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Africa Food security in Africa requires more-productive livestock (2)

Henk Breman & Wouter van der Weijden, 02-11-2023



Photo credits: Livestock Africa, Henk Breman

Food security in Africa is lower than in other continents. To feed the fast-growing population much more food production is needed. Not just more calories but also more proteins, partially from meat and milk. This requires more-productive livestock. However, there will be less and less space for nomadic herding. Sedentary systems will prevail, either separated from or mixed with arable farming. How can these systems be made more productive? And how can pastoralists be supported to settle?

The productivity of livestock in Sub Sahara Africa (SSA) is low. The primary cause is the low natural production potential (NPP) of the land, determined by poor soils and difficult climates, leading to low productivity of rangeland and food and feed crops. Both crops and livestock require more inputs.

Ironically, there are countless development projects that focus first on veterinary care and/or

breed improvement of cattle. This is simply a waste of money since veterinary services are not cost-effective due to the low productivity of cattle; and breed improvement – even including imports of Friesian cattle! - are meaningless until better feed is available at affordable prices. Moreover, the genetic milk production potential of indigenous cattle is not that low: approximately 10 litres/day - considerably higher than the current average of 2 litres/day¹.

Studies – not including the deserts - have been conducted on the availability and quality of animal feed in Africa². Findings were:

1. Good quality fodder dominates rangeland in the arid climate regions, where arable farming is impossible³.
2. In the other climate zones, generally more favourable for arable farming than for livestock, there are still small areas, especially banks, and floodplains of highly fluctuating rivers, where good quality productive grasslands can be found - the pillars on which pastoral livestock farming was traditionally based. However, most of these areas are used today for arable farming.
3. Another important source of feed is low-quality crop by-products, in particular vegetative parts of crops, such as straw.
4. Small quantities of good to high-quality feed exist, e.g., the vegetative parts of certain crops, beans, pulses, and sweet potatoes, as well as by-products from the flour, beer, and sugar industries.
5. The main source of feed is usually "natural" vegetation: grass, herbs, and leaves of trees and shrubs. These are low to medium quality fodders. If livestock pressure is limited, good feed can be obtained through selective grazing (legumes, seeds, herbaceous leaves, etc.). In addition, burning the vegetation during the dry season, as is traditionally done, results in regrowth of reasonable quality, though in limited amounts.

The products listed under 4 are the ones that enable some increase in cow milk production, particularly around larger cities. The cattle in question are often in the hands of rich people who have contacts in the food industry and among decision-makers. This helps explain why FAO reported as early as 2002 that 42.7% of milk consumption in SSA was produced by improved smallholder dairy systems, whose cattle represented only 4.3% of the cattle population. So these cows were already quite productive⁴.

It is good to note that this form of intensification, mentioned by the FAO, is achieved not by "external" means of production, but by concentrating local means of production that improve the livestock diet by adding small amounts of high-quality feed to the low to medium-quality fodder. As a result, the increase in milk production that can be obtained is limited.

Disclaimer on intensification

By intensification, we do not mean simply using more fertiliser per hectare, but sustainable intensification, based on efficient use of fertiliser with low losses and emissions, combined with soil amendments through adding organic matter and lime. In addition, improved seeds are needed.

We might also call it “optimisation” but that term does not make it clear enough that in SSA more external inputs per hectare and per animal are required.

Fertiliser use

More substantial increases in animal production require external means of production. Basically, there are two options: importing high-quality expensive concentrates⁵ or using chemical fertiliser. The latter, producing better-quality feed locally, is to be preferred. There are three options for applying fertiliser:

1. fertilising rangeland to create pastures
2. fertilising cultivated feed crops
3. intensifying food crop production, which also increases the availability and quality of by-products.

