"Defensives" or "pesticides"? A history of the use and perception of pesticides in the state of Santa Catarina, Brazil, 1950-2002

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Abstract

The article presents a history of the use and perception of pesticides in the state of Santa Catarina, Brazil, between 1950 and 2002. A variety of primary sources were used, including technical newsletters, government reports, agricultural censuses, newspaper articles, data from the state center for toxicological information, and an interview with a key technician from the field. It was found that the use and perception of pesticides passed through different phases in Santa Catarina, much as in other places, with changes in attitude prompted both by the personal experiences of technicians and farmers and by the influence of the broader cultural context and circulation of environmentalist ideas starting in the 1980s.

Keywords: pesticides; green revolution; Associação de Crédito e Assistência Rural do Estado de Santa Catarina (Acaresc); environmentalism; agroecology.

Brazil is currently the world's leading consumer of pesticides, and this consumption has kept step with advances in agricultural production. Since the publication of Rachel Carson's *Silent Spring* in 1962 – called a cornerstone of contemporary environmentalism (Lytle, 2007) – the world has grown increasingly aware of the risks of pesticides. The US biologist's concern was prompted by her own observations and by those of other authors on the effects that pesticides were having on biodiversity overall. While the purpose behind the broad use of insecticides was to exterminate specific insects, the ultimate impact was to kill off many other animals, including domesticated animals, resulting in the "silent spring" of the book's title.

> Future historians may well be amazed by our distorted sense of proportion. How could intelligent beings seek to control a few unwanted species by a method that contaminated the entire environment and brought the threat of disease and death even to their own kind? (Carson, 1964, p.19).[1]

Carson's book recounts myriad cases where a veritable extermination of biodiversity occurred in the United States in the 1940s and 1950s, linked to the use of pesticides. With the aim of eradicating insects and weeds that were considered harmful, huge sweeps of agricultural and non-agricultural areas were dusted from airplanes and tractors or by hand. Even roadsides were sprayed to eliminate physical or visual obstructions, even though other methods could have been employed. Moreover, according to Carson, this took place in a context of overproduction, when the US government was spending vast sums of money to store surplus food.

Since then, many publications, scientists, politicians, and organizations have decried the adverse effects of different types of pesticides on human health and the environment (Hess, Porto, 2014). In recent decades, various types of pesticides have been banned or their use abandoned, while others have come on the market. Yet despite this debate, despite the recent development of agroecology (an agricultural system that uses no agrochemicals), and despite demand for organic products, pesticides are still being used on a large scale and in unprecedented amounts. From 2000 to 2012, Brazil's consumption of the active ingredients in pesticides and related products per planted hectare more than doubled, according to the sixth edition of Indicators of Sustainable Development (Indicadores de Desenvolvimento Sustentável Brasil, IDS), published by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, IBGE). In 2002, 2.7kg/ha were marketed; in 2012, the figure reached 6.9kg/ha (IBGE, 2015). Industry and a portion of the scientific community minimize the risks and blame farmers for improper use, while also arguing that it would be impossible to feed the world's population or guarantee cheap food with an organic or agroecological production system.

Based on a study of primary sources, the present article contributes to this debate by presenting original research on the history of the use of pesticides in the state of Santa Catarina, Brazil, and seeks to advance discussions of a topic that has been explored very little from a historical perspective (Wright, 2005; Russel, 2001; Soluri, 2005; Porto, Pacheco, Leroy, 2013; Davis, 2014). An analysis of these historical sources detects various stages in the use of these products and allows us to investigate how the practical experience of technicians and farmers influenced the use and perception of pesticides over this 50-year period.

We also take into account the influence of broader contexts, like the 1980s economic crisis and the emergence and popularization of environmentalism in Brazil during that same decade, factors that had a bearing on the use and perception of pesticides.

Based on this analysis, we present evidence that suggests that the use and perception of these agrochemicals depended not only on technical studies of their impact on health and the environment but also on the individual conceptions and experiences of farmers, technicians, politicians, and environmentalists. According to Viola (1987), the Brazilian environmentalist movement can be divided into three periods. The first, which he calls the "environmentalist," ran from 1974 to 1981 and was characterized by the existence of two parallel movements that labeled themselves apolitical. The second, from 1982 to 1985, was a period of transition, when the two movements overlapped somewhat; one involved environmental denunciations in the city and the other, the construction of alternative rural communities. This was a time of politicization and of qualitative and quantitative expansion. Viola calls the third period, which began in 1986, a phase of "ecopolitical choice," when most of the ecological movement self-identified as political.

The state of Santa Catarina was chosen because of the relatively easy access to primary sources, the absence of any research on this region, and the need to study what happened in this state and thus provide information that may be useful to understanding other contexts in Brazil and abroad. During the period under analysis, Santa Catarina agriculture was strongly marked by family labor, a prevalence of small and medium-sized farms, and quite diversified crops.

