Trends in Parasitology

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Opinion

Reimagining access and sustainable parasiticide innovation for African livestock

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Livestock is a vital source of nutrition, income, and resilience in Africa, yet parasitic diseases remain a major constraint to productivity. Access to safe, effective, and affordable parasiticides for smallholder farmers is limited, while reliance on outdated or substandard products, rising resistance, counterfeit drugs, and weak regulation further reduce effectiveness. This article summarizes outcomes from a recent multi-stakeholder meeting on parasiticide access, emphasizing that innovation must extend beyond new molecule discovery to include adapted formulations, smart regulation, local delivery models, workforce capacity, diagnostic and product stewardship. Coordinated action by governments, industry, farmers, and animal health professionals is essential to improve access and make parasite control a driver of resilient, equitable, and sustainable livestock systems across Africa.

Highlights

In sub-Saharan Africa, where livestock sustains over 60% of rural households, improving productivity is essential to strengthen food security, livelihoods, and climate resilience.

Parasites remain a major barrier to productivity, yet access to safe, effective, and affordable parasiticides is limited.

Heavy reliance on old or substandard molecules, counterfeit products, and rising resistance threatens both animal health and market sustainability.

Innovation for Animal Health must focus on five priorities grounded in African realities: locally relevant R&D, smart regulation, workforce training, better data and diagnostics, and access-oriented partnerships.

Coordinated action across governments, companies, funders, and veterinary professionals can turn parasite control into a driver of rural resilience.

The parasiticide access imperative

Livestock systems support more than 60% of rural households in sub-Saharan Africa (SS-A) and are essential for the nutrition, income, and resilience of smallholder farmers, yet they do not currently meet the continent's needs. As the region's population is projected to nearly double by 2050, demand for animal-derived foods is expected to almost triple, placing unprecedented pressure on the continent's livestock systems that already have low productivity [1,2]. Boosting Africa's livestock productivity is about closing a critical gap in food security, rural incomes, and climate adaptation. Parasites remain one of the top threats to such effort. Globally, parasites adversely impact livestock and human health and livelihoods, and the burden is particularly acute in Africa. Endemic parasitic diseases of ruminants – including tick and tick-borne diseases (TTBD), animal trypanosomosis, and gastrointestinal helminth infections – remain among the most significant impediments to livestock productivity and are responsible for more than US$5 billion in losses annually [3]. In arid and semi-arid regions, gastrointestinal helminth infections in large ruminants raised by pastoralists drive higher food intake, exacerbating overgrazing and soil erosion. The impact of parasites is likely to grow as climate change expands vector or free-living parasite stage's habitats [4] and drug resistance rises. Effective, convenient, and affordable treatment options, alongside environmentally sustainable control measures, are key to addressing this challenge [5].

In April 2025, the Gates Foundation convened a multidisciplinary expert forum titled 'Innovation for livestock parasiticides: from molecules to market'. The event gathered over 50 specialists to examine barriers and enablers of innovation for parasite control in Africa, with a particular focus on parasiticides. Participants represented a broad spectrum of stakeholders across the veterinary product value chain – including research institutions, pharmaceutical companies, industry associations, regulatory authorities, distributors, veterinary professional bodies, and service

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providers such as market intelligence firms and digital platforms. Collectively, they reflected the interconnected system shaping access to parasiticide innovation, from early research to field delivery. They issued a joint statement articulating a shared vision: to ensure that parasiticide innovation for African livestock becomes demand-driven, system-oriented, locally anchored, and collaboratively led. This article builds on that statement and explores the following question: What is holding us back, and how can we unlock access to parasiticide innovation?

African livestock systems, disease burden, and parasiticide market reality

In 2023, the African continent was home to an estimated 1.3 billion head of cattle, sheep, and goats [respectively 390 million cattle, 436 million sheep, and 522 million goats according to FAOSTAT, the database of the Food and Agriculture Organization of the United Nations (FAO)]. In addition to those species, camels are also a species of growing importance. These animals are raised across a wide range of diverse livestock systems, and the number of smallholder farmers relying on livestock for their livelihoods continues to grow [6]. Goats and sheep are managed predominantly by resource-poor **smallholder farmers** (see Glossary) and **pastoralists** since they require low inputs, tolerate harsh climatic conditions, and reproduce quickly. Pastoralists also manage a large proportion of the cattle – for example, 75% of cattle in Kenya and 90% in Tanzania are managed by pastoralist communities [7]. Milk production, meanwhile, is often driven by smallholder farmers, who account for about 80% of the milk produced in countries like Kenya and Uganda.