The cost/benefit ratio plays a key role in the choice between these options, with the high price of phosphate in comparison to nitrogen fertiliser being an important factor. Whereas for options 1. and 3. nitrogen fertiliser will dominate, it will be phosphate for option 2. In SSA, limited purchasing power for meat and dairy products will generally make the third option the most attractive one in terms of cost/benefit; the food produced will cover the cost, and feed is a by-product⁶. However, SSA is large and varied; there are countries as well as regions within countries where the other two options may also be feasible.

However, fertiliser is often expensive because the fertiliser market is underdeveloped. And where it is used, it sometimes generates problems, as many farmers are not familiar with the use of fertiliser, nor are blends adapted to local soils⁷. Fertiliser use is often sub-optimal and not efficient, leaving a marginal or even negative cost/benefit ratio. In addition, applying fertiliser without soil amendments, including sufficient organic matter, may easily deteriorate the soil and cause nutrient losses as well as environmental problems.

Surplus products resulting from fertiliser application may not easily be sold on a liberalised market with heavy competition from rich countries that have intensified their agriculture much earlier and are still subsidising it

Addressing these problems requires providing an independent quality extension to farmers. Fortunately, fertiliser use will not only increase crop yields but also yield and quality of crop residues, which may be even used directly to enrich the soil. Possibly even indirectly by feeding it to livestock, the manure of which will provide nutrients as well as organic matter.

The high fertiliser prices could be addressed by developing a well-functioning fertiliser market. But there is a second factor that discourages its use: surplus products resulting from fertiliser application may not easily be sold on a liberalised market with heavy competition from rich countries that have intensified their agriculture much earlier and are still subsidising it. Fair competition may require selective implementation of import levies.

Pigs and poultry

What about pigs and poultry? Agricultural development in the sense of increasing yields based on external inputs, typically goes hand in hand with increased consumption of pork⁸ and poultry meat as key sources of animal proteins for consumers. In Africa, pig and poultry meat is on the rise, whereas beef consumption is decreasing. But the 7 kg per capita consumption in 2020-22 is only one-quarter of the global average. While worldwide, almost as much pig as poultry meat is consumed, poultry is dominant in Africa. It has even surpassed beef as the nr 1 source of meat for the continent⁹.

In Africa, as elsewhere in the world, urbanisation and increasing per capita incomes are driving forces for the expansion of poultry production. However, particularly in SSA, demand has been growing faster than the local production, also due to rapid population growth. The gap is filled by increasing imports of poultry meat, facilitated by the largely low-productive, extensive production systems, related to inadequate grain production. “The main challenge to chicken production in the region is addressing the general problem in the overall agricultural system¹⁰,” the general problem being low productivity.

Just as in the case of ruminants, the availability of quality feed is the limiting factor for the productivity of poultry. It even requires higher quality feed, such as soy. The recent expansion in the production of poultry (and fish, aquaculture) through intensive farming, is largely based on imported soy. However, this could also be (and increasingly is) produced within SSA. This would be a win-win for smallholders and reducing imports. As mentioned, local production of quality feed may be more profitable than imports of concentrates. This helps explain why soybean production has recently expanded rapidly in several countries including South Africa, Nigeria, Zambia, and Malawi. To generate a similar development in other regions, some protection of soy and poultry meat markets would be considered.

Ideally, however, plant-based human food supply would be secured first, before pursuing intensification of meat and dairy production. Where and when a surplus of cereals, beans, and pulses has been achieved, pigs, poultry, and ruminants are all candidates for intensification. Using surpluses for ruminants at their present low level of productivity leads to exponential production growth, which provides an argument to prefer them. However, in particular when and where surpluses of human food are still limited and irregular, using them for poultry has an advantage because of their short life cycle. Besides, from a public health point of view, eating white meat is to be preferred over red meat.



African livestock in green pasture, Henk Breman

Future animal production systems

Worldwide, [average meat consumption](#) rarely exceeds 40 kg/capita/year where incomes are below a gross national income per capita of US\$ 5,000. However, beyond that level it typically increases rapidly, even exceeding 120 kg/capita in a few very rich countries. In SSA meat consumption exceeds 40 kg/capita in just two countries, whereas in seven others it is between 20 and 40 kg/capita. These nine countries can be divided into three types: a) one country where the green revolution was adopted long ago (South Africa), b) those countries where livestock dominate over crops ([some Sahelian countries](#)¹¹), and c) those that use revenues from mining activities to ensure food security (including Namibia).

