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Pesticide Reduction for Tropical Agricultures

Institutional barriers and levers to pesticide reduction in tropical agriculture

A look at West and Central Africa

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In a context of growing awareness of the harmful effects of pesticides on human health and biodiversity, their use in tropical agriculture is increasing sharply. This paradox raises the question about institutional barriers and levers to reduce their use, including agroecological alternatives. Our results show that, despite new regulations on the international level, policies supporting pesticides continue unabated. This support distorts technological competitiveness to the detriment of reducing pesticide use. Potential institutional levers for reduction have been identified. Specifically, they suggest that better information should be provided on the burden of pesticide costs on public budgets and the investment needed in agro-ecological innovations.

Tropical farming and food systems face the challenge of increasing food production (and accessibility) to meet food security challenges against a backdrop of rising labor and chemical fertilizer costs. However, pesticides, the central input of the so-called Green Revolution, are being questioned due to their harmful, sometimes irreversible, impact on human and animal health and ecosystems. The production and use of pesticides continue to grow worldwide, with a particularly rapid increase in Africa, despite the regulatory policies initiated in the 1970s in North America and Europe (Jas, 2007) and the banning of active substances,

However, many solutions exist to reduce pesticide use, including those promoted by the agroecological transition, which are increasingly effective in addressing transformation challenges (Martin et al., 2025). Therefore, how can we understand and support technological transformations in tropical agriculturein order to reduce its dependence on an input that has structured the competitiveness of industrialized countries?

We report on existing barriers and possible levers for a structural transformation in pesticide use Based on a research initiative in various tropical countries (Côte et al., 2025), particularly in West and Central Africa and Asia. The notion of 'lock-in' refers here to blockages stemming from technologies developed in the past that have become central to production structures and methods and their relationship to upstream and downstream farming, as well as to the economic and institutional organization of agricultural markets. The adoption of new technologies is conditional on their compatibility with existing structures and production methods because of these bottlenecks.

The Periodization of Public Policies on Pesticides in Tropical Agriculture

Entre les années 1960 aux années 2000, de nombreux soutiens publics et privés (programmes de développement, d'aide, projets) ont structuré des transferts technologiques de l'agriculture

Between the 1960s and the 2000s, many public and private support initiatives (development programs, aid, projects) structured technology transfers from industrial agriculture in the Global South, promoting the use of pesticides alongside chemical fertilizers and new crop varieties. The 1990s integrated Pest Management programs often contributed , paradoxically, to the growth of pesticide use. Technological transfers in favor of pesticides have not ceased since that period.

Public policies aimed at regulating pesticide use were initiated in some countries in the 1980s and developed from the early 2000s onwards. The first regulatory standards on pesticides primarily concerned the approval of commercial products, marketing and usage conditions, and the prohibition of certain active ingredients. The implementation of these regulations takes place in a context marked, among other things, by the increasing production capacity of active ingredients in China and later in India, as well as the development of generic formulations in these and other countries. The restructuring of the global agrochemical sector in Africa is reflected in the expansion of supply and distribution networks.

In the 2010s, renewed initiatives aimed at reducing pesticide use emerged in connection with the criticism of pesticide use in industrialized countries (Bureault and Temple, 2023). For example, the African Union adopted a Strategic Plan for the Organic and Ecological Agriculture Initiative in 2015. These regional dynamics are in line with the growing recognition of agroecology and organic farming. Two technological trajectories show this recognition. The first, called «substitution» or «optimization,» involves replacing synthetic pesticides with biological inputs (aromatic plants, essential oils, pesticidal plants) and resistant cultivars. The second trajectory, known as agroecology, relies on practices that harness the potential of ecosystems through integrative approaches to disease and pest prevention, such as «physical» controls, sanitary harvesting, barrier plants, agroforestry, intercropping, crop rotations, and the use of alternative methods.

Multi-Level Characterization of Barriers to Reducing Synthetic Pesticide Use

The identification of lock-ins distinguishes three levels of analysis: macro-institutional, mesoeconomic (sector and territorial), and microeconomic (business and farm).

Macro-Institutional Barriers

Macro-institutional barriers can be categorized into three main areas:

- **Regulatory and legal frameworks for pesticide use:** These frameworks encompass legal norms, rules, and implementation mechanisms, as well as monitoring actions. Public and private standards cover several aspects, including: (i) Approval standards, which extend to the accreditation of companies in the pesticide sector and prior import authorizations; (ii) maximum residue levels (MRLs) in agricultural and food products imported by industrialized countries; (iii) standards for pesticide life cycle management, including packaging and obsolete (fraudulent, expired) pesticides.

