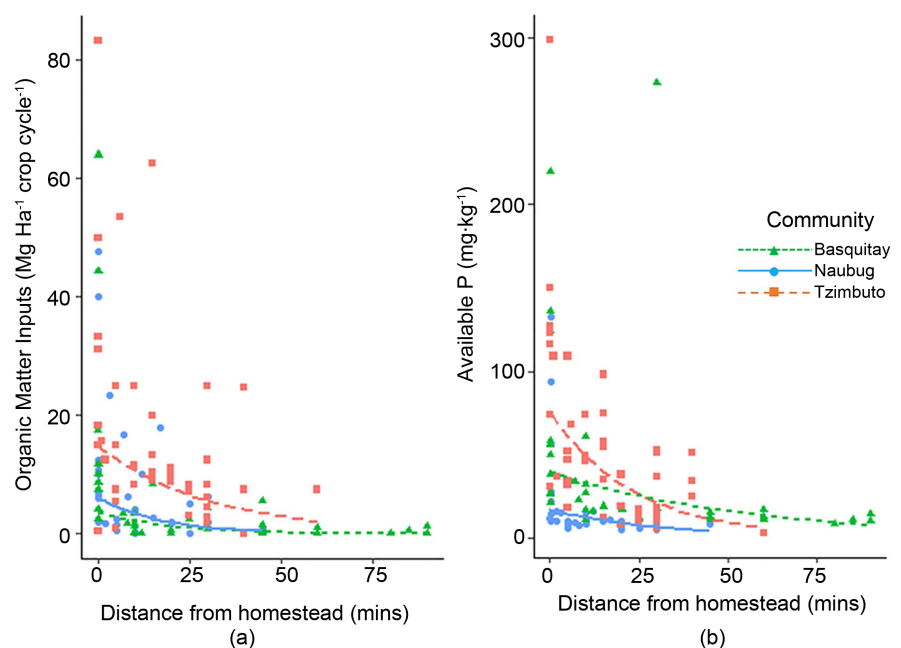


Figure 1. Rate of soil fertility decline trend in Sub-Saharan Africa.