For most SSA countries, the first category provides the most relevant model: accelerating agricultural development. The book “From Fed by the World to Food Security - Accelerating Agricultural Development in Africa” shows that such development not only improves food security but can also be a major driver of socio-economic development. The book shows that chemical fertiliser is a key factor of change, whereas mixed production systems are the most appropriate to utilise it in a profitable way¹². In Africa, as chemical fertiliser use increased from 10 to 100 kg/ha in the period 1981-2014¹³, the average grain yield increased from less than 1,000 kg/ha to 3,000 kg/ha of seed. This leap forward was associated with a rise of the average Food Security Index from 30 to more than 50, while the average gross national income increased from US\$ 2,000/person to US\$ 6,500/person¹⁴.

[African livestock producers require a considerable learning period before being able to compete in meat and dairy markets](#)

This may also have a beneficial demographic side-effect, particularly a reduction of the number of births per woman. The latter number is still unsustainably high in most SSA countries, particularly in rural areas, causing a negative demographic dividend due to a high “age dependency ratio”¹⁵. In the poorest SSA countries, including several in the Sahel, the average number of births is between 5 and 7, as opposed to 2-3 in the richest countries. Reduction of the fertility rate may turn the negative demographic dividend into a positive one, generating more wealth and food security. Thus, increasing wealth and lower fertility rates reinforce each other. The latter may also over time moderate competition for food and land between farmers and herders and thereby help avoid conflicts between them.

Market protection needed

Accelerating the productivity growth in crops and livestock requires a stimulating agricultural policy rather than a neoliberal market model. African livestock producers require a considerable learning period before being able to compete in meat and dairy markets. The same holds for agricultural input markets. Prices of external inputs are often too high, partly as a consequence of late and limited development of transport infrastructure. The latter was related to the - until recently - low population density, which in turn had been caused by a low natural production potential as well as many centuries of slave trade. One precondition for development may be a revision of current trade agreements to protect the domestic market from cheap imported meat and dairy¹⁶. The EU cannot fully reject such a market protection as it used to be a key pillar of its own Common Agricultural Policy.

Today many projects in SSA aim to promote agricultural intensification, some of them more successful than others. Mixed farming is one of the key conditions for effective intensification, both for crops and livestock¹⁷. But we may expect that over time - as

development proceeds in spite of all bottlenecks – mixed production systems will become divided again. This has happened earlier on other continents, in regions where agriculture has become intensive by the use of substantial amounts of external inputs. The use of such inputs is better managed and more profitable when linked to single use, be it crops or livestock.

Three perspectives

Three perspectives emerge.

First, we may expect more farmers to produce soybean or cereals for the animal feed industry, next to those producing for the food market.

Second, a range of livestock production systems will develop, which will include:

- intensive cow or goat milk and dairy production around larger cities;
- intensive ruminant fattening and meat production in sub-humid and semi-arid regions;
- pig and poultry farms.

Besides, land will become available due to fertiliser use as well as mechanisation, because cattle are no longer required for manuring and draught. Feeding them requires a large portion of land: 40 hectares of natural pasture per ha of cultivated field in the southern Sahel, and 15 ha in the savanna¹⁸. Many of these pastures can be cultivated.

To mention one case, thirty years ago in Burkina Faso, where fertiliser use and mechanisation were still negligible, livestock density¹⁹ increased proportionally with the fraction of land being cultivated: the more arable farming, the more livestock was required. Hence pastoralism was in decline. However, in some regions some fertiliser was applied, and the ensuing higher cereal yields went hand in hand with a somewhat lower livestock density. In other words: fertilizer replaced livestock²⁰. In the country as a whole, food security was still very low; food surpluses did not yet exist.