Primary sources included technical newsletters, reports by rural extension and other agencies, IBGE agricultural censuses, newspaper articles, data from the Santa Catarina Center for Toxicological Information (Centro de Informações Toxicológicas de Santa Catarina, or CIT/SC), and an interview with a leading technician from the sector. Sources were collected at the library of the Santa Catarina Corporation for Research in Agriculture/Livestock Raising and Rural Extension (Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina, Epagri); the Santa Catarina State Public Library (Biblioteca Pública do Estado de Santa Catarina); and the IBGE library, all located in Florianópolis, Santa Catarina.

The "golden age" of pesticides in Santa Catarina, 1950-1980

The "golden age" of pesticides bears some resemblance to the golden age of antibiotics, marked by exaggerated optimism, or naïve technological optimism, about how humanity could rid itself of plagues through technological advances – whether these plagues involved microorganisms that cause human disease or organisms that damage crops and livestock (McNeill, 2001, p.201). Yet basic knowledge of evolutionary biology was overlooked, and the adaptive and evolutionary abilities of the organisms targeted by these agrochemicals were not taken into due account. It was a phase of great excitement for technicians, politicians, and farmers, as if they were in reach of miraculous products that would defeat challenges faced by farmers for centuries in their dealings with agroecosystems. This is apparent in the following advertisement, excerpted from a newsletter published in 1963 by the Santa

Catarina State Federation of Rural Associations (Federação das Associações Rurais do Estado de Santa Catarina, Faresc):

> The enormous crop damage caused by soil pests can be avoided in time when you use Aldrin before planting, either directly on the soil or to protect your seeds. A versatile and notably powerful insecticide, Aldrin kills the termites, ants, cotton borers, banana borers, sweet potato borers, *bicho-bolo* [*Diloboderus abderus*], *bicho-arame* [*Heteroderes* spp], mole crickets, cutworms, *percevejos-castanhos* [*Atarsocoris brachiariae* Becker], and leafhoppers that attack a gamut of crops, devouring the fruit of your labor and destroying the crops that your livelihood depends on!
>
> Aldrin guarantees an abundant yield!
>
> By applying it once, or twice at most, Aldrin affords the speediest, safest, most efficacious, and most economic way to eliminate the problem of soil pests. And thanks to its residual effect, it keeps the bugs away throughout the season, guaranteeing an abundant, profitable harvest! Aldrin offers other advantages as well: it leaves behind no taste or smell and it can be used efficaciously on a wide variety of crops, which will develop strong, deep roots that ensure their hardiness (As pragas…, 1963, s.p.).

We could discard this 1960s ad as nothing more than a Shell marketing tool, but if we note that the insecticide Aldrin – an organochlorine – was banned in Brazil in 1985 and classified as a very hazardous product, we realize that this pesticide advertisement was both naïve and unconcerned with product safety (Flores et al., 2004; D'Amato, Torres, Malm, 2002).

Pesticides were part of the technological package of modernization – part of the "green revolution" – and their use and the perceptions surrounding them were inextricably linked to a series of other agricultural technologies, like synthetic fertilizers, lime, tractors, certified seeds, and agricultural implements. In order to convince farmers to adopt these technologies, the Brazilian government and its states imported concepts and methods from rural extension in the United States and began opening technical assistance offices and hiring farm technicians, agronomists, veterinarians, and home economists in the 1950s. In 1957, the state of Santa Catarina created its Rural Credit and Assistance Association (Associação de Crédito e Assistência Rural do Estado de Santa Catarina, Acaresc) (Olinger, 1996). Shortly thereafter, when the military took power in 1964, a broad and generous system of rural credit was implemented and played a vital role in disseminating these technologies.

It is evident from Acaresc's first report – *Relatório de atividades* (1957) – that pesticides were already in use in Santa Catarina. The report mentions them in the context of the Acaresc Plant Protection project. Acaresc worked with other projects as well, in such areas as soil conservation, animal sanitation, nutrition, health and sanitation, swine raising, the fight against ants, hybrid corn, and reforestation. In the realm of what was deemed "plant protection," the "pests" that assailed corn, potatoes [*Solanum tuberosum*], cassava, rice, wheat, grapes, and other crops were first described and control methods then indicated. With a number of crops, the report suggested, control would only be possible through reliance on crop rotation, selected seeds, or fertilization. In most cases, however, the recommendation was to "spray," "dust," or "eradicate." In the case of rice, this entailed the following:

11. Rice stink bug
a) Water depletion
b) Dusting with BHC at 1.5%

12. Rice weeds
a) Planting in rows
b) Eradication

13. Bean rust
– Spraying (Acaresc, 1957, s.p.).

BHC (benzene hexachloride) is an organochlorine. To safeguard human and animal health and the environment, the Ministry of Agriculture banned it in Brazil on September 2, 1985 (Portaria no.329). According to a source cited by Zanin (1992, cited in Grando, 1998, p.5), in December 1946, it was applied in Caçador, Santa Catarina, to exterminate locusts, making it the first pesticide to be used in Brazil.

