Toxicity and apple production in southern Brazil

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Abstract:

The article explores the links between the controversial apprehension of contaminated apples in southern Brazil in 1989 and the reactions of the apple industry to press reports on the use of pesticides in Brazilian orchards. The issue is framed within a broader analysis of the notions of toxicity and 'danger' surrounding the consumption of healthier food and the idea of 'food security,' notions that have begun taking hold in public and private life. It is argued that apple growers' responses to the problem can be better understood through a historical reading of the interactions between the biology of the apple tree, the agroecology of this monoculture, and the structures, actors, and discourses of the human and non-human groups in Brazil's apple-producing region.

Keywords: environmental history, toxicity, apple production, southern Brazil

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By 1989, commercial apple production had firmly established itself in Brazil. The industry's crop of nearly 300,000 metric tons, harvested between February and April, was cause for celebration. Brazilian apple production was concentrated almost wholly in the southern part of the country, particularly in the municipalities of Fraiburgo and São Joaquim, in the state of Santa Catarina, and of Vacaria, in the state of Rio Grande do Sul. Since the mid-1980s, the industry's economic success had pushed growers to expand old orchards and plant new ones. In Fraiburgo at least, the only available space coincided with what remained of a region of tropical rainforest known as *Floresta Ombrófila Mista* (FOM), a type of old-growth forest that makes up an important area of the Atlantic Rainforest biome in midwestern Santa Catarina. When they razed what remained of the FOM in the late 1980s, producers in Fraiburgo would run into trouble with fungi that attacked tree roots and with parasites that were often held responsible for a variety of ecological and economic woes, such as the need to destroy orchards and to hold wages down.

In the 1980s, it cost roughly USD 10,000 per hectare to plant or expand an apple orchard in Brazil. After planting, it would then take three years for the orchard to produce its first crop, and from then on an average annual harvest of 28 metric tons per hectare would be needed to cover all costs involved in maintaining one hectare of orchard per year. Thanks to more frequent reliance on efficacious inputs, crops steadily improved both in size and quality, so that sales covered investments.[1] In light of these profits, the Fraiburgo Fruit Growers Association (Associação dos Fruticultores de Fraiburgo) and the Brazilian Apple Producers Association (Associação Brasileira dos Produtores de Maçã, or ABPM) ended up directing agronomic research funds to the public sector, which had the effect of making agricultural research institutions in Santa Catarina somewhat dependent on the industry. A prime example is the agricultural and livestock research corporation Empresa Catarinense de Pesquisa Agropecuária S.A. (Empasc). Within this 'institutional symbiosis,' apple companies incorporated methods and products for use in improving, reproducing, raising, and marketing apples. Research included ways of combating disease and parasites and of adapting apple cultivars from countries like New Zealand, Japan, or France to the climate of southern Brazil, something that remains an issue today.[2]

Things could not have been better for the Brazilian apple industry in 1989, or at least that was how it looked. From 1979 to 1988, annual apple consumption rose from 1.9kg to 2.8kg per capita. A total of 31,000 metric tons were harvested in 1979, while the 1988-1989 crop rose to 300,000. The three leading production areas – Fraiburgo, Vacaria, and São Joaquim – were home to Brazil's ten largest temperate-climate fruit growers and provided over 20,000 direct jobs, besides indirect ones (BDRE, Mar. 2005, p.45).

However, in July and August of 1989, two months after the harvest and at the height of Brazil's apple marketing season, the ABPM was involved in a national scandal. Government agriculture inspectors apprehended a load of apples between the states of Paraná and São Paulo, allegedly originating from Guarapuava, Paraná, and from Argentina. An analysis by the Paraná Institute of Technology (Instituto de Tecnologia do Paraná, or Tecpar) concluded that the fruit was contaminated by the acaricide dicofol,[3] in violation of Ministry of Agriculture Administrative Ruling 329, signed on September 2, 1985, which

banned the sale, use, and distribution of organochlorinated pesticide products throughout Brazil because of the danger they presented to both the environment and human beings.[4] The news about these acaricide-contaminated apples was such a blow to apple sales in Brazil that in the last week of July 1989 apple growers were already reporting losses (Poglia, July 30, 1989, p.5).

The apprehension of the contaminated apples, the nationwide publicity surrounding the event, the illegal use of pesticides by Brazilian producers, and the ensuing crisis all highlight an important yet historically under-researched connection between the rapid devastation of forests in southern Brazil as a consequence of agricultural modernization, the historicity of the concept of toxicity, the emergence and questioning of the belief in agricultural technology, and the impact of these issues on the preservation of biological diversity. Based on 1980s media reports about the use of dicofol in Brazilian apple orchards, this paper explores these connections, along with the industry's reactions to the press coverage. It also examines the dissuasion strategies and tactics used by producers to 'save' fruit sales nationwide. The issues are framed within a broader analysis of the notion of toxicity and 'danger' that began circulating in the press that decade, contrasting with the notions of consuming healthier foods and of 'food security.'

I argue that we can better understand apple growers' responses to this problem through a historical reading of the interactions between the biology of apple trees, the agroecology of this monoculture, and the structures, actors, and discourses involving human and non-human groups in Brazil's apple-producing region. My analytical focus is on the scientific practices applied to apple trees and the translations inherent to the process of transforming the plant into an object of observation by specialists, a process that engenders a precise, specific technical discourse that agronomic engineers use to refer to a rural environment which has implemented technological advances in apple production.

The dicofol controversy and the 1989 contaminated-apple incident can be followed in a variety of sources, especially the pages of national magazines and newspapers – in other words, in the 'big media.' These texts reflect the concerns of sectors with diverse interests, which created tension between apple producers and consumers and also lent visibility to a variety of social representations, such as 'toxicity' and 'belief in technology.' I also address the event by conducting semi-structured interviews with professionals who were directly involved. Their identities have been kept confidential for reasons of security and to protect their careers. The four reports by agricultural specialists that appear in this article are thus identified as interviews with Agricultural Specialist 1, 2, 3, and 4.