In regions such as the northern Sahel, which are less or not at all suitable for arable farming, we may see a third perspective: development of (large-scale) ranches in the hands of - or managed by - former pastoralists. They traditionally moved their livestock annually between these areas and regions with better growing conditions for plants and longer seasons. The latter pastures have increasingly been cultivated by arable farmers. True, the production of milk and meat per hectare will be (much) lower on ranches than in transhumance but expressed per working hour the animal production on ranches is at least ten times higher²¹. In addition, the protein production per hectare can also become higher on ranches once concentrates (quality feed) are used to improve the diet.

For ruminants, three levels of productivity can be distinguished, dependent on the system and the nutritional value of the feed used:

1. sedentary animals for traction and for manuring fields, kept on low-quality natural pastures in densities far beyond their carrying capacity, leading to very low dairy and meat production, overgrazing and pasture degradation;
2. pastoral semi-nomadic transhumance, primarily for feeding the families of the herders;
3. intensive meat and/or dairy production, kept on improved fertilised pastures or on natural pastures complemented with quality feed, such as in the above-mentioned ranches.

The difference in productivity between these systems is enormous. Expressed in kg of protein (meat & milk) produced per animal of 250 kg live weight per year, the figures are 2, 10 and >17 kg, respectively²². In ruminants, even a small quality increase of feed, from 9 to 10 and >12 g of nitrogen per kg feed²³, respectively, can generate a huge production increase²⁴.

Conclusions from both articles

1. To ensure food security in SSA, agricultural productivity needs to be (and can be) substantially increased. Not only food crop productivity but even more livestock productivity for covering protein deficits (energy needs are generally met better). Both crop and livestock productivity are low due to an average low natural production potential in SSA, which - reinforced by centuries of slave trade - caused a late start of population growth and densities. This in turn limited the development of appropriate infrastructure, institutions, and service delivery mechanisms, which kept the use of external inputs too expensive to allow for agricultural intensification.
2. Until rather recently, crop and animal production were largely separated systems in many regions. The (semi-)nomadic livestock raising used to be a very effective system in terms of protein production per hectare, feeding both pastoralists and settled people in neighbouring regions. Pastoralists used to dominate in (semi-)arid regions and on the slopes of high mountains.
3. Since the 1950s, the growth of populations and population densities has accelerated and is in several regions becoming a problem rather than a blessing. Almost inevitably, the growth of pastoral populations and their herds has become much lower than those of arable farmers and their livestock. As a result, land required for productive mobile livestock raising has increasingly become cultivated by arable farmers, reducing the productivity of the livestock and thereby the power of pastoral communities. In bad years, pastoralists lost large parts of their livestock or had to sell their animals, which drove livestock prices down to near zero. The buyers were often well-to-do arable farmers. This process has become one of the root causes of violence in the Sahel and some other areas in SSA. Tackling these problems requires raising the productivity through agriculture development in arable farming as well as livestock raising.
4. To achieve this, external inputs are a key condition, starting with fertilisers for crop production. Inputs for livestock are better obtained by improving the local availability of quality feed than by importing concentrates, since the cost/benefit ratio is much better and the dependency risk lower. The most cost-effective way of intensifying livestock production is fertiliser use in a mixed crop/livestock production system, with ruminants as the main livestock. This will often be a more viable way to go than separate crop and livestock productions. However, in a later phase, once a surplus of cereals is achieved, crops and livestock may disintegrate again, with more pig and poultry farming, mainly emerging around cities.
5. The rangelands of semi-arid regions and slopes of high mountains, traditionally exploited by pastoralists, are not suitable for arable farming. Consequently, livestock should not be neglected as a source of protein, not even when fertiliser use on beans and pulses becomes financially feasible. Additional opportunities emerge when and where the food energy needs of the population are well met. Using high-quality feed from crops and crop residues to increase the productivity of ranching may become a

financially interesting production system, alongside or instead of pig and poultry farming.