It is, however, likely that only limited amounts of these agrochemicals were being used in Santa Catarina at that time. As Grando (1998) stated about the attempt to locate data on the consumption of pesticides by state or municipality in the 1990s, it is extremely difficult to find statistics on the amount of these products sold or used. For some years, the National Association of Plant Protection (Associação Nacional de Defesa Vegetal, Andef) and the National Association of Industries of Plant Protection Products (Sindicato Nacional da Indústria de Produtos para Defesa Vegetal, Sindag) failed to provide data on the production or consumption of active ingredients. Not even the state agency for plant health protection (Companhia Integrada de Desenvolvimento Agrícola de Santa Catarina, Cidasc) had these data.

In none of the IBGE censuses for the state of Santa Catarina that we reviewed, from 1940 through 1995, could we find any information on the sale or consumption of these chemical products, in either volume or weight. We were, however, able to assess total expenditures up until the 1970 census (in the currency for the date of each census); beginning with the 1975 census, information is available on the number of establishments using these products, although quantity consumed is not reported. Based on data from the 1950 census, which reports the number of sprayers in each municipality, we can thus infer that the use of pesticides was not very common then. For the 104,000 establishments polled in the state, there were only 1,963 sprayers and dusters (equipment that distributes or spreads products in powder form); by 1960, this figure had risen to a still modest 6,313. Nonetheless, the first issues of the Faresc newsletter often featured advertisements for sprayers, like this one for the "Fulminante" (Thunderer):

> Whatever pests are infesting your crops or livestock, there is a specific model of Fulminante Sprayer that will solve your problems scientifically and precisely.
>
> The complete modern line of sprayers made by Metalúrgica Combate ranges from models for applying DDT to cattle and sanitizing pens and coops to models for spraying fields both large and small, thus protecting from the pests and diseases that cause farmers so much worry and burden their lives (Qualquer..., 1960, p.33).

The only item related to pesticides that appears on censuses taken between 1940 and 1970 is 'insecticides' or 'insecticides and fungicides.' This is because, until the 1970s, Brazil made no significant use of herbicides (currently the most heavily used class of pesticides), and census items were standardized nationwide. The 1975 census brought a shift in survey approach, with the inclusion of the number of informant establishments; from this, it is evident that the use of pesticides had gained ground in Santa Catarina over the previous years. Of the 206,505 establishments or rural properties polled, 180,000 reported using an 'animal' and/or 'plant' 'defensive,' that is, some 87%. It should also be underscored that the word 'defensive' (*defensivo*) appeared for the first time on IBGE (1979, p.26) agricultural censuses that year.

While the earliest Acaresc reports show that farmers were using 'defensives,' IBGE census figures suggest that these products were still not in particularly heavy use in the state in the 1960s.

> 1,719 families learned 'plant health protection' practices and are applying them.
> 348 families purchased dusters, sprayers, or ant extinguishers to combat disease and pests.
> 375 families are combating ants (Acaresc, 1958-1960, s.p.; emphasis in original).

The leaf-cutting sauva ant was declared a major enemy of Brazil many years ago, back in the colonial era, as pointed out by José Augusto Pádua (2002). In 1970, Acaresc (p.30) launched a major campaign to combat the sauva, and its results demonstrate the tremendous growth in the use of ant poisons in just ten years.

> The year 1970 saw two major campaigns conducted by ACARESC (in collaboration with other agencies): Soil Conservation [Conservação do Solo], in fifty municipalities, with the participation of 20,000 farmers, and The Fight against the Sauva Ant [Combate à Saúva], in 49 municipalities.
>
> The sauva ant campaign, now transformed into a project, drew the participation of 10,000 farmers, consumed 46 metric tons and 24,000 cans of ant poison, and exterminated some 112,000 sauva ant colonies.

Encompassing apples, peaches, plums, pears, and nectarines, the Temperate Climate Fruit Production project (Fruticultura de Clima Temperado) was introduced that same year. Substantial amounts of pesticides and other inputs were already being used to raise these crops, like others that were deemed of greater economic value to Santa Catarina agriculture, such as corn, rice, soybean, common bean, and tobacco. In regard to the last of these, given the tight technological ties that tobacco companies have long forged with farmers, the use of pesticides was by far the most widespread in the case of this crop. Of the 38,822 tobacco-producing establishments polled by the 1975 census, 31,861, or 82%, reported using "defensives," while of the 171,709 corn-growing establishments – one of the crops of greatest concern to Acaresc right from the outset of its extension work – only 6,401, or 3.7%, stated that they used "defensives" (IBGE, 1979, p.116, 120).

