APPLICABILITY OF MONITORING IN THE INDICATION OF THE QUALITY OF WATER RESOURCES IN AGROECOSYSTEMS WHERE IS PRACTISED INTEGRATED PRODUCTION OF RICE

Maria Laura Turino Mattos[1]; José Francisco da Silva Martins[1]; Cley Martins Donizetti Nunes[1]

[1]Embrapa Temperate Agriculture, BR 392, km 78, Pelotas, RS, Brasil, maria.laura@cpact.embrapa.br

ABSTRACT

The monitoring of residues of pesticides in surface waters and groundwaters deserves featured rice regions of Rio Grande do Sul (RS), Brazil. The State is rich in springs of fresh water (Lakes, ponds, streams, rivers...) that, in addition to meet the demand for irrigation of rice paddies, supplying urban areas. Moreover, it has points of reload of the Guarani aquifer as well as environmental protection areas where rice is practiced. In this context, this work sought to monitor the presence of pesticides in soil and water, in rice fields located in the municipalities of coastal plain and Plateau RS campaign, seeking to demonstrate the applicability of the process in the indication of the quality of water resources in agroecosystems where is practised integrated production of rice (PIA). Monitoring was conducted in the vintages 2006/07 and 2007/08, in pilot areas of rice companies, located in the municipalities of Mostardas, Alegrete, Uruguaiana and Itaqui.

Keywords: water, conservation, sustainability

INTRODUCION

The main challenge of irrigated rice production in Rio Grande do Sul is to achieve greater profitability, based on the reduction of production costs, increased productivity and product quality, as well as the minimization of risks of negative environmental impacts, aiming at greater competitiveness for entry into new markets such as Europe, Africa and Middle East. The Integrated Production of Rice - PIA arises in this scenario as an alternative to add value and differentiate the product obtained, conserving natural resources, thus providing a food secure consumer and respecting worker health. In the sink, the insertion of biorationals methods of integrated pest management (IPM), aimed at reducing the vast amount applied pesticides, associated with the rational use of water and fertilizer, can decrease the risk of contamination of natural resources. The strategy of PIA can still enable the production of rice soil irrigated by submersion with food and environmental quality, serving as the basis for certification, enabling the extent of demanding markets in compliance with plant-health rules, food and environmental security.

The introduction of the system, reduce the applications of agricultural inputs, passing the cultivation of rice to be conducted according to rules that aim to cereal production with environmental sustainability. For such become necessary diagnostics and monitoring environmental pesticides. Knowledge on chemical, biological and physical environment, as well as on the various processes that influence the behavior of agrochemicals, is based on data collection and analysis. To achieve this type of knowledge, it is necessary to achieve the environmental monitoring. Among the main components of monitoring, include developing sampling plans and methods of collecting samples of soil and water (ARTIOLA et al., 1996, cited by PEPPER et al., 1996). In environmental monitoring of pesticides, there is the question of which samples must be taken to the mapping of waste and an evaluation of possible adverse or beneficial impact. Water samples, soil biota, some available and occasionally air, must be taken to determine the distribution and disposal of waste (BLAU et al., 1975; NEELY, 1981 cited by FRIGHETTO, 1997).

In this context, the monitoring of surface and groundwater, focusing on pesticide residues, nitrates and phosphates, are worth mentioning in rice production regions of Rio Grande do Sul and Santa Catarina. Both states have a wealth of water bodies of freshwater, which in addition to providing water for irrigation of rice fields supplying their populations (Figure 1). The largest underground reservoir of freshwater in the world (1.2 million km^2), the Guarani Aquifer, lies in the Brazilian underground (70%). The reservoir extends beyond the borders of Brazil and has spread to Argentina, Uruguay and Paraguay. In Rio Grande do Sul, there are recharge areas, where you can find rice farming activities. Although, in RS, there are currently no major threats of contamination, should be prioritized monitoring of pesticides used in irrigated rice fields in the recharge points.