These standards were primarily developed by industrialized countries, often based on temperate agriculture, with limited adaptation to the infrastructure and conditions of African agriculture. They are co-constructed with phytosanitary companies. Questions about their suitability for different institutional and environmental conditions arise from their transfer to tropical agriculture. Personal protective equipment that is effective in temperate climates may be ineffective or impractical in tropical climates, for example.

- **Pricing mechanisms for pesticides:** taxes and subsidies: Pesticide subsidies take many forms (Di Roberto and Jas, 2024) and can be activated through support or regulatory policies. In many countries, access to pesticides remains facilitated by free distributions through national programs supported by international cooperation. For example, initiatives to georeference cocoa plots for deforestation traceability are coupled with free pesticide distributions in some countries. Also, public spending on quality control projects, spraying training, and combating fraudulent pesticides may also function as indirect subsidies. On the other hand, taxes and customs duties—when they exist and have not been eliminated through exceptional exemptions—are relatively low. In the Economic Community of West African States (ECOWAS), for instance, VAT is set at 0%, while customs duties are at 5%. Support for pesticide use continues to grow, even through some project leaders are increasingly concerned about the health risks of pesticides. There is a duality of objectives, with instruments both promoting pesticide use and managing risks (health, environmental, illegal pesticides), while efforts to reduce their use remain anecdotal.

- **Evolution of agricultural and food policies:** In Africa, these policies are generally structured around rural sector development strategies and the implementation of National Agricultural Investment Plans since the 2020s (Bayiha et al., 2025). They finance agricultural development projects supported by regional and international donors that focus on sector competitiveness, crisis recovery, and agro-industrial development. These projects usually aim to improve the efficiency of inputs by ensuring their quality, availability, and proper application through training programs. However, regulations designed to enhance pesticide efficiency can sometimes result in a «rebound» effect, leading to increased pesticide use. Meanwhile, public funding for agroecological alternatives remains comparatively very limited.

Mesoeconomic Barriers at the Sectoral and Territorial Levels

Mesoeconomic barriers arise from the structure of agricultural sectors, territorial dynamics (local, regional), and projects that coordinate economic activity. These barriers often stem from competitiveness distortions between different geographical origins. For instance, MRLs in the European market place cocoa-, banana-, and coffee-producing countries in competition, affecting production cost differentials between Africa and Latin America. Conversely, pesticide-intensive cereals from the European Union or Ukraine compete with tropical staple crops (cassava, plantains), which require little pesticide use.

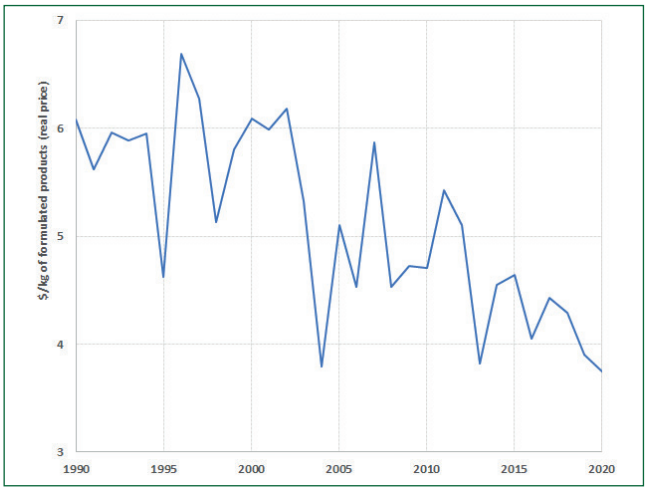

Figure 1: Import prices of pesticides in Africa in real terms (excluding subsidies). Source: FAOSTAT. Calculations: Authors.

In non-food and industrial sectors, quality standards for standardized low-cost raw materials (commodities) such as bioenergy and industrial crops (e.g., cotton) encourage simplified pesticide use. At the regional level, agro-industrial specializations (public or private) create localized supply systems (credit advances, free distributions, advisory services) that continue to favor pesticides.

Microeconomic Barriers at the Farm and Business Levels

At the farm and business level, financial profitability (such as gross margin, profit, etc.) is a significant barrier to adopting agroecological alternatives that reduce pesticide use. However, one key variable in profitability, yield, remains a subject of debate. Meta-analyses comparing yields with and without pesticides and synthetic nitrogen fertilizers have shown an average yield difference of 20% over several years, mainly due to nitrogen limitation (Schrama et al., 2018).