By the 1970s, modernization of the agricultural sector in Santa Catarina was advancing substantially, as reflected in other technological indexes from the census. This triggered a sizeable rural exodus, much as in other regions of Brazil. In terms of yield, productivity was a result of the large amount of rural credit distributed, as mentioned earlier. One example of this was Law no.4.263, of December 24, 1968, which created the Santa Catarina Fruit

Production project (Fruticultura em Santa Catarina), aimed at promotion, extension, research, and plant health protection, as well as at the purchase of seeds, seedlings, and "health protection products," with funding through the state treasury. In other words, through subsidized credit, the Brazilian federal and state governments and society as a whole financed chemical industries and contamination, particularly as of the early 1970s, when the Banco do Brasil "declared it mandatory to allocate 15% of the value of production loans to the purchase of pesticides" (Ferrari, 1985, p.27).

Como modernizar a agricultura e produzir mais alimentos (How to modernize agriculture and produce more food), a publication released by Acaresc in 1974, presents data indicating that modern technology had boosted yield, although this achievement was underwritten by a "generous" credit policy that did not withstand the 1980s economic crisis and that was environmentally unsustainable in the long run. The excerpt that follows gives us a glimpse into the motivations and hopes of that era:

> A convincing method
>
> Table no.3 clearly shows that the use of advanced technology has afforded farmers rewarding physical and economic results.
>
> The dissemination of these results among Santa Catarina rural circles, along with similar results obtained in previous years, has encouraged growing numbers of farmers to employ modern techniques on their crops (Acaresc, 1974, p.3).

In photographs included in Acaresc reports from the 1960s, it is striking to note little concern about contact with chemical products, be it through the lungs or the skin. No protective gear was used, even though organochlorine pesticides – still called "defensives" then – were very hazardous. Only medium-term experience was enough to shed greater light on the dangers of these agrochemicals to health and the environment.

There are other indications that the hazardous effects of pesticides on human health were largely unknown or ignored in the 1970s. Our interview with Elmo Piazza Branco, a retired agronomist who worked with Epagri (the rural extension agency that replaced Acaresc in 1991) confirms this lack of preparedness. Branco held various posts at Acaresc and was one of its top pesticide experts. In addition to witnessing cases of farmers who were poisoned during the course of his career, Branco (23 maio 2003) also told of his own poisoning:

> Branco: Well, it doesn't do any good to be a technician, agronomist, or farmer and get sloppy like me, who was ignorant on the matter. It was after I was poisoned that I got a bit more interested. Of course. After all, I went through a tough situation. I lost my ability to move: I couldn't walk, couldn't chew, wasn't able to move, couldn't write, couldn't speak. When I realized this, I rushed off to the EPAGRI doctor, Vani, and told him what was happening. So he recommended I see a colleague of his, who was a neurologist, and I had my first appointment with her. And I told her: 'I've been working with this junk for so many years and I didn't know anything about this.' I had to get poisoned to see that this stuff isn't sugar water. It isn't holy water.
>
> And then I had a bunch of tests done ... My head, my limbs. Some of [the tests] hurt, because they stuck needles in different parts of my arms and hands, from my knees to my feet, and hooked me up to an electric device to measure it. Well, when you get that electric shock, there's an impulse in your body, and that's how they evaluated what

> was kind of blocked. Because folks who are poisoned by phosphates and carbonates get a kind of blockage in their nerve impulses, and they can't move ... Every time the device emitted an electrical discharge, my body spasmed, and I'd stretch out my fingers, legs, hands – so everything was all straight. And that brought my movement back...
>
> Authors: Was your poisoning because you used the pesticides yourself?
>
> Branco: Since I gave training sessions, I had to have contact with the product. It was only later that I handled the water and dye. I don't know how many times I walked through a treated crop. I didn't know anything. I just knew it was good for killing pests. Nobody knew more than that here in Santa Catarina; nobody focused on studying the topic. And then I learned the hard way.

This revealing interview shows how even the most qualified, educated rural extension technicians in Santa Catarina were swayed by the era's technological optimism and displayed either naïveté or ignorance when it came to the risks of pesticides. This leads us to wonder about this situation in a context where many illiterate or undereducated farmers were handling products hazardous to human health. Laws were quite new then and were permissive despite clear-cut experiences of human poisoning and environmental pollution associated with pesticides; furthermore, Branco states that there was no type of oversight regarding minimum safety procedures. While preparing her thesis in the 1990s, Margaret Grando (1998) wrote about an allegation lodged by the acting environmental agency, the Santa Catarina State Environmental Foundation (Fundação do Meio Ambiente do Estado de Santa Catarina, Fatma): the agency had no control over what farmers were using because it lacked specialized technical staff. Even in the 2000s, when Cidasc became responsible for oversight, the efficacy of control was questionable, given that the state had no chemical laboratory that could analyze possible pesticide residues in the soil, plants, animals, or food in general, as we were informed by agency staff.