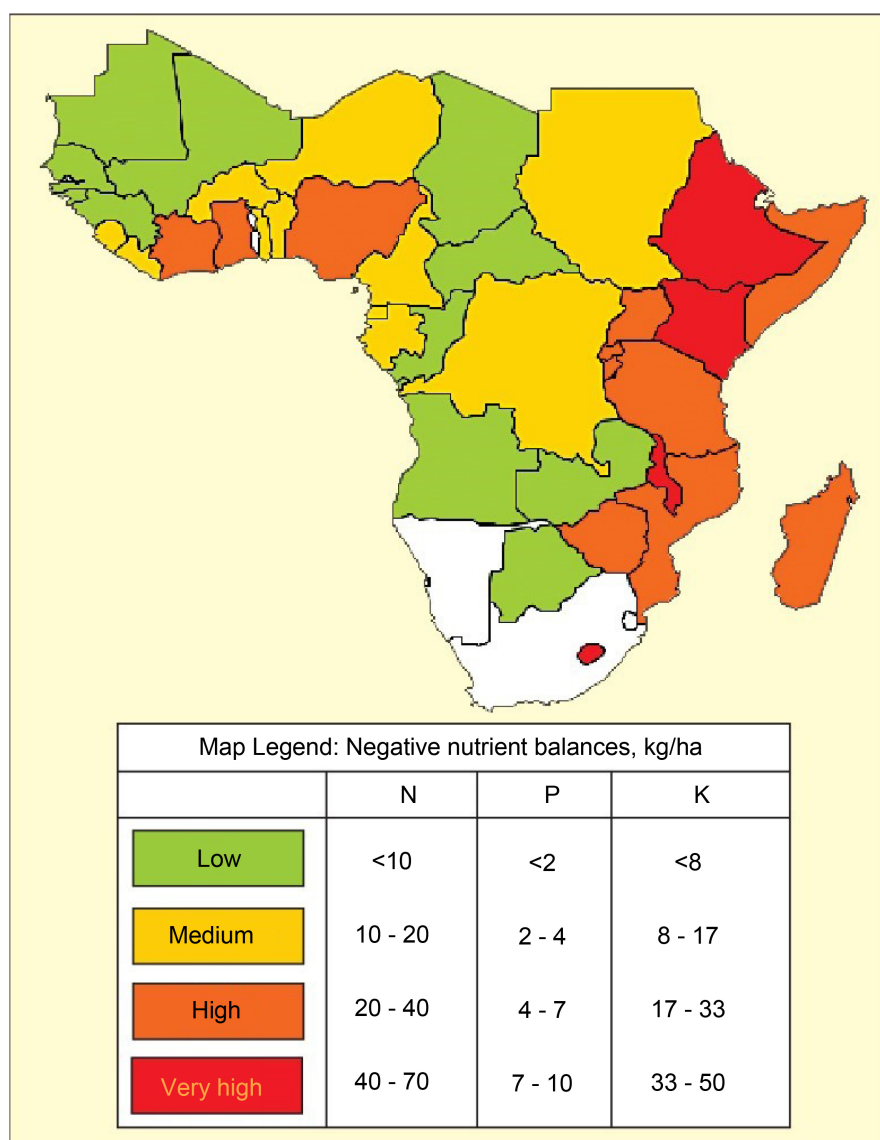


Figure 2. Rate of fertilizer usage in Sub-Saharan Africa.

In many parts of SSA where poor soil conservation methods prevail, long term productivity of soil is projected to decline considerably unless soil management practices improve.

3. Role of Fertilizers in Sub-Saharan Africa Agricultural Production

The structural transformation paradigm has been the foundation of rural development thinking for four decades. The paradigm argues that agriculture serves as the “engine of growth” during the early stages of a country’s economic development because the sector typically accounts for a high share of economic activity in developing countries and because agricultural activities tend to have strong growth linkages with the rest of economy. Although there has been some agricultural productivity growth in Sub-Saharan Africa (SSA) during the past several

decades, current growth lags far behind that in other regions of the world and is well below that required to meet food security and poverty reduction goals (Smaling, 2023) [9]. In short, SSA has not yet experienced its “Green Revolution”. There is ample evidence from experience outside Africa that increased use of mineral fertilizers has been responsible for an important share of worldwide agricultural productivity growth. Some argue that fertilizer was as important as seed in countries where a Green Revolution has already taken place (Tomich *et al.*, 2022) [10], contributing as much as 50% of the yield growth in Asia. Others have found that one-third of the cereal production worldwide is due to the use of fertilizer and related factors of production.

The general case for increased mineral fertilizer use in SSA is based on the following arguments:

- Africa’s soils are being mined of nutrients at an alarming rate because traditional soil fertility management practices are no longer adequate due to population growth and land pressure.
- Organic soil management methods contribute to soil fertility improvement but are inadequate for meeting the rapid and sustainable growth needed in SSA agricultural output.
- The only means of both maintaining soil fertility and of achieving the required rate of SSA agricultural growth is to significantly increase the quantities of mineral fertilizers used. Such fertilizers can be employed in combination with organic fertilizers to increase crop output (for food and commercial purposes) and the amount of biomass available for transfer to land on which crops are being grown.

4. Fertilizer Production in Sub-Saharan Africa

Annual demand in Africa for nitrogen, phosphate and potash for fertilizer production is expected to increase by 3.78, 2.80, and 6.76 per cent, respectively, between 2015 and 2020 (FAO, 2021) [11]. However, most countries in Africa are still heavily dependent on imported fertilizers due to a lack of low-cost readily available raw materials for fertilizer production, low domestic demand, low-capacity utilization³, and the large capital investments that must be made to establish fertilizer production plants.

With the exception of phosphate production, Africa also compares poorly with other global regions in terms of fertilizer production capacity. There has, however, been a sharp increase in urea production capacity in Africa since 2020, and Algeria, Egypt and Nigeria are expected to achieve particularly large capacity gains by 2030. Global ammonia production capacity was estimated at 174.8 million tons in 2020 and is expected to reach 188.3 million tons by the end of 2030, with the main additions to capacity occurring in North America, Eastern Europe and Central Asia, Africa, South Asia and West Asia. World phosphoric acid production capacity was estimated at 57.4 million tons in 2020 and is expected to rise to 64.8 million tons by the end of 2030, with Africa expected to

account for 52.4 per cent of production capacity gains, East Asia expected to account for 25.7 per cent and West Asia to account for 18.3 per cent. Potash production capacity was estimated at 52.9 million tons in 2020, and by the end of 2030, total global capacity is expected to reach 64.5 million tons, with North America accounting for 30 per cent of production capacity gains, Eastern Europe and Central Asia accounting for 52 per cent, East Asia accounting for 14.6 per cent, and Africa accounting for less than 3 per cent (FAO, 2021) [11].