Moreover, because pesticides and agricultural labor are often substitutable, fluctuations in labor costs, pesticide prices, and agricultural product prices significantly impact farm profitability. Ultimately, pesticides act more as an economic insurance to secure yields rather than as a direct yield-enhancing factor. While risk aversion influences pesticide use decisions, uncertainty about the costs and benefits of alternatives remains a major microeconomic barrier to pesticide reduction.

On a complementary level, farmers and companies compare the cost of subsidized pesticides with that of alternatives (bio-inputs, labor, mechanical weeding, etc.), most of which are in the prototyping phase or have low and localized adoption rates. However, the cost of importing pesticides in Africa has been decreasing for the past 30 years (see Figure 1). It has also decreased for herbicides in other contexts (Haggblade et al., 2017). Secondly, the cost of a technology evolves according to the increasing returns of its adoption, which improve its effectiveness: learning effects, the pooling of infrastructure investments (epidemiological surveillance, developments, etc.), and other factors remind us that profitability is an evolving result

linked to markets and public innovation policies that structure the cost differentials between pesticides and techniques aimed at reducing their use.

Exploration of Institutional Levers for Reducing Pesticide Use

Faced with these lock-ins, various institutional levers (Brunelle et al., 2024) that can help build public policies to reduce pesticide use have been documented by our research.

Refocusing Public Reduction Policies on the Phytosanitary Industry

In Europe, pesticide reduction policies (Green Deal, Ecophyto Plan) are controversial in terms of their effectiveness. They document bans or restrictions on the use of molecules that impact agriculture in the Global South by affecting the supply conditions of certain tropical products (cocoa, coffee, bananas) and others (market gardening). Since 2015, China has implemented an action plan (renewed in 2022) for zero growth in the use of fertilizers and pesticides, which has proven effective based on available data (Xu et al., 2024, p. 17). The countries of the African Union have recently validated, within the Kunming-Montreal Global Biodiversity Framework, the objective of reducing the global risk from pesticides and highly hazardous chemicals by a minimum of half by 2030. But these dynamics have little impact on global trends in pesticide use, which have increased by 30% between 2001 and 2018 (GLOPUT data in active ingredients, Shattuck et al., 2023). One explanation identified is that current policies focus on pesticide users (farmers) rather than the phytosanitary industry or agri-food sectors, which are protected by high profit margins and the economic lobbying of globalized firms. Another issue concerns the lack of an economic model for funding the bodies responsible for defining and controlling pesticide use, such as national or regional approval committees.

Revealing Knowledge of the Costs of Pesticide Use in Public and Private Budgets

The visibility of hidden costs, which have economic consequence, some of which are identifiable and measurable in public or private budgets—is an important axis for harmonizing the knowledge base of public actors and holding policymakers accountable for arbitrating the societal costs and benefits of pesticides. These consequences can be measured in terms of public health. In the context of African tropical agriculture, the best-documented effects are acute poisonings; however, they are largely underestimated. The most well-known impacts in industrialized countries, but poorly documented in African contexts, are chronic diseases (cancers, neurological disorders, malformations, etc.). The negative environmental effects of pesticides on agro-systems are becoming more and more characterized. For example, they include the relationship between pollinator decline and agricultural yields, reduced fish stocks, increased resistance to pesticides, and the expenses associated with polluted water and soil.

Investing in Infrastructure and Networks that Systematize Agroecology

The agroecological transition requires specific investments, including epidemic surveillance systems, collective risk insurance mechanisms, experimental platforms for partnership innovations that structure new socio-technological networks between researchers, intermediation services (pilot farms, consulting firms, statistical information services), as well as efforts to address structural issues such as land tenure security and workforce remuneration. These initiatives require appropriate financing mechanisms in order to mitigate risks or make them socially and economically acceptable.

Renewing Academic and Professional Training

Most academic and professional agricultural training programs, whether in plant protection or agro-ecology (in both the North and the South), remain focused on optimizing pesticide use. A long-term transformation requires encouraging the renewal of training programs in line with research findings on agroecological alternatives and the conditions necessary to activate the increasing returns of their adoption.

Conclusion

These issues explain the economic advantage of chemical pesticides over techniques for reducing pesticide use. This advantage is partly explained by input distribution programs, subsidies, tax exemptions, and the restructuring of the global plant protection industry, which makes it easier to produce and distribute low-cost generic products (active ingredients). These developments have driven down pesticide prices in developing countries and increased their availability. This has created a competitive distortion between pesticide-based technologies and alternative technologies. Pesticide use is based on 'routine' techniques, supported by major investments in the 1940s (chemical and mechanical industries) that have long been amortized. Conversely, (public) investment in alternative techniques remains in its infancy or is highly context-specific. Such investments require specifying and developing infrastructure, skills, training, information, knowledge, learning processes, and institutions (standards, insurance).

