

**Supplementary material for:**

Müller, Giane Carla Kopper; Serbenti, Maria Pilar; Alves, Thiago Caique; Tavaresi, Lorena Benathar Ballod. Impacts of tobacco cultivation on human health and water pollution in Chapadão do Lageado, Santa Catarina, Brazil. *Desenvolvimento e Meio Ambiente*, 66, p. 1–18, 2025. doi: <http://dx.doi.org/10.5380/dma.v66i.95456>

**Supplemental materials**

This study was approved by the Ethics Committee for Research with Human Beings, of the Regional University of Blumenau, with the commitment to protect the privacy of the actors and the confidentiality of the data. In addition, the norms of the National Health Council (Resolution nº 466/2012)<sup>13</sup> were complied with, informed in writing, all tobacco growers agreed to participate in the research and signed the Free and Informed Consent Form.

*Profile of the Chapadão do Lageado tobacco farmers*

The survey conducted by community health officials revealed that there are 258 tobacco producers (N) in ChL. This information was used to determine the minimum sample size:

$N$  = size (number of elements) of the population of tobacco producers.

$n$  = size (number of elements) of the sample.

$N_0$  = A first approximation of the sample size.

$E$  = Tolerable sampling error.

An initial sample size calculation was performed using expression 01, which was assigned only the sampling error (Eo):

$$n_o = \frac{1}{E_o^2} \quad (01)$$

In a second calculation, the value of Eo was attributed to the population and is 7 %, which is considered common in surveys and is 95% reliable. Therefore, the population size (N known) was taken into account and the expression 02 was used:

$$n = \frac{N \cdot n_o}{N + n_o} \quad (02)$$

### *Chemical analysis*

In the chromatographic separation, a poroshell EC C18 column was used as stationary phase (2.1 mm x 100 mm, 2.7  $\mu$ m) and 25% HPLC grade acetonitrile with 75% distilled water content 0.1 % formic acid as mobile phase. The applied flow rate was 0.45 mL min<sup>-1</sup> at 40°C and with an injection volume of 4  $\mu$ L. A 11-point calibration curve was constructed, performed in triplicate at concentrations of 2.0; 1.0; 0.7; 0.5; 0.3; 0.1; 0.07; 0.05; 0.01; 0.007 and 0.005  $\mu$ g L<sup>-1</sup>. For analytic curves, first-order and second-order mathematical models were used.

