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Geopolitical Food Policy: Can Food Security be Achieved for Africa?

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The Russian attack on Ukraine has had major effects on world market prices of cereals (and of food in general) and of fossil fuels. Is compensation of food supplies form elsewhere feasible? African populations are the main victims of less cereals on the world market. Can they make their own continent less vulnerable to price setting in global commodities markets? In this article, agrobiologist Henk Breman and expert on African agriculture articulates a cautious answer for discussion. Cautious, because agricultural development in large parts of the continent is lagging far behind. And cautious also because the free world market hinders production in Africa. The continent is an expensive production area. Imports are more attractive from an economical point of view.

Professor Martin van Ittersum et al. tried to answer that question for sub-Saharan Africa (SSA) in an article six years ago. The researchers focused on Africa's self-sufficiency in cereals by 2050. The answer was not very hopeful. In 2014, SSA was already for almost 20% dependent on cereal imports. Although a strong increase in productivity in arable farming is possible, the population will have grown considerably by 2050. According to the latest estimates from the United Nations (June 21, 2021), 26 of the 54 African countries will "at least double" their populations between now and 2050. The agricultural development needed to feed them will have to go hand in hand with socio-economic development, so as not to increase population growth even further. After all, poverty invariably leads to more children.

But the intended increase in prosperity will increase the demand for food faster than population growth. Part of cereal production will be needed to increase the production of animal protein. After all, that too is an anthropological law: as people become richer, they eat more animal protein.

It won't happen without African owned agricultural research and eduction. The efforts needed are enormous and, moreover, require more than the acceleration of current agricultural development.

For self-sufficiency in 2050, the productivity of arable farming would have to increase from the current 20% of the potential rain-dependent yield to 80%. If irrigation is applied where possible and the number of harvests per year is maximized where possible too, then even a good 100% self-sufficiency seems feasible. In order to achieve it, politicians, entrepreneurs (suppliers of means of production and buyers of agricultural products) will really have to commit themselves. It won't happen without African owned agricultural research and eduction. The efforts needed are enormous and, moreover, require more than the acceleration of current agricultural development.

In my initial calculations for this article I was more optimistic than Van Ittersum. That's why I asked him to discuss the differences, an invitation he kindly accepted. Van Ittersum convinced me to temper my optimism. Please check his analysis - written in collaboration with 25 co-authors - and try to assess my considerations.

Van Ittersum and his colleagues limit themselves to cereal production in SSA and use data from 10 of the 49 countries to analyze the situation. The choice of countries is representative. The population of the 10 countries covers 54% of the total population of SSA and 58% of the total arable area. In addition, the average self-sufficiency rate for cereal production is 83% compared to 82% for that of SSA as a whole.

This text is based largely on From Fed by The World to Food Security - Accelerating Agricultural Development in Africa, the book I wrote with Tom Schut. It made a comparative study of 47 of the 54 African countries[1]. Some of our figures are a bit more recent than those of Van Ittersum. Moreover, our book shows the entire arable domain and not only the cereal fields. That approach allowed us to assess total African food production and offers a broader view of food security in Africa now and in the future. It shows better how varied Africa is. And it showed the need for very differentiated approaches to the 'development package' that Van Ittersum and his co-authors propose to have an effect.

Africa compared to the rest of the world

For example, the average cereal yield worldwide is already 4.0 t/ha, whereas the weighted

average for Africa is only 1.5 t/ha. The average world fertilizer use is 140 kg/ha, but in North Africa it is 75 kg/ha and in sub-Saharan Africa only 20 kg/ha. When sufficient fertilizer, improved crop varieties and crop protection products are used, global rainfall-dependent cereal yields increase by approximately 75 kg/ha annually. At least, as long as it is not water availability, but soil fertility that determines crop growth and production. In more than half of the African countries, this average annual increase in yield per hectare is still almost negligible. On average, the increase for Africa as a whole is 25 kg/ha/year, or 1.7% of the average annual yield, while population growth averages over 2.5%.

Can accelerated agricultural development in Africa lead to food surpluses for the world market? This can only be achieved if productivity can be increased in such a way that population growth does not spoil the challenge. Below I make an attempt to answer that question and identify crucial factors and conditions that can prevent population growth from becoming the limiting factor.

Method

Of almost all African countries, is known for the year 2020:

- The size of the population and the population growth;
- The average cereal yield and the theoretical potential yield, both in kg/ha;
- The arable area and the fraction of it that can be irrigated in Africa, in addition to the total area of agricultural land and the forest area.

I express arable production in cereal equivalents and I initially assume that the entire arable area is used to produce food for humans. Cereals have a kind of average quality in terms of energy and protein production. With many crops, such as potatoes and cassava (tuber and root crops), it is possible to produce more food, but the quality - such as the protein content - decreases. With other crops you can produce more protein, but they have a lower energy production. In the Netherlands, for example, the yield of cereals is on average above 8 t/ha, for potatoes around 45 t/ha and for beans around 3 t/ha.

