Federal University of Rio Grande do Sul
Interdisciplinary Research Group on Environmental Biogeochemistry

DISSOLVED N-P-K LOSSES AND THEIR RELATION TO THE MAGNITUDE OF RAINFALL EVENT IN A RURAL CATCHMENT

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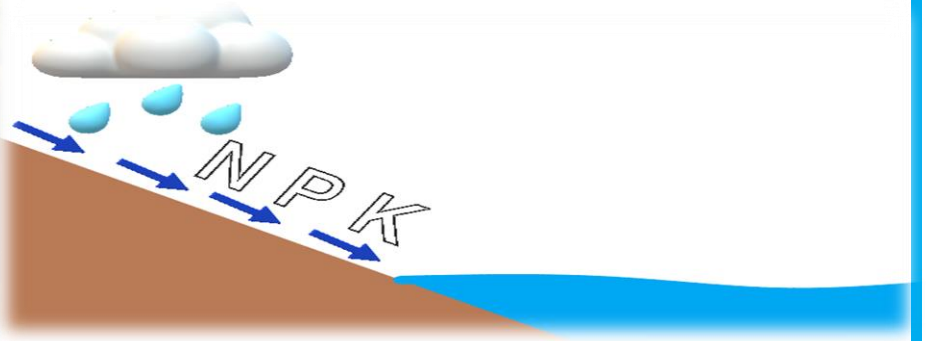
INTRODUCTION

⟶ Chemical elements transported to the streams may originate from anthropic activities or from natural sources.

⟶ The rainfall characteristics have great importance in the amount of nutrients that are transported from the soil to the rivers.

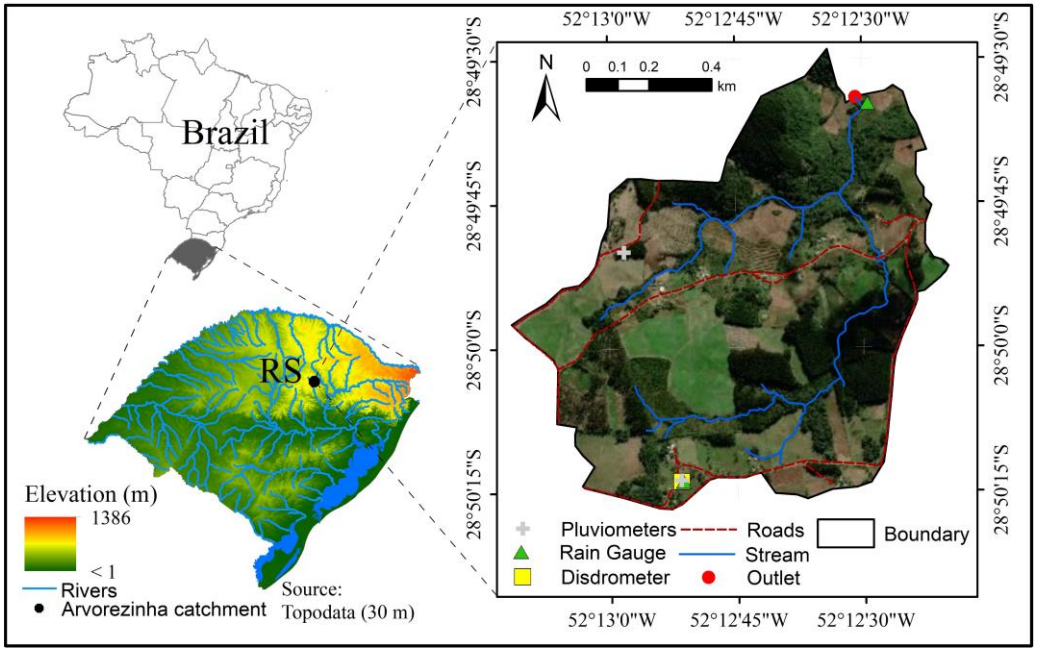


Goal

Evaluate the rainfall event characteristics that may explain the transport of N-P-K nutrients.