Parasitic diseases of livestock are often a significant concern for farmers, but major animal health interventions tend to focus on control of epidemic transboundary or zoonotic diseases [8]. A broad range of livestock parasites – including gastrointestinal nematodes, liver flukes (*Fasciola* spp.), coccidia (*Eimeria* spp.), and hemoparasites such as *Trypanosoma* spp., as well as ectoparasites such as ticks and mites (*Sarcoptes* spp.) – are prevalent in many geographies and inflict

Box 1. Endemic parasitic diseases: a persistent barrier to livestock productivity in Africa

Parasitic diseases – especially helminthoses, ticks and tick-borne diseases (TTBDs), and animal trypanosomosis – remain a major constraint to livestock productivity and rural livelihoods across sub-Saharan Africa (SSA). These infections reduce growth, reproduction, and market value of animals, particularly affecting smallholder farmers who rely heavily on ruminant livestock.

Endoparasites, particularly gastrointestinal nematodes and trematodes, are widely prevalent in both small ruminants and cattle. Although they can cause acute disease and mortality, their effects are often subclinical and overlooked, causing chronic weight loss, anemia, poor fertility, and reduced milk yields. A meta-analysis of 88 studies found that 86% reported significant production losses in sheep due to gastrointestinal nematodes, with reductions in weight gain (77%), wool production (90%), and milk yield (78%) [32]. In East Africa, parasitic diseases consistently rank among the top health constraints to small-ruminant production systems [33]. In SSA, gastrointestinal nematodes alone account for 28% of mortality and 8% of weight loss in sheep [34]. In cattle, parasitism reduces feed efficiency, weight gain, fertility, milk yield, and hide quality, and can lead to condemnation of offal or entire carcasses. Some helminths also pose zoonotic risks.

Ectoparasites, particularly ticks, cause direct economic losses through blood loss, toxicosis, and skin lesions and hide damage – leading to rejection of ~35% of sheep and 56% of goat hides in Ethiopia [6]. Indirectly, ticks serve as vectors for multiple pathogens of veterinary and zoonotic importance which cause diseases that result in significant morbidity and mortality. TTBDs alone are estimated to cost African livestock keepers over US$ 3 billion annually [35]. In SSA, major tick-borne pathogens include *Theileria parva* (East Coast fever), *Ehrlichia ruminantium* (heartwater), *Babesia bovis*, *Babesia bigemina*, and *Anaplasma marginale* – the latter three increasingly associated with the invasive *Rhipicephalus microplus* [36]. This species has spread through transboundary trade and cattle movement, introducing new risks in previously unaffected regions [37]. Forty million cattle are at risk of ECF, with estimated annual losses of over US$ 300 million and nearly one million deaths [38].

Animal trypanosomosis, transmitted by tsetse flies and mechanical vectors, affects large parts of SSA. It causes widespread mortality and productivity losses in cattle and other livestock, while also serving as a reservoir for human-infective trypanosomes. Over 50 million cattle and 50 million people are at risk, and economic losses to the livestock sector amount to several billion US$ annually [39].

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substantial economic and health burdens (Box 1). In addition to their direct effects, parasitic coinfections increase livestock vulnerability to other conditions. For example, in cattle, the risk of death from **East Coast fever (ECF)** is higher in animals with heavy helminth burdens or concurrent *Trypanosoma* infections [9]. Parasites are a major constraint to improvement and modernization of livestock systems and have historically held back the development of rural communities in many African regions [10].

Surveys across Africa indicate that a large proportion of cattle owners rely on chemical parasiticides. Near-universal use of acaricides has been reported in studies from East Africa [11,12], and high adoption rates are also documented in West Africa [13,14] – reflecting widespread awareness of parasitic disease burdens and a strong willingness to invest in their control. At the household level, survey and field evidence indicates that routine spending on parasiticides [e.g., acaricides, anthelminthics (dewormers), trypanocides] is more common than on any other class of products, including vaccines, even though levels vary by context [15,16]. The size of the retail market for parasiticides across the continent is difficult to quantify, but it is significant; it was estimated at $359 million in 2024 across just three countries – Kenya, Uganda, and Tanzania – accounting for almost 80% of the East African animal health market based on market survey data collected by AgNexus Africa. The availability of suitable products alone is not a complete solution as timing of treatment and correct application can be critical for effective control of parasites with complex life cycles, and many farmers still lack access to know-how and appropriate guidance and diagnostic service in this regard [6]. While efforts are made by various stakeholders to provide support and advice, numerous reports indicate that smallholder and pastoral farmers in Africa may often rely on untrained drug sellers and informal markets for treatment advice [17]. Such practices raise serious concerns about the potential for misdiagnosis and inappropriate drug use, not only reducing treatment success but also driving **parasiticide resistance**. In addition, farmers in many areas may only have access to products containing a narrow set of old, often marginal or substandard molecules. Counterfeits and substandard drugs are rampant, and products based on more recent chemistry are inaccessible [18]. While specific data are not available, the unregistered/counterfeit market is estimated to be about equal to the official market. The continued reliance on substandard inputs and unproper use (over or underdosing for example) of parasiticides further erodes sustainable parasite control. For instance, acaricide resistance is increasingly reported in tick species including *Rhipicephalus* (*Boophilus*) *decoloratus, R. microplus,* and *R. appendiculatus* across several African countries [19]. In Uganda, resistance to pyrethroids, organophosphates, and amidines is well documented, driven by uninformed use and lack of chemical rotation. The situation is so severe that some farmers have resorted to using agrochemicals not approved for livestock, posing significant risks to animals, users, consumers of dairy and meat, and the environment [20]. A similar scenario is emerging in West African countries as recently reported by Campbell and Jumba in Burkina Faso and Benin where the use of motor oil, concentrated acaricide or combination with herbicides was described[i].