Prior to 1984, when the CIT/SC was created as part of the teaching hospital (Hospital Universitário) at the Federal University of Santa Catarina (Universidade Federal de Santa Catarina, UFSC), in Florianópolis, there was no control of cases of poisoning or death linked to pesticides in Santa Catarina. However, we must remember that the CIT/SC had been assigned a gamut of duties wide enough to survey broader data on such cases of poisoning in the state. The second clause of the agreement signed in 1983 between the Oswaldo Cruz Foundation (Fiocruz, 1983, p.1, 2) and the Santa Catarina State Department of Health (Secretaria de Estado da Saúde de Santa Catarina), with the participation of the UFSC, established that the CIT/SC would be:

> focused on systematizing, expanding, and disseminating technical and scientific knowledge in this field, for the purpose of the prevention, control, and treatment of diseases, accidents, risks, and damage of a toxicological nature, whether caused by medication, cosmetics, home cleaning products, or chemical products in general or by crop defensives, industrial pollutants, or any other substances potentially harmful to humans.

Based on statistics from the CIT/SC (Table 1), the only possible explanation for the tremendous growth in cases of poisoning must be the agency's increased scope per se.

Table 1: Number of cases handled by the Santa Catarina Center for Toxicological Information from 1984 to 2002 – Pesticides (human victims)

Year	Cases	Death
1984	22	38 (from 1984 to 1991)
1985	52	
1986	50	
1987	72	
1988	67	
1989	92	
1990	133	
1991	174	
1992	197	13
1993	233	12
1994	325	10
1995	392	9
1996	426	13
1997	428	11
1998	468	26
1999	402	11
2000	475	11
2001	606	11
2002	822	15

Source: Centro de Informações Toxicológicas de Santa Catarina.

The data show that the number of cases was much lower from 1984 to 1991 than from 1991 to 2002, with no apparent motive other than the one mentioned above. For its part, Acaresc conducted a survey on the use of pesticides among 7,597 farmers in 1990. Of all interviewees, 26.5% applied pesticides and had permits to do so; 56% applied the product without wearing any special gear; and 38.4% discarded the packaging in their fields after use (Icepa, 1991, p.14, 15). These data reflect the relative absence of rural extension campaigns or campaigns by agrochemical companies, along with a certain dose of farmer negligence about safety measures. Andef very often failed to provide data even on sales of pesticides. For example, the annual report for 1982, *Síntese anual da agricultura*, issued by the Santa Catarina Institute of Agricultural Planning and Economics (Instituto de Planejamento e Economia Agrícola de Santa Catarina, Icepa), an agency attached to the State Department of Agriculture, stated the following under the item "Defensives:" "The unavailability of statistics on the consumption of defensives makes it impossible to draw any major conclusions about the matter" (p.78).

Agrochemical companies, and the researchers who have ties to them, when faced with this type of data on impacts on farmer health, have argued that these products are very useful because of their potential for increasing yield and, further, that any possible deleterious effects would be practically eliminated if all safety procedures were followed, that is, through correct application and storage, proper disposal of empty packaging, and the observance of valid dates as well as of maximum levels of concentration for each substance.

For example, the agronomist Claud Ivan Goellner (1993), in his book *Utilização dos defensivos agrícolas no Brasil*, sponsored by Andef, presented a series of tables on the impact of pests on agricultural production. Goellner held that "defensives," as he called them, had historically caused an insignificant number of cases of poisoning in Brazil and that all the social pressure to ban them was stirred up by environmentalists, whose analyses lacked scientific rigor.

He stated in his final considerations:

> The whole kerfuffle that environmentalists have raised over defensives is neither clear nor objective, because it aims its sites at the wrong target – the product, rather than its use. Nonetheless, their arguments lack any technical or scientific foundation, since the data presented in this study show that Brazil displays a per-unit-area level of consumption well below that of most developed nations. As to cases of poisoning, reality demonstrates that there has been a substantial increase in the sampling of the exposed population and yet the relative position of defensives in the total volume of poisonings involves non-professionals, with suicide attempts accounting for over one-third of the total (Goellner, 1993, p.97).

As to agricultural losses caused by pests, Goellner (1993) overlooked the fact that the green revolution model itself, which relies on agrochemicals, has increased pest attacks as well as the number of pest species. It is well known that "monocrops are more susceptible to diseases and pests and this has resulted in the increasing use of chemical herbicides and pesticides on farms"[2] (Ponting, 1995, p.399). Consequently, although the consumption of pesticides grew in Brazil, "during the 1958-1976 period, 400 new species of pests appeared in 37 crops. It can be seen that most of these pests appeared during 1963-1976, when the consumption of pesticides was appreciably higher than during 1958-1963" (Ferrari, 1985, p.23).