The production of fertilizer in Africa is concentrated primarily in six countries, namely Algeria, Egypt, Morocco, Nigeria, South Africa and Tunisia. Those countries have developed robust fertilizer industries and also make widespread use of fertilizer. As already shown, significant urea (nitrogen) and phosphate fertilizer capacity development is expected by 2030 (Heffer & Prud'homme, 2021) [12]. Urea production capacity is expected to increase by some 8 million tons, with most capacity gains occurring in Algeria, Egypt and Nigeria, while phosphate production capacity is expected to increase by some 5 million tons, with most gains occurring in Egypt, Morocco and Tunisia.

If current trends continue, phosphate reserves in Africa will reach 61 million tons in 2030, with most reserves located in Morocco, followed by Algeria, Egypt, Senegal, Togo and Tunisia. A number of potash projects are being developed in the Congo, Eritrea and Ethiopia but are not expected to start production in the near future.

In sub-Saharan Africa, phosphate rock processing takes place in Mali, Senegal and Togo, while fertilizer is produced, primarily, in Kenya, Madagascar, Nigeria, the United Republic of Tanzania and Zimbabwe (Africa Fertilizer.org, 2021) [13]. No more than four fertilizer producing firms operate in any sub-Saharan Africa country.

In Nigeria, for example, Notore Chemical Industries PLC and Indorama Eleme Fertilizers & Chemicals Ltd produce 500,000 tons and 1.4 million tons of urea, respectively, and account for all ammonia and urea production in that country. However, the Dangote Group and Brass Fertilizer are expected to start production in the near future (Heffer & Prud'homme, 2021) [12]. Sable Chemical Industries account for all ammonium nitrate production in Zimbabwe, producing 240,000 tons per year, while Zimbabwe Phosphate Industries Ltd produces 150,000 tons of phosphates, 45,000 tons of TSP and 200,000 tons of single super phosphate (SSP). In Senegal, Industries Chimiques de Senegal (ICS) processes 250,000 tons of phosphate rock while Société d'Études et de Réalisation des Phosphates de Matam (SERPM) processes 25,000 tons of phosphate rock and also produces phosphoric acid, DAP, Gypsum and NPK fertilizer. In Kenya, Kel Chemicals Ltd produces 200,000 tons of SSP and sulphuric acid, while Toguna Agro Industries in Mali processes 300,000 tons of phosphate rock. In the United Republic of Tanzania, Minjingu Mines & Fertilizer Ltd processes 100,000 tons of phosphate rock and produces 30,000 tons of NPK. In Togo, Société Nouvelle des Phosphates du Togo processes 300,000 tons of phosphate rock

and International Raw Materials produces 180 thousand tons of ammonium sulphate in Madagascar. In Zambia, Nitrogen Chemicals of Zambia produces some 250,000 tons of NPK and 64,000 tons of ammonium nitrate. In South Africa, Omnia Nutriology produces 600,000 tons of ammonium nitrate and nitrogen-phosphatepotassium-sulphur (NPKS) fertilizer, while Foskor produces a range of fertilizers, including 400,000 tons of MAP, and Sasol produces over 600,000 tons of ammonia, ammonium nitrate and other fertilizer products (Africa Fertilizer.org, 2021) [13].

Several new fertilizer projects are underway in sub-Saharan Africa, including projects by Indorama Eleme Fertilizers & Chemicals Ltd in Senegal, the Dangote Group in Nigeria, a public private partnership involving Olam International in Gabon, Elemental Minerals in the Congo, Danakil Potash in Eritrea, Yara International, the OCP Group and the Chemical Industries Corporation in Ethiopia, the Tanzanian Petroleum Development Corporation, Ferrostal, Haldor Topsoe and the Fauji Fertilizer Company in the United Republic of Tanzania, Yara International in Mozambique and the Sukulu Industrial Complex in Uganda (Harrison, 2020) [14].