Sustaining animal health and market viability requires pairing innovation with education and stewardship – through development and introduction of new formulations, resistance-breaking molecules, and affordable fit for purpose options for smallholders – reinforced across five areas: locally relevant R&D and delivery models, 'smart regulation', workforce education and adoption of best practices, availability of data and diagnostics, and development of access-shaping partnerships.

Rethinking product innovation beyond new molecules

The translational approach: expanding access to existing molecules

Access to compounds with new modes of action against parasites of importance in Africa remains essential, particularly where multi-resistance is established and currently available

Glossary

African Union: a continental organization, composed of 55 member states, that promotes political and economic integration, peace, security, and sustainable development across Africa

East African Community Mutual Recognition Procedure (EAC MRP): a harmonized system for veterinary medicine registration across EAC states.

East Coast fever (ECF): a fatal tick-borne cattle disease caused by the protozoan apicomplexan *Theileria parva* and transmitted by *Rhipicephalus appendiculatus* ticks in East and Southeastern Africa.

Global Alliance for Livestock Veterinary Medicines (GALVmed): improving smallholder access to veterinary products.

Global Health R&D: the research and development of innovation dedicated to affordable, effective, and accessible human health solutions for diseases and conditions disproportionately affecting low- and middle-income countries.

Good clinical practice (GCP): the international standard for human clinical trials ensuring ethics, safety, and reliable data.

Good laboratory practice (GLP): a system of quality management controls that ensures the consistency, reliability, and integrity of non-clinical laboratory studies used to support research, product development, and regulatory submissions.

Low- and middle-income countries (LMICs): the World Bank classified countries with limited resources in health, agriculture, and infrastructure as low- and middle-income countries.

Milk withdrawal period: the minimum time that must pass between the last administration of a veterinary drug to a lactating animal and the collection of its milk for human consumption, ensuring that drug residues fall below established safety limits.

National regulatory authority (NRA): a government agency overseeing safety, quality, and efficacy of medicines.

Parasiticide resistance: the ability of tick populations to survive chemical treatments, lowering control effectiveness.

Pastoralists: mobile communities of livestock keepers in arid/semi-arid areas practicing extensive grazing.

Product development partners (PDPs): not-for-profit organizations that

molecules are outdated. However, such innovation must be grounded in the realities confronting African livestock keepers. Priority should therefore be given to resistance-breaking solutions that are easy to administer, affordable, and safe for livestock, people associated with them and consuming animal-derived products, and the environment. In smallholder dairy systems, where cattle face a unique range of parasites, and milk is consumed on-farm or sold informally, products with short – or ideally zero-day – **milk withdrawal periods** are especially critical [21].

The innovation pipeline spans from the discovery of new chemical entities to the development and approval of improved formulations (Box 2, Figure 1). While there is always a requirement for discovery and development of new molecules with novel modes of action in the long term, there may also be a significant opportunity in the African context for market access to existing modern medicines. For instance, in the field of livestock tick control, reliance over decades on just three ectoparasiticide classes – pyrethroids, organophosphates, and formamidines – underscores the need to unlock access to safer, more effective alternatives that may be available elsewhere for livestock health, such as the isoxazolines. Similarly, leveraging advances from **Global Health R&D** on neglected parasites, such as trypanocide discovery programs [22], and translating them to animal health through the development of novel parasiticide, could also reduce dependence on outdated and increasingly ineffective molecules in livestock. Promoting those new molecules, as well as their correct and responsible use, should be a priority.