Goellner (1993) was also careless when he deemed the levels of pesticide poisoning very low in Brazil, because he relied on official statistics provided by Brazil's few centers of toxicological information. According to research by Grando (1998, p.85), who was one of the coordinators of the CIT/SC, toxicological information centers are generally unable to provide information that reflects the true reality of poisonings:

> Because more information is generally available for the urban population, along with ease of access to health services, a greater percentage of reports come from this zone. In rural areas, patients only go to a health service (where reports are filed) when an accident is moderate to serious, and this is confirmed by the number of deaths in this zone of residence (Grando, 1998, Tabela 16, p.96).

Furthermore, it must be borne in mind that most reported cases of poisoning are linked to acute exposure – that is, to immediate poisoning caused by high doses of a chemical agent – while chronic, long-term exposure shows up less often in the statistics: "The low rate of chronic poisoning found in this study does not allow us to infer that this information corresponds to reality" (Grando, 1998, p.87).

In relation to maximum levels of concentration in food (Acceptable Daily Intake) or even to tolerance of certain kinds of pesticides, we must consider the histories of different countries and the extremely varied ways in which each country determines what is harmful, because

risk assessment is ultimately a social construct and does not depend solely on technical reports (Guivant, jan. 1995). In the early 1990s, Clive Ponting (1995, p.591) called attention to the power that pesticide multinationals had to influence regulatory policy in different countries, especially among fragile Third World governments: "Some of the most harmful to all forms of wildlife such as DDT are banned in the industrialized countries but still used in many parts of the Third World – a third of all US pesticide exports are of types banned within the United States."[3]

In terms of safety measures, it can be seen that corporations and governments did very little for farmer health or the environment, even though they were aware that the person applying the pesticide was very often an illiterate or undereducated Third World farmer who could not read a packaging label and did not have enough formal education to use protective gear or even the money to buy it.

From "defensive" to "pesticide:" the 1980s and 1990s and criticisms in Santa Catarina

Our sources, as well as the agronomic literature published since the 1980s, leave it apparent that the agricultural sector reconsidered the meaning of the terms "defensive" and "pesticide" during that decade. The deleterious effects of these agrochemicals on the health of farmers and extension workers were generally becoming clearer, and ever more questions and concerns were raised over the quality of foodstuffs being consumed. Farmers and agricultural technicians in Santa Catarina and the rest of Brazil were accumulating personal experience with the harmful consequences of pesticides, albeit this information was clouded by the lack of statistics. The retired agronomist Elmo Piazza Branco (23 maio 2003), mentioned earlier, recounted one of these cases:

> For example, over there in the municipality of Ouro, next to Capinzal, I talked about the question of being contaminated and accidentally touching your eyes. I was the third person to speak. The folks from CIDASC spoke, from the tobacco industry – I don't recall what company – and last came EPAGRI. When I got through with my talk, it was already dark; the lights were on in the room, it was right around this time in May or June, and an elderly gentleman, who I figured was about sixty-something, raised his hand to speak. In front of his neighbors – and sometimes farmers don't want others to know, because then they'll hassle them – he said he was blind. Why? He started to say why.
>
> He'd picked a lot of beans and used a lot of herbicide. And while he was handling the product, I don't know if it was to open the package, it got in his eyes. He didn't know that he should rush over to running water, to a spigot, and throw a lot of water on to keep the product from affecting his retina. Of course he did go and put a bit of water on, but it wasn't enough.

It was only in the 1980s that the Portuguese term "*agrotóxico*" (pesticide), which carries a heavy negative connotation, inherent to its action, became more common, given that it is a technically appropriate term. Prior to that decade, the more positive or neutral term "*defensivo*" (defensive) had been more prevalent; it is still widely used, especially by the industry. In this context, Adilson Paschoal (1979, cited in Graziano Neto, 1982, p.6) made the following critical observation:

> [We should not] assign the label 'defensive' to something that can also have the effect of harming agriculture. … When we think in terms of nature, these products cannot be viewed as instruments of protection but rather of destruction and disturbance of the balance of the biosphere.

Although there were some who championed alternative agriculture, free of pesticides and chemical fertilizers – like José Lutzemberger, Sebastião Pinheiro, Ana Primavesi, and Adilson Paschoal – most technicians felt that it was only a matter of treating pesticides more seriously; they believed it would be enough to pass and enforce regulations and disseminate information on "proper use." It was against this backdrop of debate among the founders of Brazil's nascent alternative agriculture movements, the technical specialists who still held that pesticides were efficacious, and society at large that laws were enacted at both the federal and state levels (such as federal Law no.7.802, of June 11, 1989) and that organochlorines were banned in 1985. It should be noted that in Brazil it is not just the agrochemical industry but also government agencies and even a portion of the scientific community that have continued to call these agents "defensives," while the usual term in the United States is now "pesticide" and in Europe, "biocide."