Bien faire et le faire savoir: Brazilian apples, French-Algerian technology

In 1986, Fraiburgo celebrated the First Santa Catarina Apple Festival (Primeira Festa Catarinense da Maçã). On this occasion, the ABPM launched its campaign "The Brazilian apple: the sin that worked out right" (Maçã brasileira: o pecado que deu certo, in Portuguese), an allusion to the myth of the apple as the forbidden fruit that altered Adam and Eve's fate in the Judeo-Christian Eden. The campaign was also a response to a number of U.S. technical reports from the 1960s that claimed the Brazilian climate was not suited

to apples and therefore it would be impossible to produce them on a commercial scale. There were no further Santa Catarina apple festivals, but the symbolic investment in the event by both public and private initiative served to publicize the accomplishments of technological knowledge, which had proven it is indeed feasible to produce temperate-climate fruit where nature, climate, and topography are all unsuited to apple raising – at least in the view of a large share of the foreign reports published about this region some twenty years earlier.

The idea of raising apples in Fraiburgo began to take shape in the late 1950s. Back then, some of the sawmill owners in the region known as Butiá Verde realized that forest reserves were nearing an end. This was the case of the brothers René and Arnoldo Frey, who had been harvesting timber in midwestern Santa Catarina since the 1930s. Concerned with the thinning of forests, the Frey brothers sought alternative investments that would ensure their continued standing as members of the region's economic and social elite. Located in Butiá Verde, the René Frey & Irmão Ltda. sawmill had over 100 employees; an urban center that had grown up around it would become the municipal seat of Fraiburgo in December 1961. The company also had business offices in the cities of Rio de Janeiro and São Paulo, headed by the children of both entrepreneurs. In São Paulo, the Freys sold boxes made from Paraná pine (*Araucaria angustifolia*) to Schenk, a wine producer who was the bridge between the financially strapped sawmill in Santa Catarina and the French-Algerian winegrowers Mahler-Evrard, with the Freys putting both parties in direct contact with each other between 1959 and 1962 (Evrard, Dec. 13, 2003).

The Mahler-Evrards and the Freys had matching interests: the former intended to invest in fruit and wine production in Brazil while the latter wanted to shift their investments out of logging and into agriculture. The French-Algerians wanted to flee Algeria to keep from losing their investments in a country undergoing decolonization. They had expertise in grape production and winemaking – although not in the general raising of temperate-climate fruits – as well as capital; they were also aware of Brazilian business opportunities in the arena of fruit and fruit products. The Freys owned 5,000 hectares in the Fraiburgo region and had an interest in fruit growing; they knew that the soil and climate of these lands were relatively suitable for raising fruit like apples and grapes but had no actual experience in growing them. These corresponding interests would result in a partnership between the Freys and Mahler-Evrards, with the former investing 1,000 hectares to plant temperate fruit and grapes and the latter providing the necessary capital (Evrard, Dec. 13, 2003).

Although they did not raise apples in Algeria, the Mahler-Evrard group had contact with specialists in France. They were also familiar with the *réunions pomologiques* that French nurseryman Georges Delbard had been organizing in Malicorne, France, since 1958, centered on the inauguration of an experimental temperate-fruit orchard in that region, news of which was broadly publicized in the French, U.S., Soviet, and Japanese press (Delbard, 1986, p.404-5). These scientific and business meetings led to the International Pomological Congress of Sion, Switzerland, held in October 1962, and to the Paris Workshop on Fruit, held on September 21, 1964. When Delbard met French-Algerian fruit growers at the Pomological Congress of Algeria in 1952, he was afforded an invaluable opportunity to

expand his research, create his experimental orchard, and study how temperate plants adapt to different climates. In 1960, Delbard himself (1986, p.410) declared that "plantations were the rage in Algeria. Whether *pieds-noirs* or French-born, it would seem necessary to maintain contact [with these fruit growers] in order to conduct studies and synthesize our knowledge of temperate-climate fruit growing, with the goal of undertaking more rational and dynamic actions in the future."

"Friends are worth more than money" goes a French proverb often repeated by Delbard when reporting on his experience in the apple orchards of Santa Catarina. Contacts between the Mahler-Evrard group and the Pépinières Delbard company brought the foundation of the Sociedade Agrícola Fraiburgo S.A. (Safra S.A.) in 1962, lending impetus to the planting of apple trees in Fraiburgo. The *pieds-noirs* Henri Evrard, Roland Mayer, and Roger Biau became French-Algerian immigrants to midwestern Santa Catarina, where they held technical and administrative posts in the new company. Biau was in charge of studies at an experimental orchard located a little over five kilometers from downtown Fraiburgo, which started out with 44 hectares in 1963. In a short time, Safra S.A. was marketing seedlings (apples, pears, peaches, nectarines, and plums); fruit (mainly grapes); and beverages (cognac, wine, and sparkling wine) throughout central-southern Brazil (Burke, 1994, pp.28-9).

The company's next step was to obtain both money and know-how from Delbard himself. At the pomological meeting held in Malicorne on September 1, 1965, Delbard met the *pied-noir* Evrard family in person. The Evrards presented their project to plant apple trees and grapevines in Fraiburgo. Delbard (1986, p.569) recalled the encounter in these words:

> As I was interested in the question of how young orchards behave, and after learning they had a pilot orchard in Brazil that was behaving abnormally, I immediately accepted their invitation to analyze and expand their orchard. I was delighted by the idea of discovering the fruit-growing potential of South America's largest country. ... Appointed advisor to a country in which I had never set foot, my reputation demanded that I immediately set about studying its bio-geography.