Drug access strategies must also consider the ecology of coinfections, which can complicate diagnosis and treatment [23]. Combination formulations targeting multiple pathogens could be transformative in such contexts.

drive the development of new health technologies for diseases, disproportionately affecting low- and middle-income countries, by bridging public and private sector expertise and funding.
Public–private partnerships (PPPs): formalized collaborations between governments, partners, and the private sector for services, capacity, and access.
Smallholder or small-scale farmer: a farmer with limited land or livestock, often facing barriers to inputs, finance, and services.
Stock-keeping unit (SKU): a unique identifier for product tracking by type, size, or packaging.
Veterinary paraprofessionals (VPPs): veterinary paraprofessionals providing basic animal health services.
World Association for Advancement of Veterinary Parasitology Africa Network (WAAVPAN): an organization affiliated to the World Association for Advancement of Veterinary Parasitology; it works toward the better control of veterinary parasites on the African continent.

Box 2. The R&D process: from discovery to registration in animal health phases of the R&D pipeline

The R&D process can be divided into three phases:

- Research. Identification and validation of potential targets for drug development. Compounds are screened, and lead compounds are optimized and tested for safety and efficacy.
- Development. Candidate compounds are evaluated through preclinical and clinical testing to confirm safety and effectiveness. For production animal use, safety includes target animal safety, toxicology, user safety, food safety, and environmental safety. Formulations, manufacturing processes, and quality control measures are refined.
- Launch. Regulatory authorities review submitted data on safety, efficacy, and quality before granting market authorization. Following approval, products are launched with continued support including training for veterinary professionals, marketing, and post-market monitoring and surveillance.

Time and investment

Developing a new veterinary drug based on a novel compound typically takes 10–15 years and requires substantial investment due to high attrition rates and complex regulatory requirements.

Access to innovation

Innovative products can enter the pipeline at multiple points:

- Discovery of new molecules. Essential for long-term impact but resource-intensive and a lengthy and complex process.
- Life-cycle management. Translational innovation (e.g., new formulations), re-purposing or geographic extension of existing products, offering faster and more cost-effective routes.

Regulatory complexity

Full development programs demand a complete Chemistry, Manufacturing and Controls (CMC) dossier. Evaluation of user, food, and environmental safety requires assessment of data from studies in several species, as well as the target animal. Navigating these requirements can be particularly challenging in regions where regulatory agencies have limited resources or expertise, and where regulatory requirements may not be uniform across geographies.

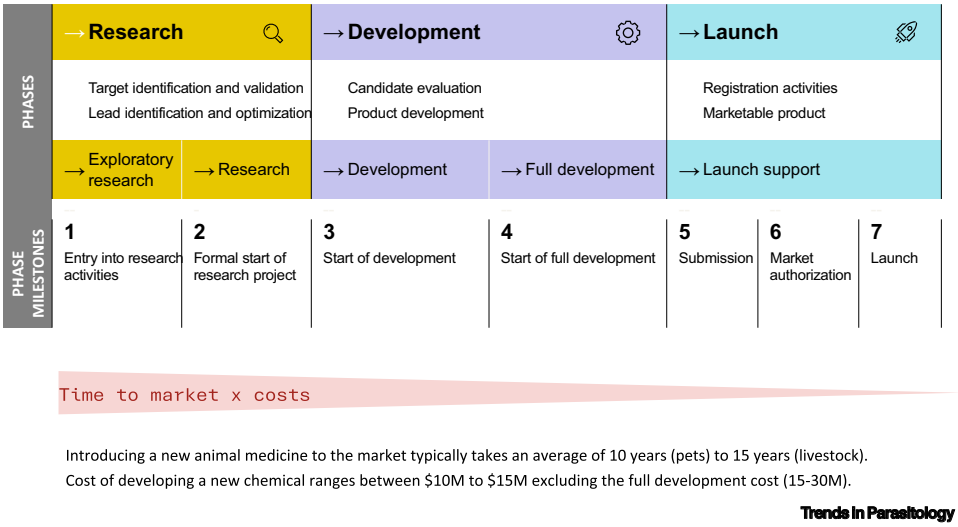

Figure 1. Schematic overview of the veterinary R&D process – from discovery and target validation to regulatory approval and launch. The process includes three main phases – research, development, and launch – each defined by key milestones from target identification to market authorization. The typical time to market ranges from 10 years (companion animals) to 15 years (livestock), with estimated costs of US$ 10–15 million for early development and an additional US$ 15–30 million for full development.

Current parasiticide R&D and innovation strategies of large global companies may not be well-aligned with the needs of African livestock systems. While antiparasitic products dominate global animal health sales, the highest-earning innovations – particularly within the top-selling products – are overwhelmingly developed for companion animals [24]. For livestock, research, development, and regulatory authorization efforts are often directed toward more lucrative markets such as those in the Americas and the European Union. New products may appear in South Africa several years after launch in other geographies and broader availability in intertropical African markets can be delayed by decades.

Partnerships to de-risk R&D, manufacturing, and commercialization

Historically, the introduction of new solutions tailored for African Animal Health markets has been slow, with manufacturers continuing to provide products that may be decades old. Lack of modern innovation may be amplified by uncertainties about market size, outlook and regulatory thresholds for new products [25].