Until the 1980s, with the exception of a few administrative rulings and decrees, pesticides in Brazil were controlled by Decree-Law no.24.114, which was passed in 1934, before the invention of organic synthetic products. Brazilian states were the first to pass legislation in the wake of heightened use of these products over the last 50 years. Rio Grande do Sul was at the fore, banning organochlorines and requiring so-called agronomic prescriptions in 1982. The actual results of this effort to control the indiscriminate use of pesticides are questionable.

During this time of intense debate over the impact of these agrochemicals, Santa Catarina – similar to 14 other states – passed a State Pesticide Act (Lei Estadual de Agrotóxicos; Law no.6.452, of November 19, 1984, regulated under Decree no.25.040, of March 20, 1985) (Grando, 1998, p.9, 10). In line with this trend, the Ministry of Agriculture banned the use of organochlorines in Brazil. It was late in the game, considering that a number of countries in the developed world had already banned them in the 1970s. But allegations of unconstitutionality were lodged against these state laws and state autonomy was eventually disregarded.

A pamphlet published in 1985 in Florianópolis, by the Free Ecological Movement (Movimento Ecológico Livre), shows existing concern over a possible setback in state laws:

> The Fight against the Dirty Dozen
>
> Ecologists around the world have joined in the struggle against the 12 most dangerous pesticides, named by the Pesticide Action Network (PAN). On June 5, World Environment Day, a historic moment will begin in the fight against the multinationals of poison.
>
> For a Federal Act to Protect Life
>
> The State Pesticide Acts that have recently been passed run the risk of being nullified. This is because multinationals lobbied the Federal Government and managed to 'undermine' the [Rio Grande do Sul law], which inspired the others. The response from Santa Catarina: at the second Santa Catarina State Meeting of Ecologist and Conservationist NGOs [Encontro Estadual de Entidades Não Governamentais Ecologistas e Conservacionistas de Santa Catarina], held on May 18-19 in Lages, a motion was passed in support of the federal draft bill that grants state autonomy in this matter.

> Parliamentarians, unions, the Church, political parties, and the public at large must show their support for this draft bill, which is now before the National Congress (Movimento..., 3 jun. 1985; emphasis in original).

But the federal bill only went into effect in 1989, with the enactment of Law no.7.802, of 1989, and Decree no.98.816, of 1990. According to Pinheiro and Luz (1998, p.191), chemical companies manipulated it so that only 6% of pesticides were categorized in toxicological classes I and II (the most hazardous), while 94% were assigned to classes III and IV (less hazardous). Prior to the law, 85% of pesticides had belonged to classes I and II.

In the 1980s, government rural extension projects in Santa Catarina and elsewhere around the country did not include agroecology or alternative agriculture systems. No certified organic products were available on the retail market. But criticisms were already being aimed at the use of these biocides, as apparent in the following excerpt from the 1984 Icepa report:

> Disorganization in the production, marketing, and use of pesticides has already wrought tremendous social damage, harming the soil and deteriorating the quality of food and natural sources of water; the direct action of these products has also caused countless deaths among rural and urban workers through intoxication.
>
> We must therefore urgently put in place effective guidance, oversight, and control mechanisms so that society can be provided with the needed instructive information, through development of an educational and consciousness-raising process (Icepa, 1984, p.115).

For the first time in this series of reports, the term "pesticides" appears in the Acaresc annual report of 1984; furthermore, the idea is no longer present that using these modern inputs is a necessary prerequisite to improving the incomes and lives of farmers. Unlike the reports released in the 1960s and 1970s, now pesticides are couched as a necessary evil; moreover, the suggestion is that efforts should be made to use alternative methods for controlling pests when possible.

> The indiscriminate use of pesticides harms people and the environment
>
> During this period, extension work was aimed at:
>
> - Guidance on the use of alternative methods of pest control;
> - A pest management campaign;
> - A course on agronomic prescriptions for pesticide use;
> - Initiatives involving vendors;
> - Guidance on phytosanitary products to be purchased;
> - Guidance for producers and leaders about the cautions, risks, and importance of proper use of phytosanitary products (Acaresc, 1984, p.21).