## **Results and discussion**

### *Activities related to labor in tobacco cultivation*

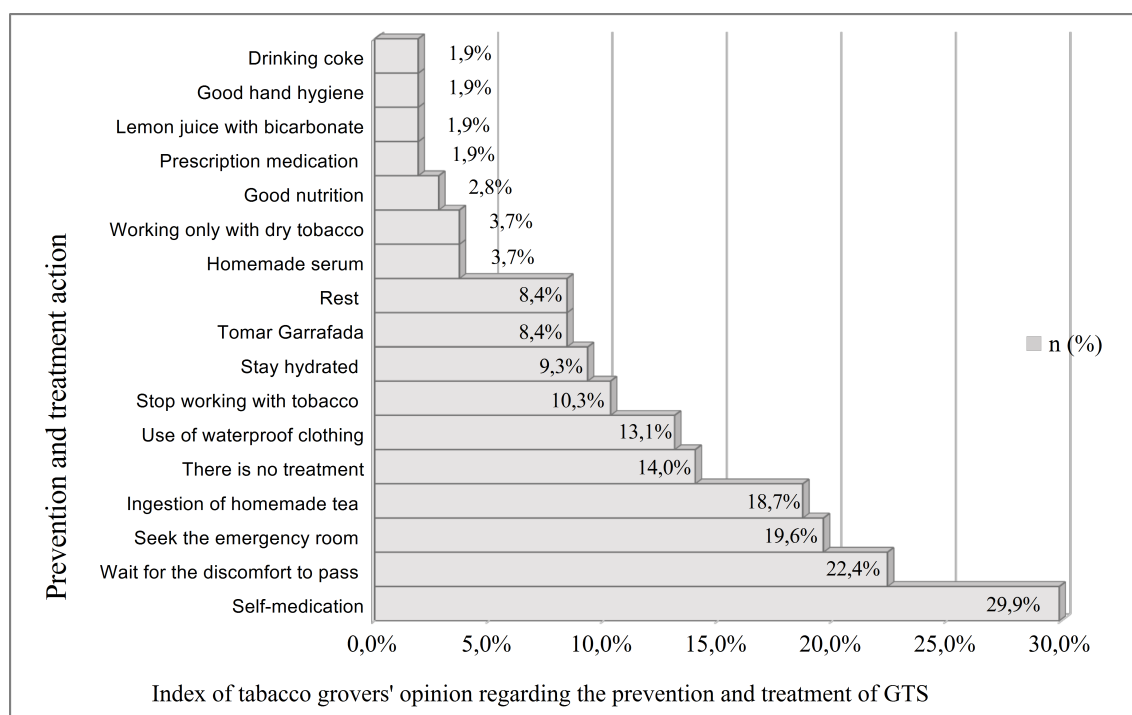


FIGURE S1 – Tobacco growers' opinion regarding the prevention and treatment of GTS.

SOURCE: authors.

TABLE S1 – Tobacco growers reported health problems due to the handling or application of pesticides.

Characteristic	n (107)	%
Have you ever felt ill while handling or applying agrochemicals?		
Yes	21	19.6
No	86	80.4
When you became ill, did you seek medical help?		
Yes	17	81
No	4	19
After the preparation or application of agrochemicals, if you felt ill, what did you feel?		
Vomiting	11	52.4
Dizziness	8	38.1
Headache	6	28.6
Body aches	4	19
Nausea	4	19
Weakness	2	9.5
Diarrhea	2	9.5
Fever	2	9.5
Other	11	52.4

SOURCE: authors.

*Pesticides residues in river and groundwater samples*

CHART S1 – Characteristics of the most used pesticides in tobacco cultivation in Chapadão do Lageado (SC).

Commercial name	Active ingredients	Chemical group	Limit quantification (LQ) (mg L <sup>-1</sup> )	Limit Detection (LD) (mg L <sup>-1</sup> )
Gamit 360 CS	Clomazone	Isoxazolidinones	0.0000250	0.0000031
Primeplus BR	Flumetraline	Dinitroanilines	0.0000250	0.0000070
Boral 500 SC	Sulfentrazone	Triazoles	0.0000250	0.0000028
Confidor Supra	Imidacloprid	Neonicotinoids	0.0000350	0.0000031
	Beta-cyfluthrin	Pyrethroids	0.0000250	0.0000146
Roundup Transbord	Glyphosate	Substituted glycine	0.06	0.0024
Talstar 100 EC	Bifenthrin	Pyrethroids	0.0000250	0.0000083
Infinito	Fluopicolide/	Carbamates	0,0000250	0.000025
	Propamocarb hydrochloride		0.0000250	0.000001
Actara 250 WG	Thiamethoxam	Neonicotinoids	0.0000250	0.000002
Orthene 750 BR	Acephate/Aluminum silicate	Acephates	0.0000250	0.000005
Rovral	Iprodione	Dicarboximides	0.0000250	0.0000012
Evidence 700 WG	Imidacloprid	Neonicotinoids	0.0000350	0.0000031
Ridomil Gold MZ	Mancozebe	Carbamates	0.06	0.0025
Herbadox 400 EC	Pendimethalin	Substituted anilines	0.00025	0.0000089
Dithane NT	Mancozebe	Dithiocarbamates	0.06	0.0025

SOURCE: authors.