While U.S. agronomists affirmed it would be impossible to grow temperate-climate fruit in a tropical country, Delbard, Biau's experimental orchard, and French-Algerian experience with fruit growing in Northern Africa all spoke towards the potential of apple-raising in Brazil. As Delbard (1986, p.569) stated, "southernmost Brazil – the region of Pelotas – lies along the same latitude as Marrakesh. The same causes produce the same effects, and my experience raising temperate fruit species in Northern Africa forms a solid foundation for bringing a new and judicious application of my theories to this great country. What had been my spontaneous thoughts proved themselves precisely true". In 1966, on his first visit to Biau's experimental orchard, Delbard concluded that the apple and pear trees planted there behaved in the same way as those grown in Algeria and that "altitude corrected the effects of latitude" (p.569). The nurseryman began supplying Fraiburgo with new varieties and also suggested new soil management and landscaping techniques. Furthermore, he invested money in the expansion of Safra S.A. through the 1970s, when he decided to leave the company.

Running from 1963 to 1973, this initial phase in the expansion of temperate orchards in Santa Catarina was characterized by the convergence of both private investments – the first of which lasted through 1968 – and public ones as well. One of the legal instruments for the latter was Federal Law no. 5.106, signed on September 2, 1966, which created an income tax deduction for both private individuals and companies, equal to "up to 50% of the amount of the tax on proven investments in forestation or reforestation, which [could] involve forest species, fruit-bearing trees, and large trees, applicable to the tax year" (Brazil, 1966).[5] According to the law's second article:

> 1) forestation or reforestation could only be undertaken by private individuals or companies that held land by just title, title deed, usufruct, or full title, or were tenants or held land in commodatum; 2) whose projects had been approved by the Ministry of Agriculture and included a program to plant at least 10,000 trees per annum; and 3) said forestation or reforestation should lay a foundation for the economic usage or conservation of the soil and water, as judged by the Ministry of Agriculture.

The law defined forestation and reforestation expenses as "those invested directly by the taxpayer or through the hiring of third-party services in drafting detailed design; land preparation; seed purchasing; planting; protecting, monitoring, and managing nurseries and forests; and opening and maintaining service roads" (Brazil, 1966).

Private enterprise made ample use of this law between 1967 and 1975. Because of certain ecological problems, like falling flowers and extremely low productivity until 1975, orchards with a minimum of 10,000 plants (i.e., 10 hectares) would not have been planted had it not been for federal fiscal incentives. Specialists had known since 1969 that steps had to be taken to address the problem of flowers dropping in September and October, which pushed yield down to only two to four metric tons per hectare (Bleicher, May 15, 2002). Yet despite the productivity issue, companies set up large projects in Fraiburgo. One example was Reflorestamento Fraiburgo Ltda. (Reflor Ltda.), founded by René Frey and his oldest son, Willy, in 1967, with the main idea of planting *Pinus elliottis*. The company eventually included *Malus domestica* as a variety to be 'forested,' with the authorization of the Brazilian Institute for Forest Development (Instituto Brasileiro de Desenvolvimento Florestal, or IBDF) (Brandt, 2005, p.12).

During this first phase, the chief instrument of public investment in temperate-climate fruit growing in Fraiburgo was the Temperate Fruit-Growing Program (Programa de Fruticultura de Clima Temperado, or Profit), launched by public 'autarchies' that provided technical assistance, research, and rural extension services in Santa Catarina (Associação de Crédito Rural de Santa Catarina, or Acaresc), with the support of the Empresa Catarinense de Pesquisa Agropecuária (Empasc), as of 1975.[6] The justification was the high cost of fruit importation and the 'new economic alternatives' for farmers (those who could pay for government benefits). The state contracted Safra S.A. as its exclusive supplier of the cultivar seedlings needed to run and expand the program.

With government support through Profit, Acaresc, and Empasc, alongside private investments, this favorable moment in the development of temperate-climate fruit production was also characterized by fervent efforts to spread a belief in technology's ability to "control and correct nature's flaws," to borrow the words of agricultural specialists working in Fraiburgo.

During this phase, there was already an awareness of the numerous environmental limitations of these fruit-growing projects, and some new or different relationships were established between humans and non-humans in apple-growing areas (Klanovicz, 2007, p.230).

Reflor Ltda. started planting orchards on their own lands, on leased property, or under commodatum or joint ownership, using seedlings purchased from Safra S.A. In 1969, another Frey family company was founded to execute fruit-growing projects using the services of Reflor Ltda. and Safra S.A. Renar Agropastoral Ltda. took advantage of fiscal incentives to plant apple trees, using "funds sourced from its parent company's logging activities" (i.e., from René Frey & Irmão Ltda.); that is, it reinvested money from tax deductions in the process of accumulating family capital. It also relied on Profit specialists (Brandt, 2005, p.12).

To summarize, the creation of Safra S.A. and other companies that raised temperate-climate fruit in Fraiburgo from the 1960s through the 1970s benefitted from investment and re-investment incentive strategies aimed at extensive orchards that made intensive use of machinery and inputs. From a macroeconomic perspective, these solutions seemed to point the activity in the right direction, since the growth in Brazil's apple output began keeping pace with imports of the fruit between 1960 and 1969, as shown in Tables 1 and 2.

Table 1: Brazilian apple imports in metric tons (1960-1969)

Country of origin	Metric tons per annum									
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Argentina	36.424	43.232	50.153	64.194	38.477	59.579	54.629	85.507	108.222	105.074
Canada	-	-	-	-	-	-	799	599	-	-
Chile	-	-	-	-	-	-	-	-	394	550
U.S	-	-	-	-	-	-	939	1.832	131	35
France	-	-	-	-	-	-	-	38	4.947	7.978
Greece	-	-	-	-	-	4	44	22	178	241
Uruguay	-	-	-	-	-	-	-	236	-	-

Source: Ushirozawa, 1979, p.88.

