Chapter

The "Affordable Food" Deception: How the Real Costs of Pesticides Are Hidden, and Food Justice Is Being Obstructed

Peter Clausing and Brian Garvey

Abstract

Cheapening labor is essential for firm competitiveness and profitability in a capitalist economy and, for the labor force to be constantly renewed, labor needs to eat cheaply. The widespread use of pesticides is a favored means to make food production more "cost-effective." This is possible, however, only because a considerable part of the cost of pesticides is socialized. Our narrative review is based on research of available literature and publicly available statistics. The continued externalization of risk includes avoidance of the cost of regulatory measures and of the considerable health and environmental costs that are instead paid by public tax monies and health insurance for example. Even conservative estimates indicate hidden costs some two to three times higher than the global annual sales of pesticides (currently ca. $60 billion), while reduced "healthy life expectancy" of farmers and the general population remain a hallmark of pesticide use. This chapter, following an interrogation of the sectoral production statistics and of the costs involved in regulation and human harm, contends that pesticides impose substantial public costs that are belied by the agrochemical industry mantra of cheap food and the avowed necessity of pesticides to feed the world and its workers.

Keywords: pesticides, cheap food, health, environment, hidden costs, externalization

1. Introduction

As cheap labor is a cornerstone of capitalist production, reducing the costs of its reproduction is an essential component of the global economy: cheap labor needs to eat cheaply. Both food and labor are among the seven things discussed in the "History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet" [1]. From a meta-perspective, there are three options to ensure that labor is sufficiently cheap, so that products can be sold at competitive prices and capitalist production remains competitive and profitable.

In the interests of maintaining global competitiveness and firm profitability, labor is disciplined or cheapened by four key means that are most relevant to our discussion are:

Firstly, new technologies and forms of automation and mechanization continue to replace labor, thereby cutting jobs and incentivizing workers to reduce wage demands [2].

Secondly, there continue to be shifts in the geographic zones of production to avail of a large labor force. As has been documented, the Global South dominates global production, and it is where a reserve army of labor serves to suppress wages for those employed in primary, secondary, and tertiary sectors [3, 4]. Thirdly, globalization has sustained a distinct coercion of large parts of the workforce, and this includes ongoing forced labor and slave labor [5]. Finally, capital continues to find a way to reduce the costs borne by the social reproduction of the labor force. This includes forcing further costs into the domestic spheres of the workforce [6, 7] and also reducing the immediate cost of food.

What is explored in the subsequent passages is how the popular image of "cheap" food hides the externalization of substantial and harmful costs of capitalist production on to workers, the state, and consumers.

The significance of cheap food as a means to facilitate cheap labor becomes obvious because people in countries where the sweatshops of the Global South are located already spend up to 55% of their household consumption expenditures on food [8]—a percentage that most likely has increased after the war of Russia against Ukraine started. At the same time, cheap food is also a means to avoid social unrest, which for centuries represented an archaic form of collective bargaining by the urban poor [9]. It is one of the contradictions of the capitalist economy that one of its currents depends on cheap food (for cheap labor) while the other (commodity exchange) is driving food prices up by speculation, eventually resulting in food riots, which became particularly visible after the steep food price hike in 2007/2008 when such riots occurred in almost 40 countries [10].

A prominent articulation of the idea to promote allegedly cheap food and at the same time eroding food sovereignty came from John Block, at that time US Secretary for Agriculture, who claimed in 1986 that the "idea that developing countries should feed themselves is an anachronism from a bygone era. They could better ensure their food security by relying on US agricultural products, which are available, in most cases, at much lower cost" [11]. This approach, originally part of the US-inspired Cold War strategy of a green revolution—to counter the "red revolutions" in the Global South of the 1960s paved the way for a tremendous increase of the global use of agrochemicals in the decades that followed.