Furthermore, a number of companies in Sub-Saharan Africa produce lime supplements, micronutrients and organic fertilizers. These include Safisana in Ghana, Profeba in Mali, Cybernetics Nigeria Ltd in Nigeria and ABM Equipment Services Ltd and Poli General Trading & Supplies Ltd in the United Republic of Tanzania (Africa Fertilizer.org, 2021) [13].

In North Africa, the OCP Group, based in Morocco, produces phosphoric acid and processed phosphates, including MAP, DAP, NPS, TSP and NPK. In Egypt, El Nasr Mining Company and Misr Phosphate process phosphate rock, a number of companies produce SSP and six companies manufacture urea. In Algeria, Somiphos processes phosphate rock, Sorfert and Fertial produce ammonia and urea, and AOA Spa produces urea. In Tunisia, the Gafsa Phosphate Company produces phosphoric acid, and the Tunisian Chemical Group and Tunisian Indian Fertilizers manufacture processed phosphates. In Libya, the Libyan Norwegian Fertilizer Company produces ammonia and urea.

The OCP Group accounts for 29 per cent of global phosphate rock exports. Its capacity, which already stands at more than 32 million tons; is expected to reach 55 million tons once planned mine expansions in Khouribga and Gantour and a new mining complex in the Essaouira region start production. In Egypt, El Nasr Mining Company currently mines phosphate rock in Sabaiya. Misr Phosphate, which operates mines in Abu Tartur, is planning expansions which will increase its capacity significantly. There is currently no commercial production of potassium anywhere in Africa except for a few sulphate-of-potash (SOP) plants in Egypt that use imported potassium chloride (African Centre for Biosafety, 2020) [15].

An enduring paradox is that most fertilizers produced in Africa, including raw materials and intermediate products used in fertilizer production, are exported

to other continents, while, at the same time, Africa continues to import most of the end product fertilizers it requires from outside the continent.

In addition to fertilizer manufacturing plants, a number of fertilizer-blending plants have been or are being established in Africa (Camara & Edeme, 2021) [16]. Those plants use pre-manufactured products to formulate products for end use (Africa Fertilizer.org, 2021) [13]. There are 59 fertilizer blending plants 4 in sub-Saharan Africa, including 14 in Nigeria, 5 six in Côte d'Ivoire, five in Ethiopia, four in Zimbabwe, four in Mozambique, four in Zambia, four in Mali, three in Ghana, three in Kenya, two in Malawi, two in Cameroon, and one plant in each of Burkina Faso, Guinea, Mauritius and Togo (Harrison, 2020) [14]. Blending plants are usually established near agricultural areas. There are 19 new blending plants planned in sub-Saharan Africa, including five in Nigeria, four in the United Republic of Tanzania, two in Côte d'Ivoire and one plant in each of Burkina Faso, Ghana, Malawi, the Niger, Rwanda, Senegal, Uganda and Zimbabwe (Africa Fertilizer.org, 2021) [13].

5. Fertilizer Supply, Demand and Balance in Africa

As indicated above, although the consumption of fertilizer in Africa remains extremely low, demand is expected to grow by 3.86 per cent per year. These are therefore a pressing need to increase the supply of fertilizer across the continent, and particularly the supply of potassium fertilizers. Because the availability of nitrogen and phosphate far exceeds total regional demand, steps should be taken, first and foremost, to promote intra-African trade to meet growing national and sub-regional requirements and to enhance fertilizer distribution networks.

Projections of future fertilizer demand made by IFA are more optimistic (Heffer & Prud'homme, 2021) [12]: demand in sub-Saharan Africa is projected to grow by 8 per cent annually to reach 5.5 million tons, or 2.8 per cent of world fertilizer demand, by 2021. Nigeria and Ethiopia are expected to account for 28 per cent and 18 per cent, respectively, of demand growth in sub-Saharan Africa. For Africa as a whole, demand is projected to increase by 37 per cent between 2016 and 2021, or by 2.2 million tons, to reach 8.1 million tons (IFA, quoted in Harrison, 2020) [14].