MATERIAL AND METHODS

1. Study area: Arvorezinha catchment, RS – 1,23 km^2;
2. Land use: forests (36.5%), tobacco (19.6%), soybean (18.7%), pasture (12.8%), yerba mate (4.9%), corn (4.7%) and others (7.9%);
3. Soil management: No-till system (59%) and conventional tillage system (41 %);
4. Acrisols (57%), Cambisols (10%) and Leptosols (33%).
5. Average annual rainfall 1,938 mm and erosivity index (EI_{30}) is 9,344 MJ mm ha^{-1} yr^{-1}



HYDRO-SEDIMENTARY MONITORING

RAINFALL

PLUVIOMETER AND RAIN GAUGES

LIQUID DISCHARGE

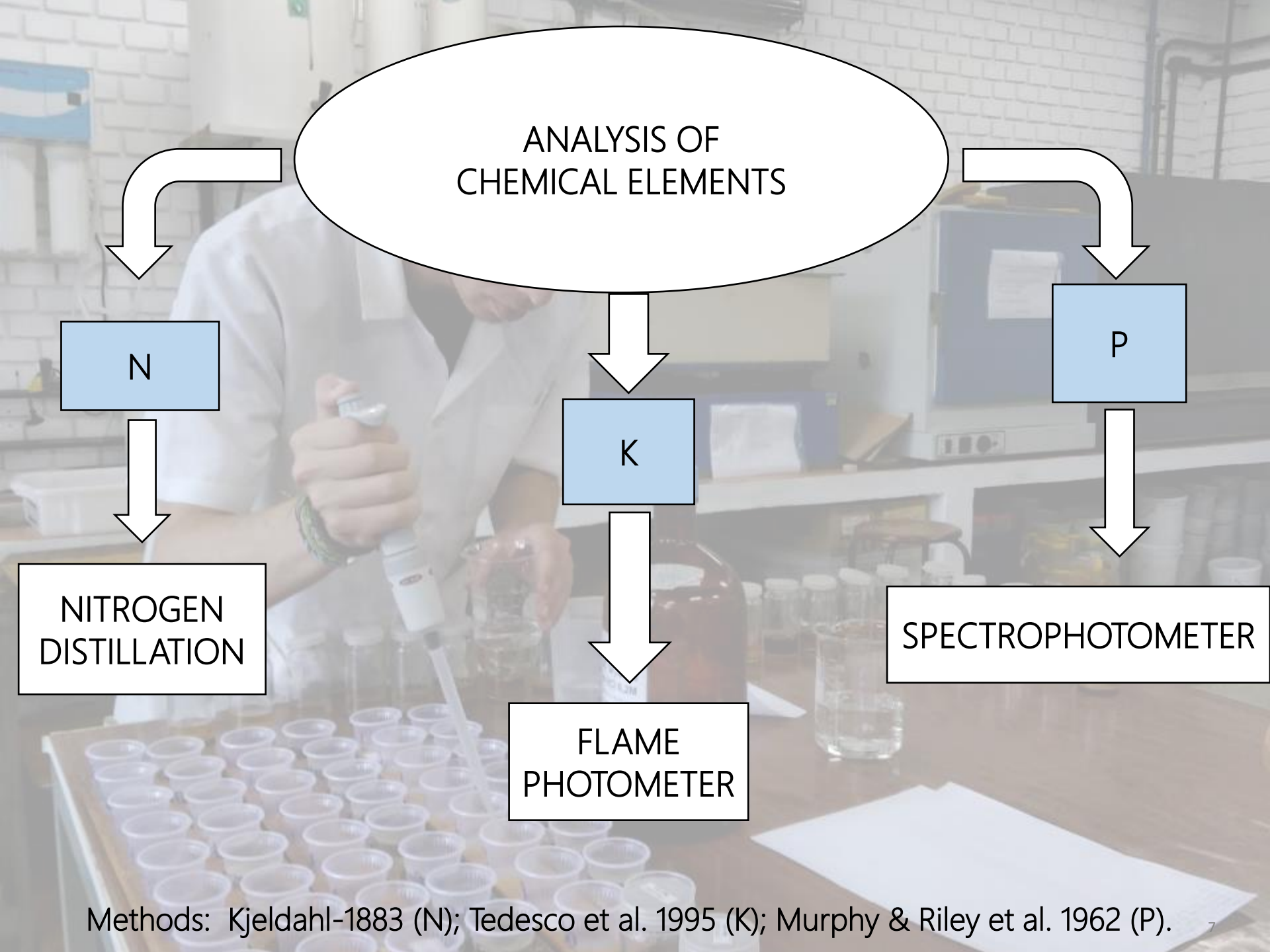
PRESSURE SENSOR

SEDIMENT CONCENTRATION

TURBIDIMETER

SAMPLING

- ✓ Seven rainfall-runoff events occurred along 2018 (winter, spring and summer 2018/2019);
- ✓ Events: 24/06, 24/07, 24/08, 31/08, 01/10, 12/10 e 23/11.
- ✓ Water + sediment samples were collected during rising, peak and falling limb of the hydrograph;
- ✓ The samples were filtered through a 0.45 µm filter to separate the dissolved fraction.