Recommendations

1. The most effective way to increase food production and security in SSA is promoting and supporting agricultural development, using external inputs in mixed cropping systems. The first step would be applying fertiliser and soil amendments to improve soil fertility and increase crop yields. The second step would be applying quality feed in livestock systems, which could increase access to affordable proteins to combat malnutrition.
2. One policy priority would be developing agricultural input and output markets.
3. Pastoral communities would be respected by governments and be involved in the transformation process. Where nomadism lost its effectiveness, the pastoral people would be encouraged and facilitated to settle, not for the sake of controlling them but for job creation through intensification of livestock production. This may also contribute towards reducing one of the root causes of violence in the Sahel.
4. A key underlying driver, fast population growth, would be addressed as well. The proposed accelerated intensification of both crop and livestock production can be used to trigger general socio-economic development. Improving per capita national income will then typically be followed by a decline in birth rate. Another effective way to reduce population growth is to increase access to education for girls and young women. This has several other socio-economic advantages, including turning the current negative demographic dividend into a positive one²⁵.
5. When and where surplus production of cereals is achieved, livestock intensification would also be promoted outside mixed systems. Extension agents could recommend applying cereals and beans to intensify meat and dairy production. Cost/benefit analyses can help to choose between cattle, small ruminants, pigs, and poultry.
6. Accelerating the increase of the productivity of crops and livestock requires a stimulating agricultural policy rather than a neoliberal market model. African livestock producers and agricultural input and output markets need a considerable learning period before being able to compete in the meat and dairy markets. One precondition may be a revision of current European-African Economic Partnership agreements.

In their [previous article](#), Henk Breman and Wouter van der Weijden analysed the historic and current role of livestock husbandry in Sub-Saharan Africa (SSA). In this article, they explore options for the future.

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Notes

1. Poultry is a somewhat different story. Soy makes quality feed. Intensive poultry farms based on imported soy are expanding around a number of African cities. For those farms veterinary care and breed improvement may make sense. Local production of soy may reduce imports but may also compete with food crops, reducing food security for the poor.
2. E.g. H.W. Koster, 2010. Fourrage, production animale et vivrière, la terre et les besoins d'engrais des petits producteurs dans la Région des Grands Lacs de l'Afrique Centrale. Un rapport du projet CATALIST. IFDC-Rwanda, Kigali; [Livestock feed resources in the West African Sahel](#). A. Tunde et al., 2022. Agronomy Journal 114: 26–45.
3. Unless irrigation can be applied.
4. [Cattle and small ruminant production systems in sub-Saharan Africa. A systematic review](#). M.J. Otte & P. Chilonda, 2002. FAO, Rome. See also, for comparisons between Africa and other continents, "[Meat and dairy production](#)" by H. Ritchie & M. Roser in Our World in Data.
5. Based on legumes and/or cereals, and proteins of animal origin for example fish meal.
6. E.g. J.C. de Grandi, 1996. L'évolution des systems de production agropastorale par rapport au développement rural durable dans les pays d' Afrique soudano-sahélienne. [Collection FAO: Gestion des exploitations agricoles](#) no. 11. FAO, Rome; H. Koster & R. Rukundo, 2012. [Elevage des ruminants dans des systèmes de production mixtes](#) Vol. II Fiches techniques pour la Région des Grands Lacs d'Afrique Centrale. IFDC-CATALIST, Rwanda.
7. H. Breman, A.G.T. Schut & N.G. Seligman, 2019. [From fed by the world to food security. Accelerating agricultural development in Africa](#). Plant Production Systems Wageningen University.
8. Except for Muslim countries, where typically no pigs are raised. Instead, in North Africa and the Middle East the buffalo is a source of proteins.
9. [OECD-FAO Agricultural Outlook 2021-2030](#).
10. Mammo M. Erdaw & Wude Ts. Beyene, 2022. [Trends, prospects and the socio-economic contribution of poultry production in sub-Saharan Africa: a review](#). World's Poultry Science Journal, DOI: 10.1080/00439339.2022.2092437
11. The Sahel is still the main origin of present regional livestock trade in West-Africa.
12. E.g. Th. Alberda, H. van Keulen, N.G. Seligman & C.T. de Wit, 1992. [Food from dry lands. An integrated approach to planning of agricultural development](#). Systems approaches for sustainable agricultural development. Vol. 1. Kluwer Academic Publishers, London.
13. Average values of national resources of groups of countries with a similar level of fertiliser consumption.
14. (See note 7).
15. Age dependency ratio is the ratio of dependent people - those younger than 15 or older than 64 - to the working-age population - those aged 15-64.
16. A profound analysis of the limitations and disadvantages of the neoliberal market model for agriculture in general, and African agriculture in particular, is presented in