In Global Health, product development partnerships, pooled procurement, and market guarantees have accelerated access to life-saving drugs or products for HIV and malaria. For example, the dual-insecticide nets project is a multi-partner initiative between chemistry manufacturers, **product development partners (PDPs)**, founders, researchers and countries that allowed deployment of improved mosquito nets that can significantly reduce the incidence of malaria [26] (WHO*, World Malaria Report 2023*). Similar tools could be adapted to the Animal Health field – including aspects of stewardship and sustainability. However, the specificity of parasite control in animal health as a private good requires the creation of distinct types of partnerships.

Several initiatives do, however, exist to strengthen **public–private partnerships (PPPs)**, de-risk investment, and ensure last-mile delivery of animal health products. Collaboration among companies, trade associations, funders, and public and private industry in animal health is increasing. Funders such as the Gates Foundation and the UK Foreign, Commonwealth & Development

Office (FCDO), the US Agency for International Development (USAID), or the German development agency (GIZ) have supported a range of such interventions. Results of those efforts are materializing: **Global Alliance for Livestock Veterinary Medicines (GALVmed) –** a not-for-profit organization cofounded by FCDO and the Gates Foundation, and dedicated to improving access to livestock health products and facilitating their adoption by small-scale livestock producers[ii] – has already enabled the registration of more than 16 veterinary products in Africa, mainly vaccines for transboundary diseases, using push–pull incentives that combine upfront funding to lower R&D costs (push) with rewards for successful product development or delivery (pull), thereby stimulating innovation where market returns alone are insufficient. Another example supporting product development through public and private partnership is the Transforming Animal Health Services and Solutions for **low- and middle-income countries (LMICs)** platform (TAHSSL), a tripartite R&D and commercialization platform led by GALVmed, Clinglobal – a private Contract Research Organism (CRO) – and the International Livestock Research Institute (ILRI) in Nairobi. TAHSSL aims at de-risking the R&D processes by offering preclinical and clinical research services complying with international quality standards – **good laboratory practice (GLP)** and **good clinical practice (GCP)** – and by supporting market, regulatory, and policy scoping for prospective products as well as providing access to Africa-centric scientific expertise.

Smart regulation and public–private collaborative platforms as cornerstone

Sustainable access to new products at scale requires supportive policy and institutional frameworks. Smart regulation – centered on quality assurance, counterfeit control, and harmonized registration – can deliver substantial improvements in availability of quality products but, without such systems, novel products will continue to remain absent from the shelves of agrovet shops [18,25]. Progress is possible as demonstrated by the **East African Community's Mutual Recognition Procedure (EAC MRP)** which provides a strong example for harmonized veterinary product registration that shortens timelines, reduces costs, develops trust among the regulators, and incentivizes market entry (Box 3).

A key lesson from the harmonization process is that sustainable change depends on multistakeholder collaboration, coordinated investment, and trust-based PPPs. Interconnected convening platforms – focused on regional economic and political cooperation and offering space for mutual understanding – are still limited in Africa but are beginning to emerge. The newly established African network affiliated to the **World Association for the Advancement of Veterinary Parasitology (WAAVPAN)**[iii], hosted by the African Capacity Building Foundation (ACBF), a specialized agency of the **African Union**, could play an important role in driving these collaborations. Such approaches need scaling as regulatory harmonization – supported by strong post-marketing surveillance and pharmacovigilance which are to be led by the national authorities – is foundational for both investment and to ensure safety and sustainable efficacy of new and existing molecules [18].

From last-mile delivery to best practices and workforce development: an ecosystem approach

For parasite control to be truly effective, it must be embedded within ecosystem-based approaches grounded in sound science and adapted to Africa's diverse geographic, economic, and institutional contexts. While policies and partnerships should enable scale, innovation must remain guided by the specific needs of local livestock systems to ensure long-term sustainability.

Across the continent, stakeholders – including animal health professionals and product distributors – are building models to strengthen access to veterinary care. Yet a major challenge persists in reaching remote users, the 'last mile', where fragmented supply chains and

Box 3. Smart regulation in action – the East African Community's Mutual Recognition Procedure

Obtaining approval to market veterinary medicines requires a marketing authorization (license) from the **National Regulatory Authority (NRA)** in each country where the product is intended to be sold. This traditionally involves submitting separate applications to each member country – a process that is often lengthy, resource-intensive, and which is not always predictable.

A well-functioning regulatory environment should address private sector concerns and enhance access to veterinary medicines by encouraging animal health companies and manufacturers to invest in product registration. This, in turn, increases the availability of safe, effective animal health products for Africa's livestock keepers and pet owners.