Methods: Kjeldahl-1883 (N); Tedesco et al. 1995 (K); Murphy & Riley et al. 1962 (P).

DATA ANALYSIS

- ✓ Characterization of the rainfall event (Precipitation depth - PPT, Peak Flow – Q_{peak} , maximum intensity in 30 min – I_{30});
- ✓ A simple regression analysis between the maximum N-P-K concentrations with the maximum discharge (Q_{peak}), precipitation depth (PPT) and maximum intensity in 30 min (I_{30});
- ✓ Total nutrientes discharge.

RESULTS AND DISCUSSION

Table 1 – Hydro-sedimentary monitoring to seven rainfall events.

Event	PPT mm	I_{30} mm h^{-1}	Q_{peak} L s^{-1}
6/24	21	16,2	55,1
7/24	103	13,7	767,9
8/24	44	38,6	2404,0
8/31	64	8,6	1051,0
10/1	31	8,6	1218,2
10/12	60	51,8	3366,5
11/23	91	15,7	905,4

RESULTS AND DISCUSSION

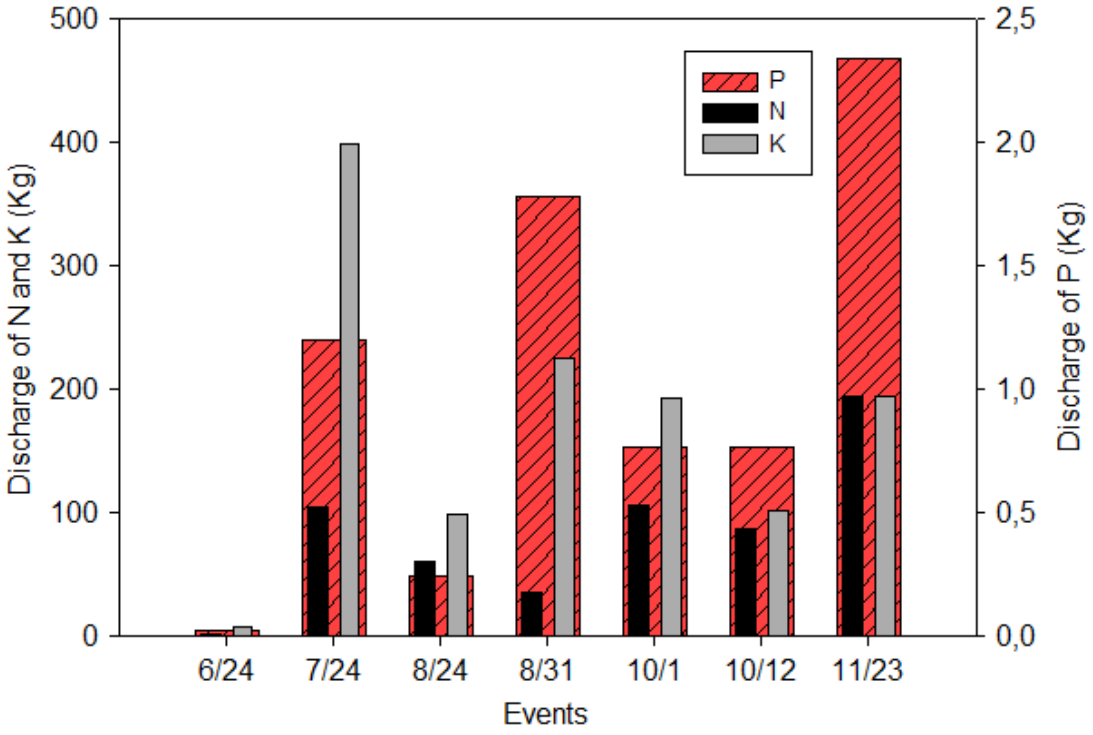


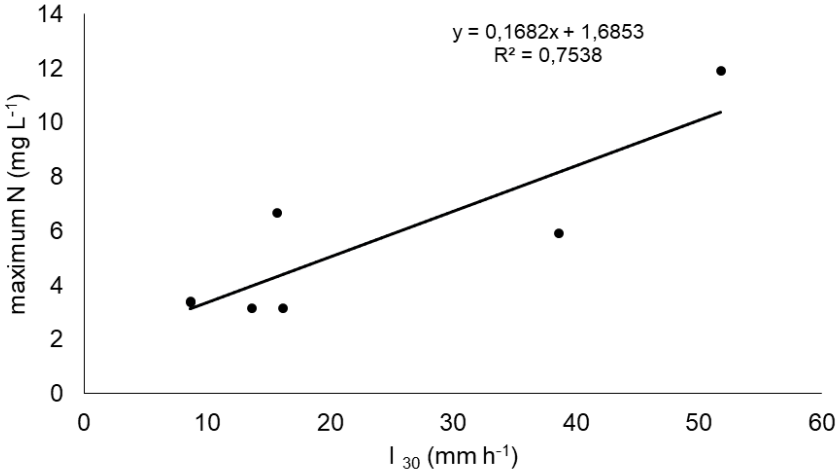
Figure 1 - Total nutrients losses.

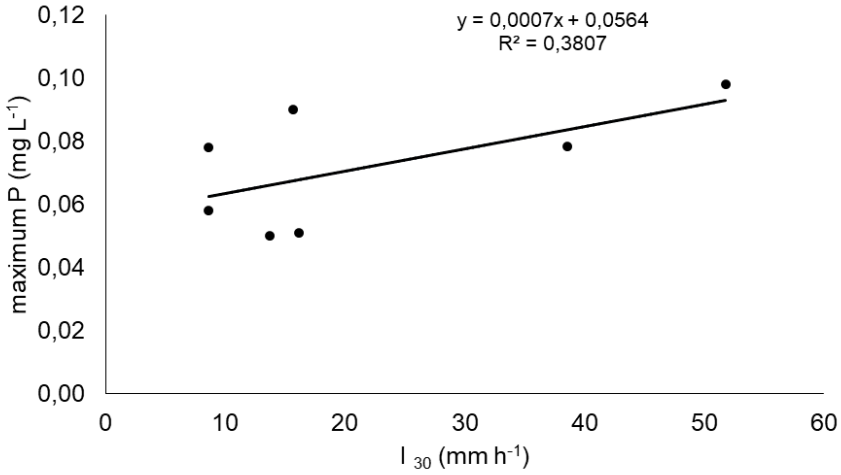
TOTAL LOSSES

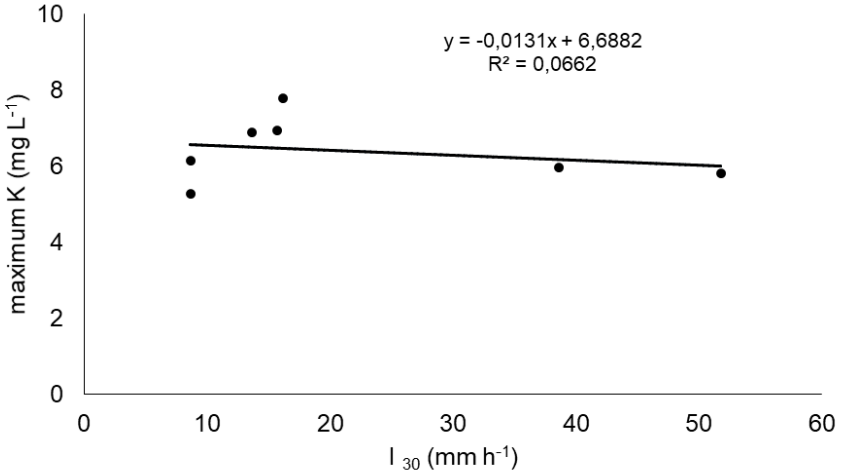
N – 584 Kg;
K – 1220 Kg;
P – 7.1 Kg.