According to Food and Agriculture Organization (FAO) statistics [12], pesticide use almost doubled between 1990 (1.8 million tons) and 2021 (3.5 million tons). However, a recent analysis identified poor quality data and data gaps in reporting pesticide use at country levels [13]. In contrast to FAO's claim that global pesticide use has leveled off during recent years [14], it became clear that this leveling-off was a result of changes in reporting and not of reduced use. Shattuck and coauthors demonstrated a continuous increase emphasizing that this trend was most prominent in low and lower-middle-income countries, particularly after 2009. The other side of the coin is an estimated 385 million unintended acute pesticide poisonings, including 11,000 fatalities per year at the global level [15]. The vast majority of these poisonings occur in the Global South. This is a bold example of sacrificing human health and human lives to the benefit of an "efficient" production.

We suggest that the health, environmental, and regulatory costs caused by pesticides must be considered when assessing the true cost of food and the alleged cost efficacy of pesticide-based food production.

The work presented here is a narrative review based on publications searched in the literature databases PubMed and Google Scholar using the keywords "Pesticides" AND "Health Costs". In addition, publicly available statistical data from the World Bank, the Food and Agricultural Organization, and the German Ministry of Agriculture were used.

2. The hidden and externalized costs of pesticide use

It is widely considered among experts that pesticides are a business tool that can be used to produce food more cheaply. But a closer look makes it clear that it is a fallacy to believe that this makes food cheap. While the use of pesticides seems to make food production more "cost-effective", a considerable part of these expenses is socialized.

In their review, Denis Bourget and Thomas Guillemaud [16] distinguish four categories of "hidden and externalized" costs of pesticide use:

1. so-called "regulatory costs" (costs to finance authorities responsible for the approval of pesticides and the monitoring of pesticide use, including control analyses of food and groundwater),

2. costs of occupational health and safety equipment,

3. costs to deal with health costs caused by pesticides, and

4. costs of environmental damage, which is the most difficult part to quantify financially.

Thinking it through, one could even add the costs of lobbying activities by the pesticide industry as well as money used to support civil society initiatives fighting against pesticides, two activities that would be obsolete if no pesticides were used, and money that could be used for other purposes if food would be produced without agrochemicals. In fact, an estimated 10 million Euros are spent annually for lobbying by the pesticide industry in the European Union—an amount "greater than the budget of the European Food Safety Authority (EFSA), which works to regulate pesticides" [17].

Cost categories 1–4 are not borne by pesticide manufacturers and, excluding category 2, are not borne by farmers either. Although for completeness, it should be mentioned that companies pay a certain fee when registering a pesticide; this fee, however, does not come close to covering the regulatory costs mentioned above.

2.1 Regulatory costs

As one can easily imagine, regulatory costs vary considerably from country to country, depending not only on its size but also on the conditions prevailing there. Standardized to the 2013 value of the US dollar, for example, the regulatory cost in 1996 in the Republic of Niger was $150,000 compared to $5 billion in 2002 in the United States [16]. This translates into about 1.5 cent per capita in Niger, versus approximately $15 per capita in the United States. One could say that part of this difference is paid in the currency of "healthy life expectancy" (HALE)—a statistical measure determined by the World Health Organization on a regular basis. The HALE "at birth" estimate for 2019 was 55 years for people from Niger and 66 years for people from the United States.

Another estimate of regulatory costs is available for France [18]. Based on data from 2017, it was estimated that 31.9 million Euros were spent on the regulation of pesticides, corresponding to 47 euro cents per person.

2.2 Cost of occupational health and safety equipment

The geographic spread of the cost of occupational health and safety has similar disparities. Many farmers in the Global South use little or no occupational health and safety equipment, if only because of cost.