Projections of future fertilizer supply and demand, in Africa and globally, show that, contrary to prevailing belief, Africa should be able to strengthen its position as a major exporter of phosphate and nitrogen. For potash, it is likely that Africa will continue to depend heavily on imports (FAO, 2021) [11].

6. Fertilizer Exports, Imports and Cross-Border Trade

As indicated in **Figure 3**, the most important fertilizer-related export in Africa is unprocessed phosphate rock. TSP and urea are also significant exports. There has been a significant increase in urea exports from Africa. This followed an increase in urea production capacity on the continent between 2014 and 2016. That increase in capacity has been driven, primarily, by the expansion of operations

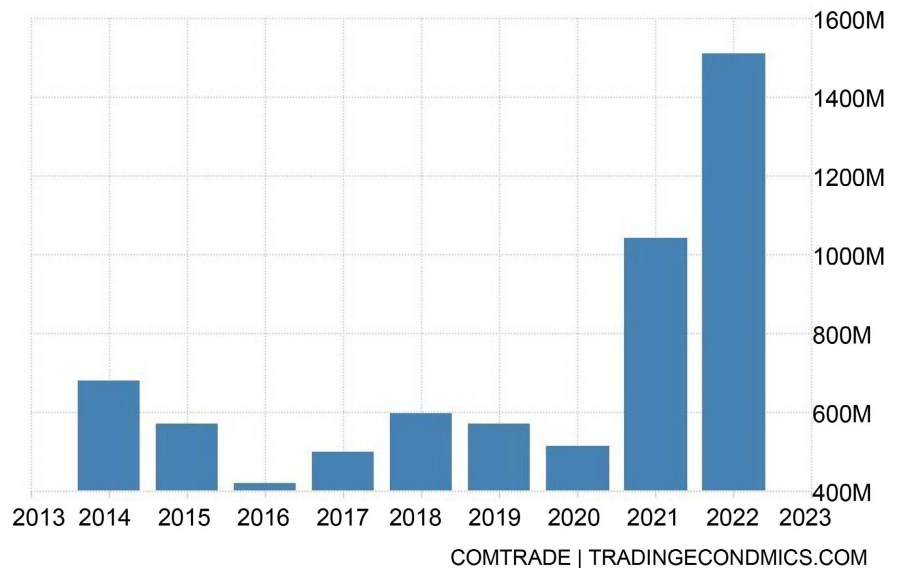


Figure 3. Fertilizer exports, imports and cross-border trade.

by several major companies in Africa, including Indorama Eleme Fertilizers & Chemicals Ltd in Nigeria, the Misr Fertilizers Production Company (MOPCO) in Egypt, and Sorfert and AOA Spa in Algeria. The amount of ammonia has also been increasing, albeit at a slow pace. Increasing urea production capacity is due to an increase in countries' captive ammonia capacity and not because of new ammonia capacity development projects initiated by urea merchants.

Recent trends in fertilizer and fertilizer raw material imports to Africa, there are almost no imports of phosphorus rock or phosphoric acid, suggesting that phosphorus rock and phosphoric acid requirements are met almost entirely by supplies from within the continent. At the same time, limited readily-available sources of potash mean that African countries must rely on potash imports to meet their potassium fertilizer requirements. Most urea fertilizer needs are also met by imports. As for ammonia, imports have been rising, mostly due to the establishment of new processed phosphate granulation plants in Morocco, which use large amounts of ammonia to manufacture DAP, MAP, NPS and NPK fertilizers.

These statistics suggest that Africa is already self-sufficient in phosphate rock, phosphoric acid and almost self-sufficient in processed phosphates. At the same time Africa must import ammonia, urea and potash from other parts of the world to meet its requirements for those chemicals. In general, most fertilizers used in Africa are imported, while those that are produced in Africa are exported outside the region. Nevertheless, there is some degree of inter-regional and intra-regional trade in fertilizers in Africa (IFDC & FAI, 2021) [17]. Much of that trade involves landlocked countries importing from and through other African countries.

Figures illustrate the fertilizer exports and imports of selected countries in Sub-Saharan Africa in 2016. As the figure shows, there are virtually no exports

from Burkina Faso, Ethiopia, and Ghana. Most fertilizer exports are from Kenya, Mali, Nigeria, the United Republic of Tanzania and Togo to neighbouring countries, clearly underscoring the importance of cross-border trade in fertilizer and raw materials in certain parts of the continent.