Table 2: Brazilian apple production (1960-1969)

Year	Apples (metric tons)
1960	9.513
1961	9.981
1962	11.300
1963	11.620
1964	10.578
1965	11.987
1966	11.779
1967	12.392
1968	13.035
1969	14.432

Source: Escritório Técnico de Agricultura/Ministério da Agricultura, cited in Sezerino, 1982. p.85.

The country was still importing apples in 1969, but the continued receipt of incentives depended on future self-sufficiency, which would be up to southern Brazil. In entrepreneurial terms, while the country was not yet exporting the fruit, it was at least starting to produce it for the domestic market using modern technology. Moreover, technological knowledge could be relied on to reverse any potential ecological issues, since Fraiburgo was a "vast experimental field," in the words of Willy Frey (1973).

Carlos Alberto de Abreu (1973), administrative manager at Safra S.A. in 1973, said that the road to raising temperate fruit like apples, pears, nectarines, and plums in Brazil was a hard one, marked by successive importations of genetic material from Europe and by adaptation and treatment. Safra S.A. was then leading the Brazilian market, with 1,013 hectares of temperate fruit trees, including grapevines (Merlot, Cabernet, Trebiano, and Marzenino); plum trees (Santa Rosa and Santa Rita); and apple trees (Golden Spur, Red Spur, Golden Delicious, Wellspur, Melrose, Blackjohn, Royal Red, and Willie Sharp). In 1973, Safra S.A.'s sales reached 414,718 seedlings, which comprised 395,154 apple, 12,021 nectarine, 4,359 plum, 794 peach, and 247 pear trees, along with 1,878 rose bushes and 265 other fruit trees. Abreu closed his report by stating that the company's fruit sales were growing steadily each year, keeping step with increased fruit consumption in Brazil.

Annual apple consumption climbed from 0.65kg per capita in 1960 to 1.45kg in 1970 (Klanovicz, 2007). This increase was certainly related to the expansion of apple orchards in Fraiburgo. A number of companies in Brazil began contacting Reflor Ltda. about setting up orchards and reforestation projects in Fraiburgo, taking advantage of federal fiscal incentives, with the obvious goal of paying fewer taxes. The companies used land owned by Reflor Ltda. under commodatum or joint ownership. A 1973 company report presents data on ten reforestation projects involving *Pinus taeda*, *Pinus elliottis*, and *Araucaria angustifolia* between 1967 and 1970, encompassing a total of 2,716.34 hectares and 3,618,750 seedlings. In taking advantage of apple trees as a legally valid forest species for the purpose of forestation pursuant to Law 5.106/66 of 1966, Reflor Ltda. rendered assistance to 13 fruit-growing projects between 1967 and 1973, totaling 592.5 hectares and 542,200 seedlings. In 1973, the company planned the planting of 141 hectares and 112,800 seedlings for the following year, plus 300 hectares with 240,000 apple trees for 1975, the latter as part of the Fazenda Castelo Branco III project.

The 500-plus hectares planted by Reflor Ltda. alone through 1974 were the concrete manifestation of a business strategy supported by public incentive policies for forest projects, which also entailed investment in research and in the training of specialized labor. According to agronomist Jorge Bleicher (May 15, 2002), there was a shortage of professionals in the fruit-growing sector, and planting 500 hectares in a few short years also brought with it deforestation, the need to open roads for machinery, kilometric drainage works, and the use of enormous amounts of limestone to correct soil pH. Considering that in the 1990s Portobello Maçãs S.A. used 25 to 35 metric tons of limestone per hectare to correct soil acidity and that orchards averaged around 100 hectares, we can infer that a 500-hectare area like Reflor Ltda.'s would require 15,000 metric tons of lime, with residue not only remaining on the surface but also reaching rivers and water tables.

During the first phase of orchard expansion, from 1963 to 1975, 'correcting' soil pH was not the only problem demanding investments and technical intervention in the environment. There were not enough insects capable of pollinating the plants, owing to the drastic reduction of native woods and the application of ever greater amounts of acaricides, fungicides, and other pesticides, keeping pace with the expansion of planted area. With each new hectare planted, problems or natural limitations would arise to test apple growers' technological expertise.

Solving the problem of falling flowers was an important step, possible solely thanks to research by Israeli specialist Amnon Erez. He observed that in Fraiburgo the number of cold hours fell short of the 700-hour minimum, thereby delaying budding (Erez, Feb. 12, 2007). Erez's suggested solution was the intensive use of bees to help with pollination, along with the use of chemical products to bring plants out of dormancy. "It was crazy then! A new phase of orchard expansion started in 1975, and at that time companies started clearing forests to open space for new orchards. Apple trees went from producing two to four metric tons per hectare to 28 or 30 tons. Guaranteed profit grounded on technology," stated Acaresc agronomist Jorge Bleicher (May 15, 2002).

Fueled by the pace of orchard expansion, Fraiburgo was the municipality that caused the greatest devastation of Santa Catarina's remaining native forests. Over 1,000 hectares of forest were toppled per year from 1980 to 1983, according to data cited by economist Carlos Eduardo Frickmann Young (2002). This devastation left insects further isolated and reduced local biodiversity. Although the use of European bees to help pollinate fruit-bearing plants was a technological success that guaranteed increased productivity and enhanced fruit quality while also strengthening the producers' financial situation, it caused problems for some humans. This was true of Agricultural Specialist 1 (Jan. 12, 2005), who had a bee allergy and suffered greatly whenever he was around a hive, since the bees were somewhat tame but not completely. Although there are no data proving that the number, variety, and presence of some bird and plant species fell in Fraiburgo, in several instances interviewees made this assertion, based on their observations (Frey, 1989, p.34).