- the book [Food security, agricultural policies and economic growth. Long-term dynamics in the past, present and future](#) (2017) by Niek Koning.
17. [Agricultural development in the West African Sahelian region: a cure against land hunger](#) H. van Keulen & H. Breman, 1990. *Agriculture, Ecosystems and Environment* 32: 177-197;
N. de Ridder, H. Breman, H. van Keulen & T.J. Stomph, 2004. [Revisiting a 'cure against land hunger': soil fertility management and farming systems dynamics in the West African Sahel](#). *Agricultural Systems* 80: 109–131.
 18. H. Breman, J.J.M.H. Ketelaars & N'Golo Traoré, 1990. Un contre remède le manque de terre? Bilan des éléments nutritifs, production primaire et élevage au Sahel. *Sécheresse* 1: 109-117.
 19. Expressed in TLU (tropical livestock units) per hectare. 1 TLU = 250 kg of ruminant liveweight, the sum of cattle, goats, and sheep.
 20. N. de Ridder, H. Breman, H. van Keulen & T.J. Stomph, 2004. [Revisiting a 'cure against land hunger': soil fertility management and farming systems dynamics in the West African Sahel](#). *Agricultural Systems* 80: 109–131.
 21. [Rangeland productivity and exploitation in the Sahel](#). H. Breman & C.T. de Wit, 1983. *Science* 221: 1341 - 1347. The field work was mainly done by two of my doctoral students, Abdrahamane Dial and Gaoussou Traoré. For their theses, they walked for 15 months, together with Fulani herdsman and their herds, a distance of 1500 km! Their publications: A. Diallo, 1978. [Transhumance:// comportement, nutrition et productivité d'un troupeau zébus de Diafarabé](#). Centre Pédagogique Supérieur, Bamako. G. Traoré, 1978. [Evolution de la disponibilité et de la qualité de fourrage au cours de la transhumance de Diafarabé](#). Centre Pédagogique Supérieur, Bamako.
A film showing the transhumance in question can be viewed on the website [AgroBioAfrica](#).
 22. Both the average protein content and the digestibility of the diet increase, from 56 to 66 to >75 g/kg for protein, and from 52 to 55 to >59% for digestibility. J.J.M.H. Ketelaars, 1991. Evaluation des pâturages et production animale. In: H. Breman & N. de Ridder (Eds), 1991. [Manuel sur les pâturages des pays sahéliens](#). ACCT, Paris/CTA, Wageningen/KARTHALA, Paris. pp. 255–288.
 23. Expressed in dry matter; dried feed no longer containing water.
 24. Increasing livestock productivity can have two advantages for conservation. 1) Insofar as it is based on more-productive crop production, it will save land per unit of meat and reduce the pressure on forests and other natural habitats. 2) If it reduces meat prices, it takes away a key incentive for hunting and poaching wildlife for bush meat.
 25. The second author has recently published, along with demographer Leo van Wissen, three articles on population growth in SSA: (1) [Moeten we bang zijn voor Afrika?](#), (2) [Vijf misverstanden over bevolkingsgroei in Afrika](#) and (3) [Bevolkingsgroei in Afrika: zes misverstanden over oplossingen](#). English versions will soon be published on Foodlog.