RESULTS AND DISCUSSION

✓ Regression analysis between maximum N-P-K with I_{30}

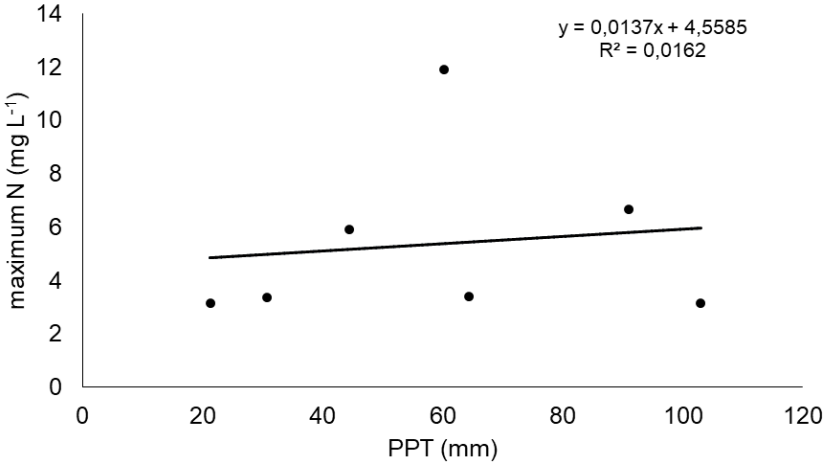


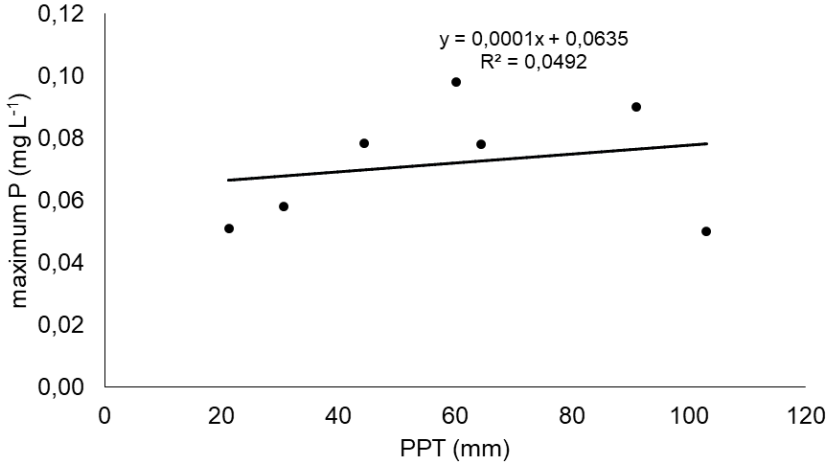


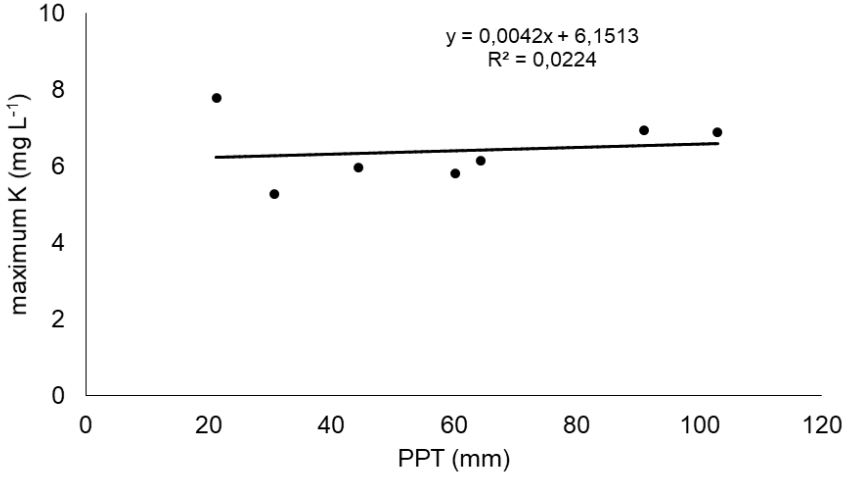


RESULTS AND DISCUSSION

- ✓ Regression analysis between maximum N-P-K with PPT

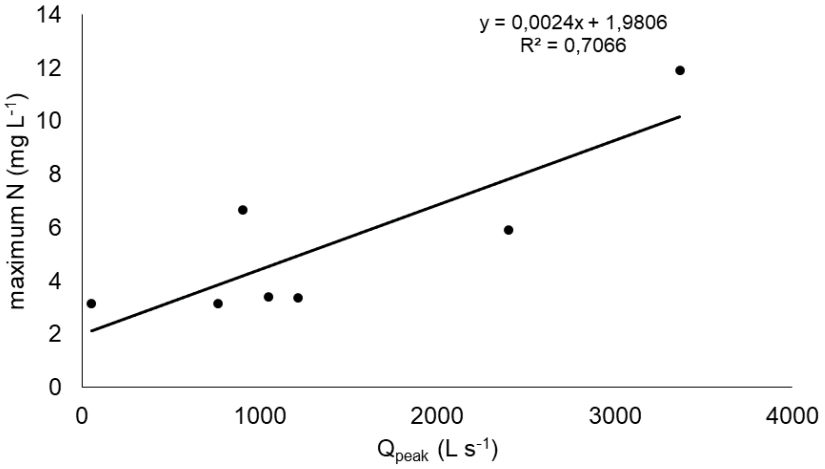


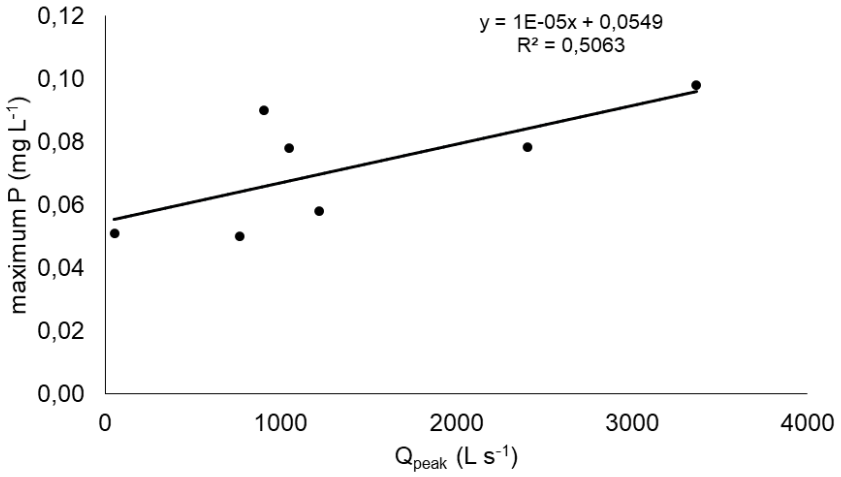


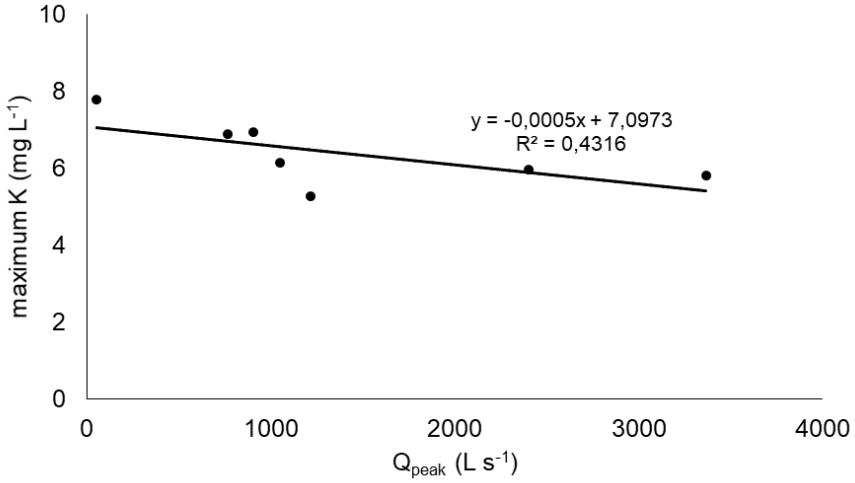


RESULTS AND DISCUSSION

- ✓ Regression analysis between maximum N-P-K with Q_{peak}







RESULTS AND DISCUSSION

Table 2 – R^2 AND ADJUSTED EQUATION FOR ALL REGRESSION ANALYSIS

Rainfall variable	$_{maximum}$ N	$_{maximum}$ P	$_{maximum}$ K
	----------R^2 and adjusted equation----------		
PPT	0,016 y = 0,0137x + 4,5585	0,049 y = 0,0001x + 0,0635	0,022 y = 0,0042x + 6,1513
Q_{peak}	0,706 y = 0,0024x + 1,9806	0,506 y = 1E-05x + 0,0549	0,431 y = -0,0005x + 7,0973
I_{30}	0,753 y = 0,1682x + 1,6853	0,381 y = 0,0007x + 0,0564	0,066 y = -0,0131x + 6,6882

Nitrogen is the element that presents the best correlation with the variables.

CONCLUSION

- ✓ The regression analysis showed that PPT does not explain the variations of N, P and K concentration;
- ✓ I_{30} is a good indicator for loss Nitrogen loss (I_{30} was able to explain 75% of the total N variation between the events);
- ✓ Q_{peak} was the hydrological variable which best explained the variations of N, P and K concentrations;
- ✓ Many areas with Eucalyptus area were replaced by soybean and tobacco using tillage system in 2018. These changes may have affected the large losses of these elements, but it needs to be better investigated.

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THANK YOU!

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