The 1970s and 1980s brought the firm establishment of the apple industry in Fraiburgo, based on mechanized, rational fruit-growing practices that drew labor power and investments from different sectors and also propelled research. From a population of little more than 2,000 in 1967, the municipality had grown to over 15,000 by 1985. The apple drove the local economy. The intensive use of applied technology ensured orchard productivity. Automated irrigation methods fought drought, hail detection systems applied military strategies to fighting hailstorms (radar and cloud-seeding rockets were first imported from France and Switzerland and later from the Soviet Union), controlled burns countered frost during spring flowering in September, and radical phytosanitary treatment combated fungi and diseases. Methods were also used to reroute waterways and apply highly efficient logistics during harvesting. All of this lent support to the 1983 discourses that touted technical success in "correcting nature's flaws" in the region, as stated in an article published by *Veja* magazine (Domesticar a natureza, Mar. 25, 1983, p.89).

In the 1980s, Brazilian apple production was affected by the eradication of varieties like the Golden Delicious or Royal Red, which were replaced by red varieties like the Gala (a

cross between Kidd's Orange and Golden Delicious that originated in New Zealand) and the Fuji (a Japanese cross between Ralls Janet and Delicious). Safra S.A. introduced the Gala to Fraiburgo while the Fuji was imported from Japan by specialists working for Acaresc in São Joaquim, SC (Epagri, 2002, p.90). Still, in technical and behavioral terms, these two varieties were relatively new for Santa Catarina specialists. Depending upon the rootstock, the adult plant might be more or less likely to be the target of diseases or pests.

Some specialists believed that the 1980s process of expanding Fraiburgo's orchards, which was marked by the progressive devastation of areas of secondary forest, could jeopardize future production because it would, for example, usher in new ecological relations between the apple tree and fungi (Bleicher, May 15, 2002). In a historical context opposed to a belief in technology's successful ability to correct the environment, it was not only fungi that started playing an important role but also mites, bugs, and bad weather. The language used by specialists and producers to describe the environment for planting and the future production of new orchards in the 1980s grew steadily more belligerent in tone. One after another, expressions like "correcting nature's flaws," "powerful machinery that corrects the environment," "rockets to combat bad weather," and "rationalization of the landscape" became part of the everyday language of specialists, even in their planner and calendar notes (Simonetti, 1973, p.13-26).

This bellicose terminology was applied to non-humans, like red spider mites (*Tetranychus ludeni* Zacher), especially in the case of large-scale plantings in the latter half of the 1980s. Specialists and local producers were always worried about what they saw as the 'mite danger,' which had to be immediately and energetically combated using pesticides like dicofol.

As orchards expanded in size and number, the dynamics of work changed, especially among producers who had little time but much planted area to protect from the spread of diseases like scab or from parasites like the red spider mite, and the result was skyrocketing use of pesticides in the 1980s. With a heated market in mind, the logic that combined intensive planting and high productivity worked in the producer's favor so long as there were no ecological upsets.

The 1980s was a decade in which producers lived in an unstable balance with problems like the European red spider mite, fruit fly, apple scab, white bitter rot and collar rot. Later on, problems arose with Brazilian leafrollers, Gala leaf spot, and white rot, while longstanding pests like the oriental fruit moth became problematic once again as well. The history of apple-growing in Fraiburgo thus saw relations between people and apple trees come to involve characters like white root rot (*Rosellinia necatrix* (Harting) Berlese), collar rot (*Phytophthora cactorum* (Lebert et Cohn) Schroeter), honey mushrooms (*Armillariella mellea* (Fries) Karsten), crown-gall disease (*Agrobacterium tumefaciens* (E.F. Smith et Townsend)), n*ectria canker* (*Nectria galligena*), scab (*Venturia inaequalis* (Cooke) Winter), and glomerella (*Glomerella cingulata* (Stoneman) Spaudling et Schrenk). In the case of pests, people started noting the presence of the codling moth (*Carpocapsa pomonella* (Linnaeus)), a variety of mites, woolly apple aphids (*Eriosoma lanigerum* (Hausmann)), and San Jose scale (*Quadraspidiotus perniciosus* (Comstock)) (Epagri, 2002).

The apprehension of contaminated apples between Paraná and São Paulo was one of the events in the history of temperate-climate fruit production in Brazil that placed within

the public arena the collectivity of humans and non-humans engaged in the debate about 'toxicity' as a discourse. It also evinced two things: the limit of technical interventions and the environmental constraints on the development of fruit-production projects. The red spider mite became one of the producers' biggest enemies in the 1980s, since the species easily built up resistance to acaricides, making chemical pest control a challenge.

Putting poison on our tables

On July 26, 1989, in the midst of the controversy over the dicofol-contaminated apples, the magazine *Exame Vip* published a cover article under the responsibility of the editors, entitled "O veneno vai à mesa" (Putting poison on our tables), which talked about the consumption of the contaminated apples (O veneno..., July 26, 1989). Until that point, few articles had ever addressed the risks of toxicity in fruit. The story placed the blame for the fact that Brazilians were eating toxic fruit squarely on apple producers. Without specifically mentioning this fruit, the magazine made the accusation that, "mixed into apparently healthy diets, some 2,500 chemical additives and hundreds of pesticides and hazardous fungi jeopardize our chances of eating well." The article did admit that a person would have to eat a "respectable amount of carcinogen-contaminated apples for ten years before she would run a serious risk of contracting liver cancer or developing any other kind of tumor." However, it warned that "when practically everything a person eats might be contaminated by one of the 2,500 known chemical food additives or hundreds of pesticides, fungi, and bacteria, this percentage rises sharply."