I then calculated the average current production of cereal equivalents (total field area x average current cereal yield) and the theoretical potential yield[2], also in cereal equivalents. I did not use the latter yield, but - just like Van Ittersum c.s. - only 80% of it. After all, even for the best farmers it is impossible to realize the theoretical potential year after year. The annually strongly varying weather and the law of diminishing returns are serious limitations for the theoretical potential yield[3].

With this data, the average production of cereal equivalents per capita of the African population in 2020 and in 2050 can be calculated. Assumptions here are: a) that from 2020 to 2050 the African population will grow from 1,340 x 10^6 to 2,490 x 10^6, that b) by 2050 African farmers will have mastered intensive agriculture, and that c) it is worthwhile to try to approach the potential level of production, which is 80% as an average.

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Distinction between two groups of countries: Group I and II

I doubted whether I would analyze North Africa and sub-Saharan Africa separately, but judged another distinction to be more useful, because it was more informative. I chose the

distinction between countries where there is significant agricultural development and countries where this is not or hardly the case. Nevertheless, it is good to note here that in North Africa food imports per capita are much higher than in SSA, so that the proportion of people who are regularly confronted with hunger is no more than a few percent.

In countries with agricultural development (I call them 'Group I') external means of production such as fertilizer, improved crop varieties and crop protection products have been used for at least some decades. The quantities of these differ markedly for the three classes 1, 2 and 3, distinguished in my book mentioned above, as well as the knowledge and experience of the farmers, which leads to annual increases in yields for cereals of 75, 55 and 30 kg/ha respectively. In countries in classes 4, 5 and 6 - with lagging agricultural development (I call them 'Group II') - no or hardly any (and then relatively recently) external means of production are used. The annual yield increases are 15 or 0 – 10 kg/ha (classes 4 and 5). In class 6 there are even yield decreases compared to the yields in colonial times.

In the countries with agricultural development, there is agricultural policy and (relative) stability. In the countries where it lags behind (Group II), one or both conditions are missing and some, such as Somalia, South Sudan and Eritrea, are extremely unstable. A small part is stable, but the focus there is on mining, not on agriculture. Group I consists of 22 countries with a combined arable area of 107 million hectares, Group II of 28 countries with a total arable area of 143 million hectares. Of the total of 250 million hectares, 40 million hectares can be irrigated. On average, more than 15% of people from group I countries are regularly confronted with hunger, in group II this is almost double.

About 80 kg per person per year of cereal equivalents (240 – 160) must come from outside Africa, almost 30% of demand. In total, this amounts to more than 100 million Mt per year, about double the annual export of cereals of a country like Ukraine

2020 - the situation now

The average yield in 2020 for the group I countries is 2.1 t/ha of cereal equivalents, for II it is only 1.1 t/ha. 80% of the potential rain-dependent production is on average 5.6 t/ha for group I countries, 6.6 t/ha for group II countries. In other words: in the group I countries the yield of the existing arable area can still grow by 3.8 t/ha, in the group II countries by 5.4 t/ha[4].

Currently, the estimated gross food production of the Group I countries is significantly higher than that of the Group II countries. The production levels are respectively 360 and 250 kg of cereal equivalents per person per year. The weighted average is 320 kg. The minimum annual requirement of a human being is 300 kg of cereal equivalents per person per year (Buringh and Van Heemst, 1977). As far as energy requirements alone are concerned, 250 kg of cereals per person per year. is sufficient, but cereals do not provide enough protein. The difference of 50 kg of cereals equivalents should enrich the diet in the form of legumes (with a significantly larger space requirement) or be used for the production of animal protein.

So the current average production is 320 kg of cereal equivalents per person per year.. However, the availability is lower. This is due to the following reasons: a) seed must be retained for the next season, b) there is also food loss in Africa on the route from production to consumption, and c) a considerable part of the arable area is used for production that is difficult to fall under "cereal equivalents". This mainly concerns export products such as cotton, tea, coffee, oil, etc. The current availability is therefore about half of the gross production, 160 kg cereal equivalents per person per year.

That need of at least 300 kg per person per year mentioned above can still be bargained for. This figure applies to adults. In Africa, 40% of the population is 15 years or younger. As a result, the average need of an African person will currently be around 240 kg per person per year instead of 300. In other words, about 80 kg per person per year of cereal equivalents (240 – 160) must come from outside Africa, almost 30% of the need. In total, this amounts to more than 100 million Mt per year, about double the annual export of cereals of a country like Ukraine. However, the food imports are considerably less than the missing 30% of the needs. A part of the African population often does not get enough to eat under normal circumstances. The "World Hunger Map" of the World Food Program gives the percentage of hungry people per country. As mentioned, for group I countries the average is over 15%, for group II it is almost double.