A Mutual Recognition Procedure (MRP) has been implemented by the EAC since 2011, enabling applicants to apply simultaneously for marketing authorizations in multiple EAC countries. This approach streamlines the process, reduces duplication of effort, and allows countries and companies to use their resources more efficiently – ultimately facilitating a more sustainable supply of quality veterinary products in the region.

The first marketing authorization under the EAC MRP was granted in October 2018 for a veterinary vaccine. Since then, 56 applications (pharmaceutical and vaccines) have been received, and 23 products successfully registered. Building on this initial success – focused on vaccines and pharmaceutical products – additional guidelines have been developed to expand the scope to include ectoparasiticides. These guidelines came into effect in early 2025, but no applications have been received to date. Countries such as Kenya, Uganda, Tanzania, and Rwanda have well-established NRAs that actively participate in the EAC MRP initiative. Standardized guidelines and application forms are available on the EAC website[iv] to assist applicants in preparing their registration applications to obtain marketing authorizations in multiple countries. This supports better availability of quality veterinary products that can prevent disease, improve livestock productivity, and enhance the incomes of smallholder farmers. While the EAC has harmonized procedures for the regulation of veterinary medicines, applicants may choose between the national or MRP pathway when submitting their applications.

In West Africa, the UEMOA region has implemented a centralized procedure in which a single assessment leads to a marketing authorization valid across all member states, whereas the EAC's decentralized MRP allows a product approved in one country to be recognized by others. This enables staged submissions, allowing companies to serve new markets incrementally while reducing regulatory duplication. Most registration activities are conducted jointly among participating Partner States.

multiple intermediaries often weaken the continuum of care [25]. Promising innovations such as mini **stock-keeping units (SKUs)**, combination products, and mobile diagnostics could transform last-mile delivery, but these applications remain under-utilized and under-supported.

The ongoing professionalization of the livestock sector and the emergence of integrators or smallscale farmers' cooperatives are giving rise to bundled service providers that combine animal health services with product sales, enhancing farmer engagement at scale and improving access to essential inputs.

Beyond access, effective parasite control in smallholder livestock systems depends on informed and coordinated implementation and a well-trained, connected workforce of veterinarians and other stakeholders. For example, because livestock in Africa are often exposed to multiple parasites at the same time and treatment options frequently overlap, integrated management of ticks, trypanosomes, and helminths – adapted to local epidemiology – is essential [9]. In communal grazing areas, where transmission pressure is highest, coordinated deworming at herd or community level can reduce infection risk and slow the emergence of resistance. This entails avoiding long-term reliance on a single drug class or the 'dose-and-move' strategy and instead promoting rotational use of anthelmintics alongside tick and tsetse control [27].

Success also depends on leveraging the widespread presence of **veterinary paraprofessionals (VPPs)**, who deliver up to 80% of rural animal healthcare in many parts of Africa. Their effectiveness is maximized when they are supported with training, digital tools, referral networks, and professional associations [28–30]. This connection could also include laboratory networks that

provide parasite diagnosis and resistance testing to support evidence-based control. For example, the Monitoring of Tick-Acaricide Resistance (MoTAR) Laboratory Network, piloted in Uganda by Makerere University with GALVmed, is promoting evidence-based tick and tick-borne disease management and responsible acaricide use for livestock across Uganda. Strong coordination between veterinarians and VPPs is crucial to ensure evidence-based decision-making and timely interventions, particularly in areas with limited veterinary infrastructure.

Digital innovations further amplify these efforts by enhancing knowledge sharing, diagnosis, and decision support where animal health capacity is limited. Kenya–UK partnerships developed the African Clinical Veterinary Livestock App (ACVLA), to provide real-time disease alerts, parasite forecasting, and coordinated responses [31]. Complementary technologies – such as artificial intelligence-powered image recognition, national drug compendia, and product traceability tools – can improve treatment accuracy and reduce the spread of counterfeit products

Training and decision support must reach all intermediaries – from veterinarians and VPPs to agrovet shop owners and bundled service providers – to ensure responsible product use, early disease detection, and sustainable parasite control across the entire value chain.

Concluding remarks: call for action

The progression of innovation to end-users of products is complicated not only by technical barriers but also by systemic challenges in regulation, investment, product stewardship and local and regional alignment. As such, innovation must be redefined – not just as new technologies, but as the entire process of developing and delivering new solutions that provide a sustainable positive impact on the life of the people whose livelihood depends on livestock in Africa.