For Mali, it was estimated that a farmer would need to spend between $30 and $60 annually to protect himself against pesticide exposure [19]. Obviously, for African smallholders earning $2 per day [20], these $30–$60, corresponding to 6–12% of their annual income, cannot be afforded. Even in Iran which, according to the World Bank definition [21], belongs to the group of lower-middle-income countries, farmers do not use all the personal protective equipment (PPE) necessary. This was demonstrated in a study conducted with 370 farmers in the Ardabil province [22]. These farmers used eight different pesticides (chlorothalonil, chlorpyrifos, diazinon, glyphosate, imidacloprid, metribuzin, paraquat, and trifluralin), which all belong to the group of highly hazardous pesticides [23]. According to the product information, the use of these pesticides with an acceptable risk needed at least five pieces of PPE (long sleeve shirt and pants, rubber boots, googles, resistant gloves, and filter mask), and for four of the eight pesticides a sixth piece of PPE was required. On average, these farmers used only three PPE items (between 2.7 and 3.3 items, depending on the pesticide used). This gives an expression of what PPE use can be expected from even less educated, poorer smallholders.

The problem is not confined to small, independent producers, however. It is commonly found that farm workers of large agribusinesses are denied the adequate provision of protective equipment. For example, the South African nongovernmental organization, Women on Farms Project, reported that when authorities come to visit, managers hand out protective clothing beforehand and then have it collected again. In addition to economic reasons, a lack of knowledge of risk ("it's not necessary") and adverse climatic conditions (where protective equipment adds to heat stress) are important reasons for the insufficient use of PPE in the countries of the Global South. Who wants to walk around with a protective mask and a protective suit when the temperature rises above 30° Celsius? This, in turn, has consequences for their health but not for the price of their products.

2.3 Cost of health impacts

To put it simply, every year, millions of people go to the hospital—if they can get there at all—so that food prices can be kept low enough for those who survive on low-paying jobs. Depending on the type of damage, there are very different estimates of pesticide-related health costs. These costs are not paid by industry but instead either directly by those affected or by the general public through insurance premiums, tax money, or sick leave benefits, and thus, are not reflected by the price of the food.

2.3.1 Acute poisonings

The most commonly available figures for ill health from pesticides are those for acute poisoning, although the reported cases represent only the tip of the iceberg. These costs are relatively easy to calculate because here, the link between the cause of poisoning (pesticide) and its financial consequences can be established directly; for instance, by field studies in which the affected persons are interviewed and the expenses related to the poisoning are reported. Such expenses include transportation costs to the hospital, treatment costs, and loss of earnings. In contrast to chronic diseases, loss of earnings after acute poisoning mostly occur for a relatively short period of time—the time needed to recover from, e.g., respiratory, neurological, or gastrointestinal disturbances. Twelve publications reviewed by Bourget and Guillemaud [16] covered nine countries in the Global South. The data provided an (unweighted) average cost of $55.17 per affected farmer per year, ranging from $2.63 per case in a study from China to $187.36 per case in the studies from Sri Lanka (all standardized to the 2013 value of the US dollar). Expenses of less than $10 per case might be considered an underestimate because the China study ($2.63 per case) and the Zimbabwe study ($9.42 per case) did not take into account the loss of earnings due to the poisoning. How much money is needed to recover from an acute pesticide poisoning depends not only on the intensity of exposure, but also on the type of pesticide.

For paraquat, a herbicide banned in the European Union but still widely used in the Global South, the average cost per acute intoxication in Colombia was $2642 [24]. The 344 cases reported for 2017 translate into almost $900,000 alone in Colombia. Paraquat causes acute hepatic, renal, and respiratory problems, with pulmonary fibrosis being a complication that generates long-term morbidity in survivors. In a study conducted in Chile from January 2009 to December 2011, the average cost per case was $794 in case of hospitalization (23% of cases) and $25.5 in case of ambulatory treatment (77% of cases) [25].

In contrast, for a sample of 307 farmers surveyed in the Punjab province of Pakistan between June and September 2019, an average health and protection cost of $3.60 was calculated [26]. These farmers used exclusively Class II (moderately toxic) pesticides [27], which seems to make a difference. According to the authors, the daily wage of the farmers participating in this survey was an estimated $3.22, and the cost of living was $3.00. In other words, the acute pesticide poisoning in this setting consumed the spare money ($0.22) of 16 work days.