Africa's often inadequate infrastructure, weak economic integration and the continent's numerous armed conflicts continue to impede the cross-border trade in fertilizer. Cross-border trade is, moreover, often impeded by lengthy delays at border crossings, frequent checkpoints on main roads and burdensome documentary requirements. These all tend to raise transaction costs and hence the costs of doing business.

Although some cross-border trade in fertilizer does take place, that trade tends to be limited and informal in nature. For example, fertilizer is exported informally from Malawi to Zambia and from Malawi to Mozambique. Rwanda also exports some 2000 tons of fertilizer to Burundi (United States Agency for International Development (USAID), 2022) [18]. Burkina Faso imports 95 per cent of its fertilizer requirements from international traders and from bordering countries, particularly Mali and Côte d'Ivoire (Wanzala-Mlobela, Fuentes and Mkumbwa, 2023) [19].

Among the COMESA countries, the United Republic of Tanzania imports fertilizers from manufacturers in Egypt, South Africa and Tunisia, while in West Africa, Cameroon imports fertilizer from Côte d'Ivoire and Tunisia. Similarly, Botswana, Eswatini, Lesotho and Namibia import fertilizers from South Africa, while Uganda imports fertilizers from Kenya and South Africa. However, in many cases, products traded within Africa originate in countries outside the continent. For example, Burundi, Rwanda and Uganda import fertilizers from outside Africa via the ports of Mombasa in Kenya and Dar es Salaam in the United Republic of Tanzania (IFDC, 2021) [20]. The Sudan imports fertilizers from Egypt, Libya and Tunisia, while Seychelles imports fertilizers from Mauritius and South Africa, and Egypt imports them from Libya and Morocco (IFDC & FAI, 2021) [17].

The Russian Federation provides 30.3 per cent of fertilizer imports to Senegal, with Ukraine providing 18.2 per cent, Morocco providing 16.2 per cent, Poland providing 8.4 per cent, Estonia providing 6.7 per cent, France providing 6 per cent, Lithuania providing 5.1 per cent and Egypt providing 3.1 per cent. Fertilizer exports from Senegal go, primarily, to Mali (96.8 per cent) and Burkina Faso (2.7 per cent) (Africa Fertilizer.org, 2021) [13].

In Nigeria, 62.5 per cent of fertilizer imports originate in Morocco, 14.6 per cent in the Russian Federation, 5.5 per cent in Estonia, 4.7 per cent in Belgium, 4.4 per cent in the United Arab Emirates, 3 per cent in Egypt, 2.3 per cent in Ukraine and 1.2 per cent in China (Africa Fertilizer.org, 2021) [13]. A total of 52.3 per cent of fertilizer exports from Nigeria go to Brazil, 23.4 per cent to Uruguay, 9 per cent to South Africa and 5.6 per cent to Argentina. There is almost no domestic production of fertilizer in Côte d'Ivoire, and almost all exports originate in third countries and should be considered re-exports. Some 73.3 per