Advancing sustainable parasite control requires concerted commitment from governments, private companies, funders, organizations, and the scientific community to a shared and ambitious agenda for collective impact (see Outstanding questions). Innovation will reach farmers faster and deliver meaningful impact on the ground if (i) governments invest in regulatory reform, curb the use of substandard and counterfeit drugs, and advance harmonized registration pathways; (ii) companies and distributors develop and deliver safe, resistance-breaking parasiticides suited to African contexts while ensuring stewardship through responsible use and training; (iii) veterinary professionals and paraprofessionals strengthen coordinated training and knowledge sharing to sustain efficacy and enable timely interventions; (iv) service providers develop data-driven solutions and networks that leverage digital innovations for surveillance and ensure the inclusion of underserved populations; and (v) scientists address critical knowledge gaps with locally relevant evidence that can be translated into practical solutions.

At stake is not only animal health, but also rural livelihoods, system resilience, and climate adaptation. Failure risks accelerating resistance, misuse, and exclusion from next-generation parasiticides. Success, however, would make parasite control a key lever for rural transformation and for providing a positive contribution to animal and human health and wellbeing across the continent.

Outstanding questions

What collective intervention can reduce reliance on substandard or counterfeit products across African markets?

How can workforce capacity, particularly of veterinarians and veterinary paraprofessionals, be strengthened to support responsible use of parasiticides?

What role can digital tools and data systems play in improving diagnosis, surveillance, and resistance management?

What access models best incentivize innovation in resistance-breaking molecules and adapted formulations for African livestock?

How can collective platforms foster trust among stakeholders and deliver regionally grounded solutions?

What evidence is still needed to shape demand-driven, system-oriented, and sustainable parasiticide markets for livestock in Africa?

What collective measures could accelerate the unionization of remote smallholder livestock keepers, enabling more effective capacity building by relevant stakeholders?

Acknowledgment

We are thankful to Peter Ballentyne, who ensured a smooth facilitation of the discussion between the stakeholders of the Working Group on Parasiticide Access during the meeting and to Jalisa Lee for her excellent support in coordinating the meeting logistics.

Declaration of interests

The authors declare no competing interests.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT to assist with text clarity and flow. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Resources