No reliable estimate of the global annual costs of acute poisonings exists. However, one could use an arbitrarily selected lower bound of $10 per case or accept the unweighted average of $55.17 per case as representative [16] and multiply this with the global estimate of 385 million unintentional acute pesticide poisonings annually [15]. This would yield an annual cost between roughly $4 billion and $20 billion for acute poisonings. It should be noted that even the $55.17 per case could be an underestimate when taking into account the more recent reports mentioned above [24, 25]. Furthermore, it should be noted that the figure of 385 million includes 11,000 fatal poisonings. Fatal poisonings are rarely taken into account in the cost-illness studies published so far. Neither were they considered here. Monetizing human lives may be an issue in courts. For statistical estimates, it represents an ethical question.

Another aspect to be kept in mind is that exposure to pesticides resulting in symptoms of acute intoxication is a strong indication for a more subtle but high long-term exposure to the pesticides used. Long-term health consequences are likely to occur from such a high chronic exposure, which, however, mostly remains unnoticed because it is below the threshold of clinical symptoms.

2.3.2 Chronic health effects

While the costs of acute poisoning vary widely and may have been underestimated, a monetary assessment of chronic health damage caused by pesticides is virtually lacking for countries in the Global South. This is all the more dramatic because, due to weaker or missing regulations, the exposure to pesticides is much higher [28–30] than, e.g., in Canada, the United States, or the European Union. In addition to the higher exposure, the pesticides used in countries of the Global South are often more dangerous. Many of the "highly hazardous pesticides" [31] are meanwhile forbidden, e.g., in the European Union, but still used in the Africa, Asia and Latin America. Therefore, it can be assumed that the incidences of chronic diseases such as cancer and Parkinson's disease or birth defects are higher in low and lower-middle-income countries. However, health statistics are often poor, and epidemiological studies are sparse.

The few estimates for the cost of long-term effects of pesticides refer almost exclusively to the European Union or their member states.

Alliot and coauthors [18] calculated the health costs for long-term illnesses due to synthetic pesticides in France in 2017 and identified 46.7 million Euros for Parkinson's disease and 1.8 million Euros for non-Hodgkin lymphoma (cancer of the lymphoid system). It should be noted that these are the figures of recognized cases of agricultural occupational diseases only. Numerous epidemiological studies provide evidence that pesticides can be the cause of many more chronic diseases. Significantly increased risks due to pesticide exposure were demonstrated, e.g., for leukemia, prostate cancer, brain tumors, colon cancer, and lung cancer [32].

Two extensive analyses [33, 34] looked at the EU-wide annual costs caused by so-called endocrine-disrupting compounds. Their projections amounted to 157 billion Euros [33], with organophosphate pesticides responsible for the lion's share of $121 billion [35, 36]. In all these studies, the economic impacts of the following health problems were taken into consideration: intellectual disability (as measured by a reduced intelligence quotient), psychological disorders (autism and attention-deficit hyperactivity disorder), metabolic disorders (obesity and diabetes), and reproductive disorders as cryptorchidism, male infertility, and mortality associated with reduced testosterone [33, 35, 36]. In an updated analysis, they also added fibroids and endometriosis and estimated a median annual cost of 163 billion Euros [34]. As for acute poisonings, the cost estimates included not only the expenses related to medical treatment but also loss of income due to the diseases.

While the total disease burden and costs were much higher in the United States—an estimated $340 billion in 2010—the share of pesticides was much lower, estimated at $48 billion [35]. This difference was due to the different use spectrum of pesticides in the United States vs. the European Union. For instance, a certain type of flame retardants (polybrominated diphenyl ethers) played a major role in the United States, whereas the use of certain organophosphate pesticides was a prominent factor in the EU.