2050 - theory and practice

If, in 2050, there are indeed 2.5 billion people in Africa instead of the current 1.35 billion, and agriculture manages to realize its rain-dependent potential, then the production will be 645 kg per person per year. If the potential to irrigate land is optimally used, then the average annual production becomes 700 kg. Production can therefore in principle grow much faster than the expected population growth. Assuming that 20% is still lost due to loss and waste, while 30% of the acreage does not directly serve African food security, then the availability will be about 350 kg per person per year.

This could suggest that there could be a quantity to be exported in 2050, given the mentioned minimum requirement of 300 kg of cereal equivalents per person per year. Theoretically, an average of 2.5 billion x 50 kg = 125 x 10^6 Mt of cereal equivalents above the minimum requirement could be produced per year.

But unfortunately, nothing could be further from the truth. As mentioned above, with sufficient knowledge and experience and with sufficient availability and affordability of good seed, fertilizers and plant protection products, an average annual productivity increase of 75 kg/ha of cereals is possible. But that's theory on patient paper. The growth must double in order to increase the yields in the period 2020 – 2050 to 80% of the potential yield that was calculated. And, as also explained, in more than half of the countries, group II, agricultural development - say political and business confidence, the two crucial organizational conditions - has not yet started, if at all. That is the unruly practice.

Getting agricultural development going in Africa is more difficult than in many places elsewhere in the world. The average natural production potential, a combination of soils and climates, is lower than in Eurasia and North America. This makes the cost-benefit ratio of developed agriculture less favorable. Competitive production is difficult, because imports from abroad are cheaper. Its location, perpendicular to the equator and largely in tropics and subtropics, is the basis of great variation in production conditions and crops[5].

Without growing prosperity, the African population will (far) exceed the estimated 2.5 billion in 2050. With a growing prosperity comes an improving daily menu

And, last but not least, an obstacle related to the minimum food requirement of 300 kg of cereal equivalents per person per year affects Africa. Population growth worldwide is related to prosperity. With growing prosperity, the number of births per woman decreases. The

estimated growth rate of the African population with which I calculated, assumes a growing prosperity. Without growing prosperity, the African population will (far) exceed the estimated 2.5 billion in 2050. With a growing prosperity comes an improving daily menu. In Africa and elsewhere in the world, population growth more or less stops from an average national income per capita of 10,000 $US/year. At that state of prosperity, the average annual menu is about 800 kg of cereal equivalents per person per year. In the Netherlands it is already almost double! In rich societies like the Dutch one a large part of the cereals is fed to livestock.

Like Van Ittersum et al., I have to conclude that it is unlikely for Africa to export food in the future, while that is economically the condition for becoming self-sufficient in a free world market. After all, if own food is too expensive, there are no significant farmers who want to produce it. Securing Africa's food security requires strong socio-economic development alongside agricultural development and – presumably – import restrictions that give entrepreneurs the confidence to invest in making staple food for their own continent.

As far as agricultural development is concerned, every effort should be made. Modernization must quickly become general, where possible the number of harvests per year must be increased, and with the intensification of arable farming, livestock farming must also be included[6]. If this does not happen, the exploitation of forests will increase as well as the degradation of existing fields and pastures. And then the African demand for food from outside grows even stronger. This is literally life-threatening for the lives of hundreds of millions of people. It will trigger migration flows and will put pressure on the EU in particular.

Notes

1. The small island states are missing and for some countries, such as South Sudan, little or no data have been found.
2. Potential production: The supply of nutrients in the soil for the crop is increased with manure and fertilizer in such a way that not the average annual rainfall becomes the factor that determines the production, but the soil fertility. The current productive cereal varieties are used, and crop protection products are used where and when necessary. Wherever possible, the fields are irrigated. My estimate of potential production was based on has been 'wet finger' work, using the land units (soil and climate) defined by Buringh & Van Heemst, 1977 (An estimation of world food production based on labour oriented agriculture. Centre for World food Market Research, Amsterdam, The Hague & Wageningen). Unfortunately, I did not know the Yield Gap Atlas from the Wageningen school. But I confronted the data from the atlas with my own estimates of the difference between current average cereal yields and theoretical potential yields. The atlas provides data with .b to 14 African countries and the average difference is 4.1 t/ha. My estimate of that difference for the same countries is on average 4.4 t/ha.
3. In the Netherlands and elsewhere where intensive arable farming has been practiced for some time, an average of 80% of the potential yield is realized when the costs: benefits are interesting enough.
4. For the 10 countries of Van Ittersum et al., the current cereal yield varies between 1.2 and 2.2 t/ha, and the difference with 80% of potential production is 4.9 and 3.8 t/ha respectively.
5. In Guns, germs and steel, Jared Diamond elaborates on this idea.
6. Livestock and food security in Africa. Henk Breman. NVAS Newsflash February, 2021