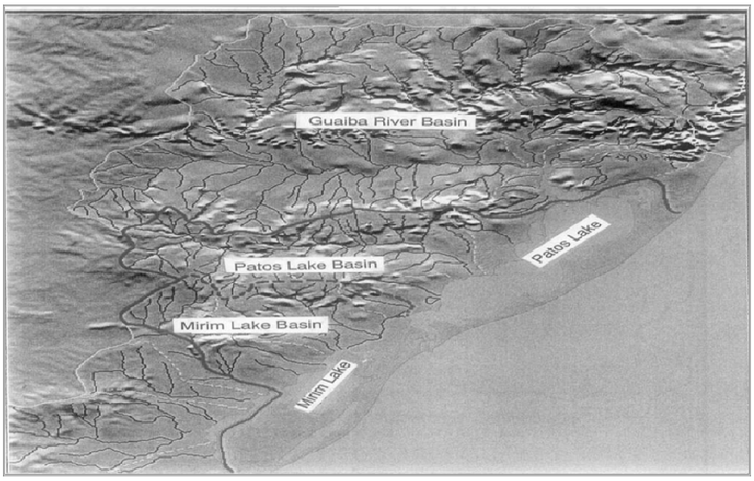

Figure 1. Hydrics springs in RS: Patos Lake, Mirim Lake, Mirim Lake basin, Patos Lake basin (Japan International Cooperation Agency, 2000). The map covers the Internal and External Coastal Plains and the Campanha Plateau, of the Pampa biome, where irrigated rice production takes place around hydric springs.

The presence of agrochemicals in samples of soil and water, collected in pilot areas of PIA, in the cities of Alegrete, Uruguaiana, agricultural crop in 2006/07, was monitored by MATTOS et al. (2006), aimed at assessing the impact of the use of agrochemicals on edaphic stress and water resources. The detection of residues of a nutrient (phosphorus) in water and herbicide (2,4-D), on the ground, demonstrated the applicability of monitoring in the indication of the quality of the natural resources of a given agroecosystem where Integrated Production of Rice is being practiced and may make its certification.

In this context, this study aimed to monitor the presence of pesticides in soil and water in rice fields located in cities of the Coastal Plain and Plateau Campaign in order to assess the impact of pesticide use on the edaphic and hydrological resources.

METHODS

The monitoring was carried out in the season of 2007/08, in pilot areas (PA) from nine companies rice production (EP) in the municipalities of Mostardas, Alegrete Uruguaiana and Itaqui (Table 1).

Table 1. Number of samples tested by undertaking paddy in the districts of the pilot areas of the PIA.

Municipality	Companies Rice Production	Number of Samples Analyzed
Mostardas	A	33
Mostardas	B	35
Alegrete	C	29
Uruguaiana	D	06
Uruguaiana	E	08
Uruguaiana	F	05
Itaqui	G	13
Itaqui	H	11
Itaqui	I	10
Total		**150**

Were collected 150 samples of surface water and sediment, in rice paddies in funding sources, the water depth inside the rice field and irrigation canals and drainage on various dates during the period from november to march. Immediately after collection in the field, the samples were placed in polystyrene boxes with ice and then stored in freezers. At a later date, samples were sent frozen in styrofoam boxes with dry ice to laboratories for analysis. The analysis of pesticide residues were conducted in laboratory Bioassays Analysis and Environmental Consulting Ltda. Porto Alegre, RS. Quantitative analysis was performed in a high-liquid chromatograph (HPLC) coupled to a spectrometer mass/mass (LC/MS/MS), Applied Biosystems model 3200 QTRAP, and a gas chromatograph coupled to a mass spectrometer (GC/MS), Shimadzu model QP5050. The active ingredients were analyzed: 3-hydroxy carbofuran, 2,4-D, azoxystrobin, bentazone, betacyfluthrin, clomazone, cyhalofop-p-butyl, captan, carbosulfan, carboxin, carpropramida, cyfluthrin, cypermethrin, chlorothalonil, etoxisulfurom, ciclosulfamurom , difenoconazole, dithiocarbamate (CS2) edifenfós, fenitrothion, fentin acetate fentin hydroxide, fipronil, glyphosate, imazapic, imazethapyr, mancozeb, metsulfuron-methyl, molinate, oxadiazon, oxyfluorfen, penoxulam, propanil, pirazosulfuron-ethyl, quinclorac, quintozene tebuconazole, tetraconazole, thiabendazole, thiamethoxam, tiobencarb, take tricicazol, triclopyr, trifloxystrobin. The limit of quantification (LOQ) was 0.0001 mg kg^{-1} for all active ingredients, except for dithiocarbamates, which was 0.07 mg kg^{-1}.