2.4 Environmental costs

Environmental costs are even more difficult to estimate, resulting in a large range between the lower and upper boundary of the estimates. Alliot and coauthors [18], using official data of the French government and the European Commission, provided the most accurate, but at the same time also the most restrictive estimate. For 2017, they could allocate 291.5 million Euros of environmental costs to pesticides. Of these, 260 Euros alone were used for water treatment because of the presence of pesticides. An extrapolation of this cost to the EU level yielded an estimate of 1.3 billion Euros for water treatment [17]. The fact that, according to UN statistics, more than two billion people worldwide do not have access to clean drinking water gives an idea of the dimension of the problem [37].

Many other environmental damages (e.g., loss of biodiversity and pollination "services" by insects, reduction of soil fertility due to glyphosate) are mentioned but not measured in monetary terms. Bourget and Guillemaud [16] had 11 fully independent datasets at their disposal to extract data on environmental costs. The estimated amounts ranged from (lower bound) $270,000 for a single pesticide (carbofuran) used as a seed dressing for one crop, rapeseed [38], to approximately $8 billion for all crops and pesticides in the United States [39]. The estimated costs covered loss of natural enemies, cost of pesticide resistance, honeybee and pollination losses, crop losses, fishery losses, bird losses, and groundwater contamination.

2.5 A rough estimate of the minimum total cost

Keeping in mind that many estimates mentioned above were either geographically restricted or limited in their scope (e.g., chronic health effects limited to recognized occupational diseases), the data collated in **Table 1** must be considered as a severe underestimation. Nevertheless, they provide an idea of the overall hidden cost of pesticides, which equals at least $140 billion annually. Compared to the global sales of pesticides of $60 billion in 2020 [17], the externalized costs are two to three times higher than the sales.

Entity	Amount (billion $)*	Geographic area	Reference
Regulatory costs	5	United States	[16]
Regulatory costs	0.23**	EU	[18]
Personal protective equipment (PPE)	4***	EU and the Americas	[19]
Acute poisoning	3 85****	Globally	[15, 16]
Occupational diseases	0.34#	EU	[18]
Endocrine disruptive pesticides	120	EU	[35, 36]
Environmental costs	8	United States	[39]
Environmental costs	1.9##	EU	[18]

**Euro converted to US$ using a factor of 1.1.*
***Extrapolated from France (68 million inhabitants) to EU (447 million inhabitants).*
****Extrapolated from upper bound annual PPE cost in Iran ($60) multiplied with the 2020 farming population of Europe and the Americas—68 million people [40].*
*****Extrapolated from lower bound cost per case ($10) and 385 million cases annually.*
#Extrapolated from France to EU, only for recognized cases of Parkinson's disease and Non-Hodgkin Lymphoma (recognized occupational health disease in France assuming similar incidences in other European countries.
##Extrapolated from France to EU.

Table 1.
Estimates of different types of hidden costs.

3. Enough food for all?

The mantra of the agrochemical industry is that pesticides (and synthetic fertilizers) are needed to feed the world. The counter-narrative by then UN Special Rapporteur on the Right to Food, Olivier de Schutter, is that hunger is a result of poverty rather than insufficient production and that smallholder farmers "in critical regions" of the world could double food production within 10 years using agroecological farming practices [41, 42].

Although agroecological farming is accompanied by a moderate reduction in yield per hectare [43], this tends to reverse in world regions where hunger is prevalent [44]. Moreover, it is not only a question of comparing yields per hectare but also of what agriculture will look like in future decades. Long-term soil quality is an ongoing concern while in view of climate change, water, and energy efficiency need to be taken into account.

Today, while water use in (large scale) agriculture receives $700 billion in subsidies annually [45] withdrawn from rivers and from groundwater, 771 million people have no access to clean drinking water UNICEF [46]. This underscores the importance of efficient use of water, especially rainwater by crops, among other things, to achieve better yields even without artificial irrigation. For a number of important components of agroecological management, it is clear that they also improve water use. This includes shade trees in agroforestry and an increased humus content in the soil.