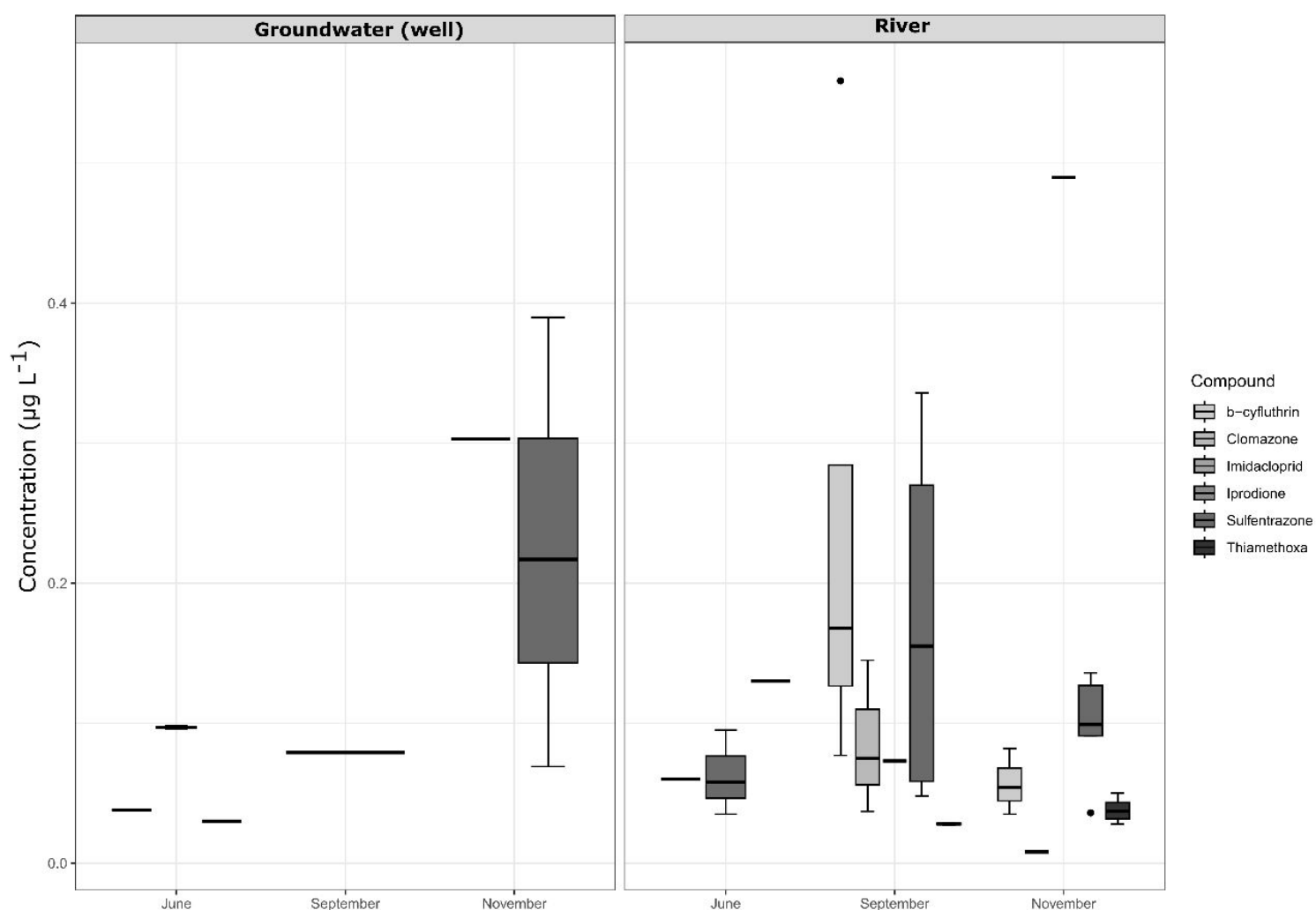


FIGURE S2 – Comparison of pesticide residues in river and groundwater samples.  
SOURCE: authors.

CHART S2 – Factors that influence the transport of pesticides.

Pesticide active ingredients	Water solubility ( $\text{mg L}^{-1}$ )	Octanol-water partition coefficient ( $\text{Kow}$ ) <sup>1</sup>
Sulfentrazone	110	$\log \text{Kow} = 0.99$
Imidacloprid	$6.1 \times 10^2$	$\log \text{Kow} = 0.57$
Tiamethoxam	$4.1 \times 10^3$	$\log \text{Kow} = -0.13$
Clomazone	1.100	$\log \text{Kow} = 2.5$
Iprodione	13.9	$\log \text{Kow} = 3.0$

<sup>1</sup> Kow values are usually measured at room temperature (20 or 25°C).

SOURCE: PubChem (2020).