According to the discourse of this disheartening article, the contamination of these apples was a consequence of mistakes in the amount of pesticides used, which accounted for the apprehension of a 300-metric-ton load of dicofol-contaminated apples: "The apples were coming from Paraná and Argentina and were intercepted – a good sign, without a doubt. Yet many shipments were and are still being consumed since the harvest began in February." According to the magazine, apple growers from Paraná and Argentineans were to blame for the contamination. On the other hand, officials in Paraná let themselves off the hook by attributing the problem to the purchase of toxic fruit from Santa Catarina – it was standard practice among apple producers in Guarapuava, Paraná, to guarantee their slice of the market by reinforcing their stock with fruit from other regions. At the same time, apple growers in this region of Paraná were part of the ABPM, meaning they were all, so to speak, "in the same boat," facing the same commercial and technical crisis as other producers.

Likewise on July 26, Brazil's top business news daily, the São Paulo paper *Gazeta Mercantil*, ran the headline "Agrotóxicos: Santa Catarina produziu maçã contaminada" (Pesticides: Santa Catarina produced contaminated apples) (Agrotóxicos…, July 26, 1989). Armed with information on carcinogenic residues found on apple samples analyzed by Tecpar and with the fact that Paraná's health officials were holding Santa Catarina producers accountable, the news story portrayed the crisis in temperate-fruit production, including some complaints by Brazil's longtime apple suppliers in Argentina (Autoridades argentinas..., Aug. 1, 1989).

That week in Lages, Santa Catarina, apple growers handed free fruit out to people while they also blocked traffic on highway BR-116 in an effort to protest declining apple sales (Consumo de maçãs..., Aug. 2, 1989). Fax messages and clippings on press coverage of the crisis by sources in Rio de Janeiro and São Paulo circulated among producers in Fraiburgo and at the ABPM headquarters.[7]

The Brazilian government was under pressure from national producers and was also concerned about the marketing of contaminated fruit, so in the final week of July 1989, it called an embargo on Argentinean apples, prompting an immediate reaction from Brazil's Latin American neighbor. On Aug. 1, 1989, Argentina demanded the immediate normalization of apple sales to Brazil, arguing that "apple exporters in Argentina comply rigorously with the sanitary regulations set out by the Brazilian Ministry of Health, and authorities are concerned about a drop in Brazilian imports, which could have a negative impact on the trade balance between the two countries" (Autoridades argentinas..., Aug. 1, 1989, p.9).

As part of a counter-attack by the ABPM, on July 30, the economic section of Santa Catarina's chief newspaper, *Diário Catarinense*, devoted an entire page to the subject, under the headline "Santa Catarina produz 58,47% da maçã nacional" (Santa Catarina produces 58.47% of Brazilian apples). According to the journalist Tarcísio Poglia (July 30, 1989, p.5), the increased output and productivity of Brazilian orchards was directly proportionate to population growth, but higher apple consumption and production had been hurt by the dicofol controversy. The journalist explained that dicofol was used "on apple trees in a number of countries, like the United States, West Germany, France, Italy, Sweden, and Argentina. It had been applied in Brazilian orchards up until 1985, when it was banned. Yet use of this pesticide is still legal in Brazil for oranges and cotton." He continued by citing the words of the ABPM chairman, agronomic engineer Luiz Borges Junior, who argued that there was a ban on the use of dicofol on apple trees "but this was an isolated incident and the level of detected contamination was twenty times below that permitted by the World Health Organization."

For the ABPM, the application of dicofol was an isolated incident. This contradicts the information provided by agronomic engineer Paulo Baggio, from Acaresc. According to him, Brazil exported apples to Europe in 1989 and dicofol was accepted normally. He argued that the product would have been sent back if there had been any trouble. He also pointed out that "before being banned in Brazil, dicofol had been used for over ten years on thirty-one crops, including tomatoes, beans, and potatoes, and no problems with toxicity had been found" (Poglia, July 30, 1989, p.5). In the same article in *Diário Catarinense*, Luiz Borges Junior underscored the fact that the dicofol controversy was wrapped up in something of a conspiracy theory: "the news that apples from Guarapuava were contaminated made national headlines because some sectors are interested in jeopardizing Brazilian production. With Brazilian apple output … gaining a larger slice of the domestic market over the past ten years, importers have had to reduce their market presence."

Within the media, the next step in the controversy was ABPM's counter-offensive against claims that Brazilian apples had been contaminated, with papers and magazines around the country accompanying the story. "We need to clear up this misunderstanding about

contaminated apples," the ABPM's spokesperson declared to *Gazeta Mercantil*, in an obvious reference to the article published by that same paper on July 26. The report stated that "dicofol was used on some crops in Paraná but at much lower levels than that accepted in any developed country. Part of [these apples] will be lost if the market situation doesn't turn around by September" (Consumo de maçãs..., Aug. 2, 1989, p.23).

The next day, Renar Maças S.A., of Fraiburgo made headlines in *Gazeta do Povo*, a paper in Curitiba, Paraná: "Produtor catarinense afirma: 'Maças Renar não têm dicofol'" (Santa Catarina producer states: "Renar apples contain no dicofol"):

> Brazilian apples, previously considered a top-quality fruit, have suddenly become the focus of news stories on the use of dicofol and have been branded with the stigma of forbidden fruit. This report on the recent events turned to a leading authority on the subject. Willy Frey, pioneer in raising this prized fruit in Brazil, is the managing director of Renar, the largest apple producer in Santa Catarina. ... The company saw to it that their dicofol was buried using utmost care and precautions, and since then its use has been rigorously banned on the many square kilometers of land planted by Renar (Produtor catarinense..., Aug. 3, 1989, p.11).