Less widely known, but well-documented, is the higher energy efficiency of agroecological farming. This is demonstrated by so-called food EROI studies, where EROI stands for "Energy Return on Investment." It involves the balance of energy invested (from agrochemicals to fuels to irrigation) compared to energy gained in the form of food calories (e.g., [47, 48]). At the extreme, estimates range from 1:10 (1 kilocalorie used to produce 10 kilocalories of food) in the case of smallholder agroecological production to 10:1 for large agro-industrial settings [49].

Most importantly, when the protagonists of chemical-based agriculture bring into play the argument that high yields per hectare are necessary to feed the world's population, it is also necessary to consider how agricultural 'food' products are being used in the world. In 2018, according to Food and Agriculture Organization (FAO) statistics, 35.6% of the world's grain harvest was used as animal feed, and 21.8% was used as agrofuels, leaving only 42.6% of grain available for direct human consumption. Criticizing the excessive consumption of animal protein is not about a "vegan ideology", but about adequate proportions. The World Health Organization recommends 18 kg of protein for nutritional purposes. In contrast, annual per capita consumption in Europe was already at 25 kg in 1960. At that time, half of the protein consumed was vegetable protein. In 2007 per capita consumption was at 30 kg of protein, and this further increase was exclusively covered by animal protein [50].

In addition to the inefficiency of using plant products as animal feed, and the competition for land between food vs. agrofuel production, there are avoidable (!) food losses, which for Germany alone are estimated by the Federal Ministry of Food and Agriculture (BMEL) at six million tons, about 7% of total production [51].

While the cereal crisis as a result of Russia's war against Ukraine is a tragedy, it should be kept in mind that the dependence on food imports, especially in African countries, emerged in the 1980s when structural adjustment programs were imposed on heavily indebted countries by the World Bank and International Monetary Fund.

All in all, it can be seen that—provided there is political will—there are sufficient possibilities to buffer the currently existing yield difference between conventional and agroecological cultivation, although it is not even said whether these differences would remain in the long run-on the one hand because of improved agroecological cultivation methods and on the other hand because of declining conventional yields due to soil fatigue and poorer water utilization, as it is already becoming apparent in some regions.

4. Conclusion

As it has been shown, the alleged need for agrochemicals for the production of "affordable" food for a growing global population is a false claim as the proponents of the dominant model of industrialized agriculture—with its dependency on chemical inputs—omit from their calculations the substantial costs of regulation, of protective equipment, of health and environmental effects and the dismissal of the potential of agroecology. Even a conservative summation of the (hidden) annual costs caused by pesticides (at the very least $140 billion) reveals a figure more than two times higher than the global pesticide sales ($60 billion for 2020). The data provided here underpins the consideration that a significant proportion of "cheap food's" production costs are paid for in the form of tax money, insurance premiums, reduced quality of life, and shortened life expectancy. It is evident that these harms to human life are unevenly distributed across the globe, with rural workers and families in the Global South disproportionately sickened and killed as a result. Critics of agroecological alternatives may point to more labor-intensive and, thus, more expensive means of food production-especially if fair wages are paid. When the hidden costs of pesticide-based agriculture are revealed, however, these arguments would appear to dissipate. Furthermore, the new challenges facing cultivation from climate change call for not just safer means of food production but also those which can reduce fossil fuel dependence and conserve water and energy. An ethical commitment to protect human life alongside the reduction of long-term environmental harm points to a broader and more accurate appraisal of the hazards that underpin contemporary, industrialized agriculture and consideration of available alternatives.

Author details

Peter Clausing[1*] and Brian Garvey[2]

1 Pesticide Action Network Germany, Hamburg, Germany

2 University of Strathclyde, Glasgow, Scotland

*Address all correspondence to: peter.clausing@pan-germany.org

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