Agricultural research is being used to document the necessary knowledge. It also needs to look at technology performance indicators, moving beyond mere yield considerations. Lowering pesticide prices is an anachronism given the public costs they generate. Public health and environmental costs borne by individuals, communities, and public services are continuously being contextualized and revealed.

Other levers or instruments for steering pesticide reduction have been documented in complementary research, including voluntary action information systems on quality labels (Participatory Guarantee Systems, etc.), legal, social, and organizational innovations related to labor mobilization, land tenure security, and territorial governance for localized pesticide bans and reductions (protected community forests, nature parks, and drinking water catchment areas).

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Some links:

https://www.pretag.org/communication. Pesticide reduction for tropical agricultures

https://umr-innovation.cirad.fr/. Innovations and transformations of agriculture and food systems

https://www.cahiersagricultures.fr/component/toc/?task=topic&id=1997. Cahiers Agricultures, 2025, thematic file: Reducing the use of agricultural pesticides in the countries of the South: socio-technical locks and levers.

https://www.canalls-project.eu

BIBLIOGRAPHIE

Bureau-Point E., Temple L., 2023., La recherche en sciences humaines et sociales sur l'objet pesticide dans le cadre académique français : état des lieux et perspectives », VertigO - Volume 22 numéro 2 http://journals.openedition.org/vertigo/38765

Bayiha G, Temple L, Jas N, Tata Ngome PI. 2025. Caractérisation multi-niveaux des verrous et leviers à la réduction d'usage des pesticides au Cameroun. Cahiers agricultures, 34, [à paraître]. https://www.cahiersagricultures.fr/component/toc/?task=topic&id=1997

Brunelle, T., Chakir, R., Carpentier, A., Dorin, B., Goll, D., Guilpart, N., & Tang, F. H. (2024). Reducing chemical inputs in agriculture requires a system change. Communications Earth & Environment, 5(1), 369.

Côte F.X., Le Bellec F., Martin T., Temple L., Blouin A., Loeillet D., Baufumé S., Ghneim-Herrera T. 2025. Rapport final de l'initiative « Pesticide Reduction for Tropical Agricultures » (Pretag). Montpellier : CIRAD, 146 p. https://doi.org/ 10.18167/agritrop/00835

Martin T., André P., Risede J. M., Lammoglia K., Sester M., Deletre E., Diabate S., Konan A. J. K., Le Bellec A., Blouin F., Ghneim-Herrera T., Côte F.X. (2025). Chapitre 2. Caractériser les leviers techniques permettant de développer des alternatives à l'usage des pesticides de synthèse. https://doi.org/ 10.18167/agritrop/00830

Di Roberto, H., Jas, N., (2024), Déterminants macro-institutionnels du recours au pesticide. Quelles subventions aux pesticides en Côte d'Ivoire ? Notes de recherche du projet PRETAG, 36p., Montpellier.

Haggblade, S., Minten, B., Pray, C., Reardon, T., & Zilberman, D. (2017). The herbicide revolution in developing countries: patterns, causes, and implications. The European Journal of Development Research, 29, 533-559.

Jas, N. (2007). Public health and pesticide regulation in France before and after Silent Spring. History and technology, 23(4), 369-388.

Shattuck, A., Werner, M., Mempel, F., Dunivin, Z., Galt, R. (2023). Global pesticide use and trade database (GloPUT): New estimates show pesticide use trends in low-income countries substantially underestimated. Global Environmental Change 81, 102693. https://doi.org/10.1016/j.gloenvcha.2023.102693

Schrama, M., de Haan, J.J., Kroonen, M., Verstegen, H., Van der Putten, W.H., 2018. Crop yield gap and stability in organic and conventional farming systems. Agriculture, Ecosystems & Environment 256, 123–130. https://doi.org/10.1016/j.agee.2017.12.023

Xu, Y., & Chen, Y. (2024). The agrochemical complex of China: historical, global and intersectoral connections. The Journal of Peasant Studies, 1-28.

Preamble

This study aimed at the characterization of institutional barriers and levers was one of the four components of the Pretag initiative, which also included an analysis of the uses and risks of pesticides in 5 tropical sectors, a characterization of technical alternatives to pesticides, and an analysis of the levers enabled by multi-stakeholder platforms to move towards less pesticide-consuming systems.

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For more informations

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