For its part, the ABPM published a full-page paid advertisement in the magazine *Veja* and the newspapers *Diário Catarinense* and *O Globo* reaffirming the quality of Brazilian apples and of Fraiburgo orchards. The ad published in *Veja* featured images, and its lead was an ironic challenge to Brazilian apple competitors: "A maçã brasileira dá uma banana para a concorrência" (Brazilian apples give competitors a raspberry) (A maçã brasileira..., Aug. 9, 1989). The following text appeared underneath a red apple in the middle of the page, surrounded by a cloud-seeding rocket, radar antenna, and stylized apple tree, like those found in children's books:

> In Brazil, the apple is born under a lucky star. Right from the start, it is pampered and coddled. The most select species are scientifically developed, the soil is specially prepared, radar keeps a close eye on weather conditions, and clouds can be seeded to protect from hail. All this TLC might seem a bit much. But we're not worried about babying our apples. When they grow up, they're no ingrates. They pay back all this care in the form of a beautiful, healthy, vitamin-packed fruit. Once they're big, they travel the world, making a name for Brazilian agriculture thanks to their quality. Brazilian apples aren't afraid of competing with anyone. Because they know just how tasty they are. ABPM (p.68).

Another ABPM advertisement printed in the magazine that same week targeted the 'detractors' of Brazilian apple production. This time the text went into greater detail on production and interwove the belief in the role of production technology with the story of Eden, symbolized by a serpent in the middle of the page, with Adam and Eve on either side. The apple was linked to legends, biases, and ignorance:

> There is a myth that Brazilian apples are of third-world quality. This idea is simply sinful. Brazilian apples have matured. They can be compared to any other fruit in the world without the risk of turning red. Maybe you aren't aware of it, but there is an organization called ABPM that guarantees the quality of our fruit. The ABPM fosters and helps encourage the use of the most advanced techniques in developing and caring for Brazilian apples. Today's Brazilian Gala is tastier than the New Zealand original. Our Golden is juicier than

> its U.S. relative. Our Fuji is more delectable than its Japanese ancestor. You might not believe this. But the Americans and Europeans do. And they eat our apples with great pleasure. Of course, Brazilian apples have had to religiously follow the strictest technical and legal requirements to get where they are. They have complied with these rules, proven their virtues, and conquered the kingdom of first-world consumers. The ABPM has played its role in this story. We can't promise paradise. But we do promise a pure and honest product. Only a serpent would tell you anything different (A maçã brasileira..., Aug. 9, 1989, p.68).

Through this nationwide publicity campaign, the ABPM worked to deny that any problems had resulted from the use of chemical products banned in Brazil. However, agricultural specialists and agronomic engineers, especially in Fraiburgo, claimed that dicofol was still being used. Agricultural Specialist 2 recalls that the product "was used a lot. It was hazardous but good, because it was efficient. We used it all the time. I know a lot of people simply didn't know it was banned and some companies had a lot of it in Santa Catarina, Rio Grande do Sul, and Paraná. But we knew there was a limit to how much we could use." Agricultural Specialist 3 also said he used a lot of dicofol to treat mites on apple trees in Fraiburgo. On days when the treatment was applied, "we were very careful and kept explaining to the tractor drivers that they had to use their safety gear: mask, gloves, coveralls. Of course they couldn't even drive tractor without their coveralls and boots, but on those days they had to wear even more; they had to put on a mask and gloves. I kept on top of everyone and wouldn't let anyone work without this gear."

While the controversy was in the public eye, specialists in Fraiburgo say they received orders to open huge, isolated holes far away from the orchards, for the purpose of burying any containers of the product that still happened to be in stock. According to Agricultural Specialist 2, "I was in charge of taking a tractor with a bin[8] and going over to the chemical deposit and getting all the containers with dicofol. Then two workers would dig a hole with a backhoe, far away from the orchard and the rivers but near the woods. I remember that for two days I made a number of runs over there with the tractor and bin to carry loads. The order was then to bury everything real well."

Pondering toxicity: Fraiburgo as a 'toxi-city'

If we place Frey's 1989 statement that the expansion of orchards had a broad impact on biodiversity alongside Rachel Carson's warning cry about pesticide use, with its catastrophic results in the imaginary U.S. city depicted in her 1962 book *Silent Spring* (Carson, 1998), we are led to reflect upon some characteristics of the debate over the contamination of Brazilian apples in 1989. This exercise allows us to shift the issue of pesticide use out of the narrow realm of academia and into the public arena. In other words, science lost its monopoly hold over knowledge of chemical products when they entered the public debate about the deadliness of modern agricultural projects. So drawing a link between Frey and Carson helps us understand our environmental imaginary about our endangered world, as proposed by Lawrence Buell (2003). For this author, the modernization of agriculture, which has been characterized by the inclusion of outside

inputs – chiefly herbicides and pesticides – has helped democratize the debate on the role of agrochemical products in agriculture, removing it from the strict confines of academia and government agencies. This is how the metaphor of 'toxi-city' fits well in describing a portion of the history of human intervention in Fraiburgo's natural world, since it was the planting of temperate-climate fruits that made the annual application of pesticides part of the daily lives of workers and urban residents. The region under study was transformed into a toxic place, a land of agrochemicals.

From a technical standpoint, agrochemicals are classified as pesticides (for the control of insects in general), fungicides (for the control of fungi), and herbicides (for the control of invasive plants or weeds). They can be sub-classified by purpose, form of action, or origin. In terms of purpose, agrochemicals may be ovicides (which attack insect eggs), larvicides (which attack larvae), acaricides (specific to mites), or they can be meant to attack ants. Their action can be: (a) through ingestion, which means the pest must eat a plant sprayed with the product; (b) microbial, in other words, the product contains microorganisms that will attack the pest or the agent that causes the disease; (c) through contact, that is, the product must simply touch the pest's body (Agricultural Specialist 1, 2005; Paho/WHO, 1997).