Apparent Fertilizer Consumption

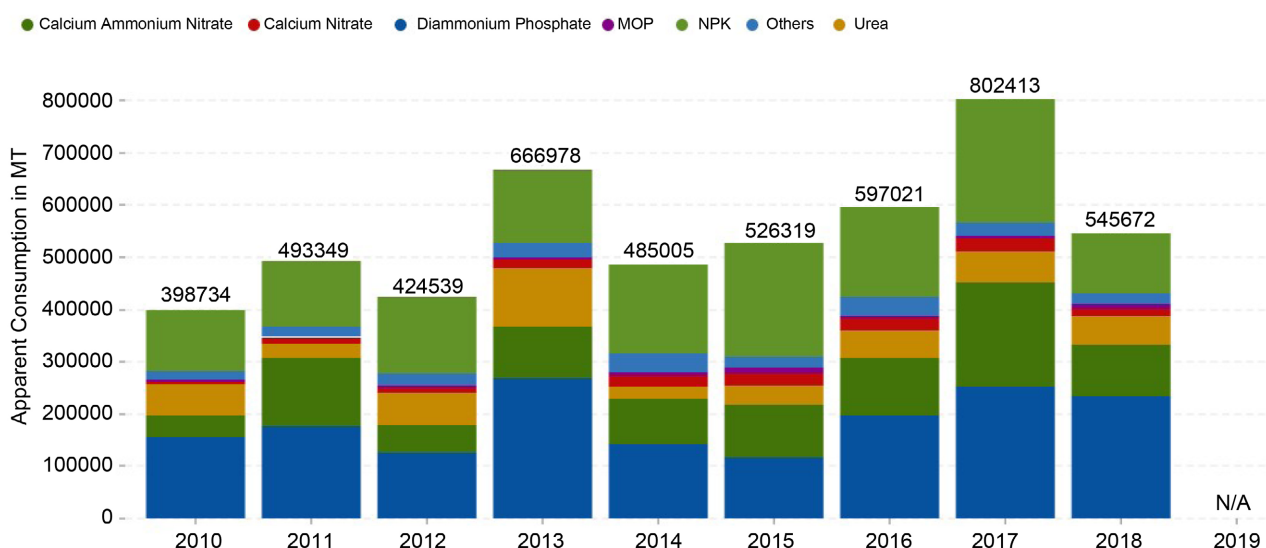


Figure 4. Apparent fertilizer consumption in Sub-Saharan Africa.

cent of those re-exports go to Burkina Faso, 17.9 per cent to Mali and 5.8 per cent to Togo (Africa Fertilizer.org, 2021) [13]. Fertilizer that is re-exported from Côte d'Ivoire originates, primarily, in Morocco (27.7 per cent), the Russian Federation (25.8 per cent), Belarus (18.4 per cent), China (5.8 per cent), Germany (2.7 per cent), Poland (2.3 per cent), Spain (2 per cent), Finland (1.9 per cent), and Egypt (1.6 per cent). Burkina Faso neither produces nor exports fertilizers. Its fertilizer imports come from Mali (45.4 per cent), the Russian Federation (14 per cent), Côte d'Ivoire (9 per cent) and Morocco (7 per cent) (Africa Fertilizer.org, 2021) [13].

Ghana also manufactures no fertilizers and all fertilizer exports are actually re-exports of fertilizers that originated outside the country. Fertilizers are mostly imported in bulk, and are blended and bagged in Ghana before export as shown in Figure 4. Fertilizer imports originate in Morocco (19.8 per cent), the Russian Federation (13.7 per cent), Italy (12.7 per cent), Turkey (10.7 per cent), Estonia (9.8 per cent), China (7.5 per cent), Germany (5.7 per cent), Ukraine (4.1 per cent), Thailand (2.8 per cent), and the United States of America (2.3 per cent) (Africa Fertilizer.org, 2017c). Some 52 per cent of the fertilizer exports of Kenya go to Uganda, 39 per cent to Burundi and some 8.0 per cent to Rwanda (Africa Fertilizer.org, 2021) [13].

7. Conclusion

The inherent lack of fertility of many African soils has been and continues to be exacerbated by widespread nutrient mining, which has led to expansion of the agricultural frontier and the opening up of less favourable soils for cultivation. This is a scenario for disaster over the long run, given the difficulty of restoring tropical soils to productive capacity. The growing contrast between the produc-

tive roles played by fertilizer in other regions of the world and the very limited use of fertilizer in Sub-Saharan Africa (SSA) calls for increased use of fertilizer in Sub-Saharan Africa if they must experience the green revolution as obtained in other regions of the world. Without nutrient replenishment, many African farmers risk taking their soil resource base beyond a point of no return. Mainly for this reason, there is widespread agreement that the improvements in soil fertility needed to boost agricultural productivity growth, improve food security, and raise rural incomes will require substantial increases in fertilizer use, in combination with accelerated adoption of improved land husbandry practices. Proper soil conservation becomes imperative when considering issues regarding soil fertility improvement in SSA. This becomes evident in the light that the lives of a greater percentage of the populace in the region are directly connected to agriculture and agricultural-based Industries. Sustainable agricultural production incorporates the notion that natural resources be used to increase agricultural output and income without depleting the natural resource base. Effective soil management ensures nutrient conservation in soils and can lead to steady reclamation of degraded lands in sub-Saharan Africa over long term.

Conflicts of Interest

The authors declare no conflicts of interest.

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