[i]https://hdl.handle.net/10568/174278

[ii]www.galvmed.org/

[iii]www.waavpafrica.org/

[iv]www.eac.int/documents/category/livestock

References

1. Latino, L.R. *et al.* (2020) Africa: the livestock revolution urbanizes. *Glob. Food Sec.* 26, 100399
2. FAO (2013) *Investing in African Livestock: Business Opportunities in 2030–2050*, FAO www.fao.org/4/al757e/al757e.pdf
3. Grace, D. *et al.* (2015) *OIE Regional Commission. Impact of Neglected Diseases on Animal Productivity and Public Health in Africa*, WOAH publication, Africa www.woah.org/fileadmin/Home/eng/Publications_%26_Documentation/docs/pdf/TT/2015_AFR1_Grace_A.pdf
4. Marques, R. *et al.* (2020) Climate change implications for the distribution of the babesiosis and anaplasmosis tick vector, *Rhipicephalus* (*Boophilus*) *microplus*. *Vet. Res.* 51, 81
5. Kaminsky, R. and Mäser, P. (2025) Global impact of parasitic infections and the importance of parasite control. *Front. Parasitol.* 4, 1546195
6. Kimeli, P. *et al.* (2025) Important diseases of small ruminants in sub-Saharan Africa: a review with a focus on current strategies for treatment and control in smallholder systems. *Animals (Basel)* 15, 706
7. Nyariki, D.M. and Amwata, D.A. (2019) The value of pastoralism in Kenya: application of total economic value approach. *Pastoralism* 9, 9
8. Alemu, B. *et al.* (2019) Application of mixed methods to identify small ruminant disease priorities in Ethiopia. *Front. Vet. Sci.* 6, 417
9. Thumbi, S.M. *et al.* (2014) Parasite co-infections and their impact on survival of indigenous cattle. *PLoS One* 9, e76324
10. Alsan, M. (2015) The effect of the tsetse fly on African development. *Am. Econ. Rev.* 105, 382–410
11. Vudriko, P. *et al.* (2018) Chemical tick control practices in southwestern and northwestern Uganda. *Ticks Tick Borne Dis.* 9, 945–955
12. Mutavi, F. *et al.* (2021) Tick treatment practices in the field: access to, knowledge about, and on-farm use of acaricides in Laikipia, Kenya. *Ticks Tick Borne Dis.* 12, 101757
13. Adehan, S.B. *et al.* (2018) West African Cattle farmers' perception of tick-borne diseases. *Ecohealth* 15, 437–449
14. De Meneghi, D. *et al.* (2016) Experiences in tick control by acaricide in the traditional cattle sector in Zambia and Burkina Faso: possible environmental and public health implications. *Front. Public Health* 4, 239
15. Gulwako, M.S. *et al.* (2023) Evaluation of the proper use of medication available over the counter by subsistence and emerging farmers in Mbombela Municipality, South Africa. *BMC Vet. Res.* 19, 83
16. Campbell, Z. *et al.* (2021) Prioritizing smallholder animal health needs in East Africa, West Africa, and South Asia using three approaches: literature review, expert workshops, and practitioner surveys. *Prev. Vet. Med.* 189, 105279
17. Kosgey, I.S. *et al.* (2008) Small ruminant production in smallholder and pastoral/extensive farming systems in Kenya. *Small Rumin. Res.* 77, 11–24
18. Pyatt, A.Z. *et al.* (2025) Veterinary medicinal product regulation in sub-Saharan Africa: identifying barriers and opportunities for enhancing VMP regulatory systems. *Front. Vet. Sci.* 12, 1532098
19. Evans, A. *et al.* (2024) Acaricide resistance status of livestock ticks from East and West Africa and in vivo efficacy of acaricides to control them. *Int. J. Parasitol. Drugs Drug Resist.* 25, 100541
20. Vudriko, P. *et al.* (2016) Emergence of multi-acaricide resistant *Rhipicephalus* ticks and its implication on chemical tick control in Uganda. *Parasit. Vectors* 9, 4
21. Mesfin, Y.M. *et al.* (2024) Veterinary drug residues in food products of animal origin and their public health consequences: a review. *Vet. Med. Sci.* 10, e70049
22. Brun, R. *et al.* (2011) Development of novel drugs for human African trypanosomiasis. *Future Microbiol.* 6, 677–691
23. Heylen, D.J.A. *et al.* (2023) Tick-borne pathogens and body condition of cattle in smallholder rural livestock production systems in East and West Africa. *Parasit. Vectors* 16, 117
24. Selzer, P.M. and Epe, C. (2021) Antiparasitics in animal health: quo vadis? *Trends Parasitol.* 37, 77–89
25. Jaime, G. *et al.* (2022) Access to veterinary drugs in sub-Saharan Africa: roadblocks and current solutions. *Front. Vet. Sci.* 8, 558973
26. Barker, T.H. *et al.* (2023) Effectiveness of dual active ingredient insecticide-treated nets in preventing malaria: a systematic review and meta-analysis. *PLoS One* 18, e0289469
27. Nginyi, J.M. *et al.* (2001) Epidemiology of parasitic gastrointestinal nematode infections of ruminants on smallholder farms in central Kenya. *Res. Vet. Sci.* 70, 33–39
28. Ilukor, J. *et al.* (2014) Determinants of referrals from paraprofessionals to veterinarians in Uganda and Kenya. *Prev. Vet. Med.* 114, 164–173
29. Alafiatayo, R. *et al.* (2022) Training needs assessment of veterinary practitioners in Ethiopia. *Trop. Anim. Health Prod.* 54, 72
30. Endacott, I.C. *et al.* (2022) Continuing education of animal health professionals in Uganda: a training needs assessment. *J. Vet. Med. Educ.* 49, 503–514
31. Howe, M. and Ameda, B. (2023) African Clinical Veterinary Library App (ACVLA) designed to improve clinical sign recognition, treatment outcomes and animal health skills of veterinary paraprofessionals. *Anim. Sci. Proc.* 14, 113
32. Mavrot, F. *et al.* (2015) Effect of gastro-intestinal nematode infection on sheep performance: a systematic review and meta-analysis. *Parasit. Vectors* 8, 557
33. Armson, B. *et al.* (2020) Small ruminant production in Tanzania, Uganda, and Ethiopia: a systematic review of constraints and potential solutions. *Vet. Sci.* 8, 5
34. Strydom, T. *et al.* (2023) The economic impact of parasitism from nematodes, trematodes and ticks on beef cattle production. *Animals (Basel)* 13, 1599
35. Okuthe, O.S. *et al.* (2003) Use of rapid rural appraisal and cross-sectional studies in the assessment of constraints in smallholder cattle production systems in the western Kenya highlands. *Onderstepoort J. Vet. Res.* 70, 237–242
36. Bishop, R.P. *et al.* (2023) Control of ticks and tick-borne diseases in Africa through improved diagnosis and utilisation of data on acaricide resistance. *Parasit. Vectors* 16, 224
37. Githaka, N.W. *et al.* (2022) Molecular survey of *Babesia* parasites in Kenya: first detailed report on occurrence of *Babesia bovis* in cattle. *Parasit. Vectors* 15, 161
38. Kolakowski, J. *et al.* (2022) East Coast fever, a neglected tropical disease with an outdated vaccine approach? *Trends Parasitol.* 38, 930–932
39. Boulangé, A. *et al.* (2022) The COMBAT project: controlling and progressively minimizing the burden of vector-borne animal trypanosomosis in Africa. *Open Res. Eur.* 2, 67