Periodicals published in the interior of Santa Catarina likewise reflect these emerging concerns over pesticides, as we read in the 1980 article entitled "Os perigos dos defensivos agrícolas" (The hazards of agricultural defensives):

> Lush, ruddy tomatoes, shiny plump eggplants, alluring peppers, and other produce – now poisoned, and with what? With the worst of poisons: mercury. When cast into the waters of a stream, for example, mercury has the violent power to saturate the tiny aquatic creatures that serve as food for fish and thus will saturate the fish with this same

> mercury in double, and these fish, which in turn serve as food for man, will transport this mercurial poison into man's body in an even more intense form; man then carries in his body – if he manages to survive – the poison that he will pass on to his descendent, branding him with unpredictable genetic defects.
>
> It is precisely this killer mercury that is contained in certain crop defensives whose use has been banned for years, and that – now we know – have been manufactured and sold clandestinely to feed the greed of those who care most about 'making money' with attractive, lush, appetizing products that are spread across the counters at open-air markets, supermarkets, and businesses, which at this point are not even to blame for a crime that should be subject to the National Security Act [Lei de Segurança Nacional] (Os perigos..., 30 maio 1980, p.11; emphasis in original).

Although criticisms were growing more common, an analysis of the 1985 and 1995 censuses reveals a clear increase in the dissemination of pesticides among the main crops in Santa Catarina, like rice, black beans, tobacco, manioc, corn, soybeans, apples, and bananas, among others, although there is no way of knowing from these censuses whether there was any increase in the total amount used. We must also remember that organochlorines, which were the most hazardous, had been illegal since 1985, even though their use had not been wholly abandoned in practice. According to these censuses, use of pesticides remained most widespread among tobacco growers. In 1985, about 91% of establishments stated that they employed "defensives," while in 1995 – when the term "pesticides" appeared in the census – this figure jumped to 97% (IBGE, 1985, p.124, 1996, p.163). In terms of the category "number of establishments," of the cited crops, corn showed the greatest increase in reliance on pesticides: in 1985, 8% used these products, whereas one decade later, 50% of them did (IBGE, 1985, p.128).

Based on these IBGE data, it can be argued that although concern was rising about the dangers of pesticides – featured in media reports, including some on television – and even though the most dangerous had been banned, these agrochemicals were still intoxicating and killing at high rates, as demonstrated by CIT/SC data. The Epagri report for 1992 offers a fine example of a critical voice within this context of expanding use (p.17):

> The constant, intensive use of agricultural inputs, led by pesticides, is raising the index of environmental contamination to dangerous levels in our soil and water, to the point of endangering our groundwater.
>
> The degradation of our natural resources is significantly affecting the quality of life for rural families, prompting an exodus of the poorest to the peripheries of large cities and feeding pockets of poverty.

Epagri's first reference to agroecology in its reports came in 1995-1997. Since that time, agroecology has enjoyed modest growth in the state, even though criticisms of pesticides have a considerable history. Agroecology has advanced slowly in Santa Catarina and the rest of the country for technical, economic, and political reasons. We already have enough evidence to show that only holistic scientific studies – that is, research that encompasses diverse fields of knowledge – can adequately and objectively understand the dangers or advantages of pesticides. This means that we must reject the dogmatic premise defended by manufacturers that any synthetically or industrially developed product is, *a priori*, good for

farmers and harmless to consumers. Historical studies like this one help rebuff the dogmatic premise that industries automatically work for the common good and for environmental sustainability. To the contrary, chemical industries have sold and advertised products that were later proven hazardous to human health and the environment. A proper, objective understanding of the dangers of pesticides is actually just the first step in the quest to discover healthier ways to produce food while lowering the impact on the environment and on the health of farmers and consumers. Against today's backdrop of expanded use of transgenic organisms that produce or are associated with pesticides, this study also usefully teaches us that the most hazardous of these agrochemicals, like organochlorines, were once deemed safe.

Final considerations

Irrespective of mounting scientific evidence about situations that endanger human health and the environment, we need studies of other contexts to better understand how technicians' and farmers' experiences and motivations affect the perception and use of pesticides. In conjunction with these experiences and motivations, we found that an ideological context that was highly favorable to these substances in the 1950s, 1960s, and 1970s gave way to a climate of insecurity about pesticides and criticisms of these products in the 1980s, prompting the emergence and defense of what is known as alternative agriculture, organic agriculture, or agroecology. In Brazil, and especially in Santa Catarina, the 1980s were marked not only by an economic crisis and a drastic cutback in rural credit but also by the popularization and broader circulation of environmentalist ideas, as reflected in environmental legislation (and not just related to pesticides) and in the creation of environmental regulatory agencies, like the Ministry of the Environment (Ministério do Meio Ambiente) and centers for toxicological information, whose data we used in this study. But if we view increased concern over pesticides starting in the 1980s as no more than an echo of an ideological environmentalist movement imported from abroad, we lose sight of the blatant experiences with intoxication witnessed by technicians, farmers, and institutional representatives. The relative contribution of these factors has yet to be fully explained, for the danger of pesticides or of any substance is never seen in purely objective or subjective terms. It must further be said that the regulatory system itself facilitates the approval of new pesticides, since most of the scientific community has no access to manufacturers' products and therefore cannot conduct independent analyses prior to approval, leaving little room for contestation. Lastly, public policies facilitate the use of pesticides.

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