In order to reinforce the safe use of these products in Brazil, the federal government published Decree no. 3.964 on December 21, 2000 – long after the products had been introduced and their use become commonplace in the country – forcing industries to register the raw materials, additives, and inert ingredients used in making agrochemicals (Brazil, 2000). This same legal instrument acted as a derivation of the measures taken by the Ministry of Agriculture in 1985, when it banned the sale and use of the most toxic pesticides, known around the world as the "dirty dozen." Agricultural Specialist 4 states that during the 1970s, a great deal of mercury-based fungicide was used in Fraiburgo. It was only after 1985 that the frequent use of these products came under control. However, this does not mean that specialists and agronomists were unaware of the associated problems and risks; it was simply that techniques were more ostensive and orchard intervention more direct back then.

The publicity surrounding the case of the contaminated apples and the industry's reaction to the decline in Brazilian fruit sales at a time when this sector was becoming firmly established reinforced the notion that pesticides are hazardous. Particularly as of the 1960s, the notion of toxicity was an ongoing part of daily modern life, on the list of 'modern anxieties' about nature. The very term 'toxic' acquired new connotations and forms; not only were a variety of meanings attached to it but a strong emotional impact as well, according to Jake Sigg (1999). This can be traced to certain elements inherent to the discourse on toxicity. The first is that the term 'toxic' only has meaning as it relates to other things; this is the case, for instance, with oxygen, which is toxic for some organisms and vital to others. Likewise, products like salt, chlorine, or aspirin can be toxic to humans in high doses but beneficial when the appropriate amount is taken.

At the same time, pesticide use has a political aspect, likewise closely tied to the emotional element – that is, it has implications regarding the safety of humans, microorganisms, the soil, wildlife, and ecosystems. In this regard, other artificial agents began 'causing trouble'

for human beings in Fraiburgo's apple orchards in the 1980s, as a result of the very technology people were using in response to competition between these plants and other non-human species. Examples include copper sulfate, virgin lime, benomyl, and captafol, as part of a Phytosanitary Treatment Schedule (Agricultural Specialist 1, 2005).

In the latter half of the 1980s, phytosanitary treatments and the use of pesticides on fruit moved from the world of production into the public limelight. The preference for consuming the finest, cleanest fruit – a tendency dating to the 1960s – shifted somewhat as a result of modern anxieties, like fear about pesticides, which enhanced appreciation for apples produced in southern Brazil.

Understanding landscapes requires us to locate our environmental imagination within a specific context, with specific time-space relations. The modern world of apple production in Fraiburgo displays the anxieties of modernity, characterized by intersections between technology and a 'suspicious trust' in progress, which often slides into total disbelief, especially at moments when a set of ideas about a productive system or economic activity finds itself in crisis. In other words, on a journey through cultural constructs on the one hand and economic constructs on the other, the landscape and the non-humans making up the collectivity examined in this article wield influence over both spheres.

If disease and pests have an ecological connection to apple trees (an example of relationships between non-humans within an environmental history), the historicity of these relations comprises human beings who are invisible yet indispensible to the process of the historical construction of ecological relations as a whole. Expressions like natural tragedy, flaws in nature, and the need to fix nature's problems reflect the potential meaning of the term 'landscape.' At the close of the 1980s, apple production in Brazil was establishing itself as an efficient, modern, and profitable economic sector, with the power to enhance the development of regions like Fraiburgo. This process fetishized the apple and forced the municipality to be structured upon an unbreakable bond between this product and the political, cultural, and economic directions inherent to it. But during the process of constructing the local histories of the apple, these narratives were systematically haunted by a ghost: although the apple usually is framed as the 'salvation' of the local economy, it is not characterized as a robust, outstanding fruit but rather as a docile, fragile one that must be treated, domesticated, and controlled.

NOTES

[1] An average output of 28 metric tons per hectare covered all investments and even left a profit. Fraiburgo produced an average of 35 metric tons per hectare over an area of more than 6,000 hectares, according to the Brazilian Apple Producers Association (http://www.abpm.org.br; accessed on May 15, 2006).

[2] A large part of commercial apple varieties need at least 700 hours of cold per year in order to produce a healthy-colored fruit of the weight and size demanded by the market. In technical terms, 'cold' is defined as 700 hours of temperatures equal to or lower than 7°C (Epagri, 2002).

[3] Dicofol ($C_{14}H_9Cl_5O$) is produced through the hydrolysis of dichlorodiphenyltrichloroethane (DDT) and is chemically known as 2,2,2-trichloro-1,1-bis(4-chlorophenyl)ethanol).

[4] Article 1 of this Administrative Ruling reads as follows: "The marketing, use, and distribution of organochlorinated pesticide products for agriculture and livestock-raising purposes is banned throughout the national territory, including therein, among others: aldrin, camphene, *chlorate* (toxaphene), DDT,

dodecachloride, endrin, heptachlor, lindane, endosulfate; *methoxychlor*, monochloro acetic acid, dicofol and *chlorobenzilate* (Brazil, 1985).

[5] All quotations from works and documents in Portuguese and French have been freely translated into English.

[6] Prior to the existence of Profit, the state government had launched the Executive Fruit-Growing Program for Santa Catarina (Programa Executivo Frutícola para Santa Catarina, or PEDF), between 1965 and 1967. The program encompassed fruit production in general, not just apples and temperate-climate fruit; it called for the planting of one thousand hectares of apple trees in the Rio do Peixe Valley, which included Fraiburgo, and of 2,500 hectares of peach and nectarine trees in midwestern Santa Catarina. Funds for the program came from state economic plans (Plamegs) and were supplemented with resources from the Superintendence for the Development of the South (Superintendência para o Desenvolvimento do Sul, or Sudesul) and from U.S. agencies like USAID.

[7] Located in the district of Rio das Pedras, in Videira, Santa Catarina, the holdings of the VF Group's Museu Empresarial (Business Museum) include four files containing some 200 pages of reports and clippings on the mid-1989 crisis over contaminated apples.

[8] Apples are harvested in 300-kilo-capacity wooden bins.

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