RESULTS AND DISCUSSION

The irrigation water from rice farming is framed as the resolution N°. 357 of 17 march 2005, the National Council on the Environment (CONAMA), as fresh water "Class 3". In this class, given only the standard of quality for the following active ingredients: 2,4-D (30.0 mg L^{-1}) and glyphosate (280 g L^{-1}). Table 2 shows the number of active ingredients of pesticides detected in the analysis of residues in water samples and sediments from the AP. The most frequently detected were: 3-hydroxy carbofuran, clomazone, cyhalofop-p-butyl, 2,4-D, azoxystrobin, bentazone, difenoconazole, edifenfós, etoxisulfuron, fipronil, glyphosate, imazethapyr, mancozeb, oxadiazon, oxyfluorfen, penoxulam, propanil, tebuconazole, tetraconazole, thiabendazole, tiobencarb. Of these, eleven belong to the class of herbicide, insecticide and two to seven of the fungicide. Glyphosate and 2,4-D were detected at concentrations below the limits established. Residue of 2,4-D was also detected in a pilot area (PA) PIA, located in West Border in RS in the season of 2006/2007, the concentration of 0.001 mg kg^{-1} soil. The adsorption of 2,4-D is stronger clay soils rich in organic matter, soil characteristic of the PA where the sample was collected (MATTOS et al, 2007).

Table 2. Number of active ingredients found in samples of water and sediment for paddy company.

Municipality	Companies Rice Production	Number of Active Ingredients Detected
Mostardas	A	15
Mostardas	B	7
Alegrete	C	12
Uruguaiana	D	4
Uruguaiana	E	3
Uruguaiana	F	6
Itaqui	G	8
Itaqui	H	9
Itaqui	I	11
Total		**75**

Residue of 2,4-D was detected in a soil sample from an AP at a concentration of 0.001mg kg^{-1}. The adsorption of 2,4-D is stronger clay soils rich in organic matter, soil characteristic of the PA where the sample was collected. The results highlight the need for a reassessment of residues of 2,4-D, the AP said, however, involving a larger number of samples. In the other sample points of AP, and points of water collection (Ibirapuitã up the river and dams) and the irrigation canals and drainage, there was no detection or residues of any of the other active ingredients before related.

In this context, the monitoring enable partners to producing PIA suitability of production systems to the precepts and guidance set out in Instruction No. 27, of 30 August 2010, the Ministry of Agriculture and Food Supply, which regulates, among other , The monitoring system, sustainability of production processes and property management with a view to certification and traceability.

The adoption of the PIA by producers of the RS can show in the first instance, the environmental awareness of themselves and, subsequently, the vision of a differentiated market (MATTOS et al., 2009). Thus, breaking the paradigm that producers can only join if there PIA support a public policy.

CONCLUSIONS

The detection of residues of these fungicides herbicides and insecticides in water and sediment monitoring demonstrates the applicability of the in indicating the quality of the natural resources of a particular ecosystem where the PIA is being practiced and may facilitate their certification. At the same time, indicates the need for implementation of Integrated Pest Management (IPM) aimed at rationalizing the use of pesticides e,consequently, we the safety of the environment and safe production of rice, ensuring the health of consumers.

REFERÊNCIAS

FRIGHETTO, R.T.S. Impacto ambiental decorrente do uso de pesticidas agrícolas. In: MELO, I.S. de; AZEVEDO, J.L. de. ed. **Microbiologia ambiental**. Jaguariúna: Embrapa-CNPMA, 1997, p.415-438.

MATTOS, M. L. T.; SILVA, J. F. da; BARRIGOSSI, J. A. **Produção integrada de arroz. In: Produção integrada no Brasil : agropeuária sustentável alimentos seguros** / Ministério da Agricultura, Pecuária e Abastecimento. Secretaria de Desenvolvimento Agropecuário e Cooperativismo. – Brasília : Mapa/ACS, 2009. 1008 p.

MATTOS, M. L. T. MARTINS, J. F. da S.; NUNES, C. D. M.; SCIVITTARO, W. B.; MOURA, F. Monitoramento de agroquímicos em áreas de produção integrada de arroz irrigado no Rio Grande do Sul. In: SIMPÓSIO BRASILEIRO DE PRODUÇÃO INTEGRADA, 1., 2007, Bento Gonçalves. ***Anais**...* Bento Gonçalves: Embrapa Uva e Vinho, 2007, CD.

PEPPER, I. L.; GERBA, C. P.; BRUSSEAU, M. L. **Pollution science**. London, Academic Press, 1996. 397 p.