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Comparison of nitrate-nitrogen leaching in diverse hydrological conditions

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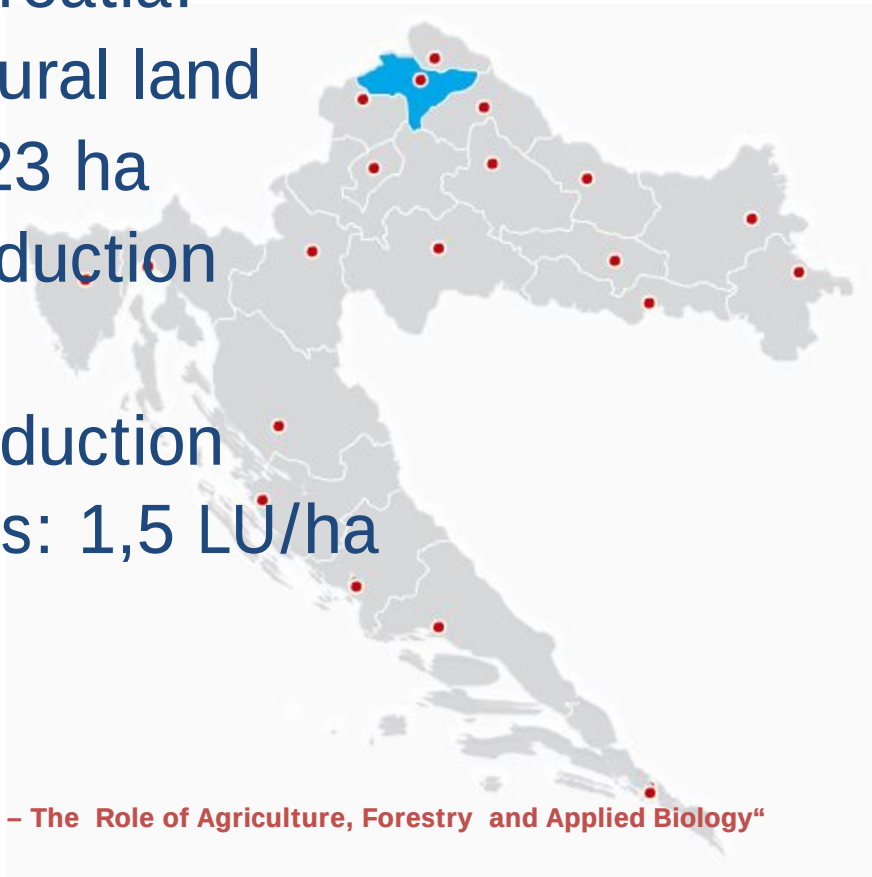
- nitrate leaching to groundwater is major concern throughout intensive agricultural area
- expected increase of mineral fertilizer use
- estimation: on 20% EU area the drinking water contains more residual agrochemicals than it is allowed by the regulations
- when it comes to measures for nitrate leaching reduction, then climate characteristics or natural soil properties can not be controlled ⟷ land use and land management can be adapted to the given natural conditions

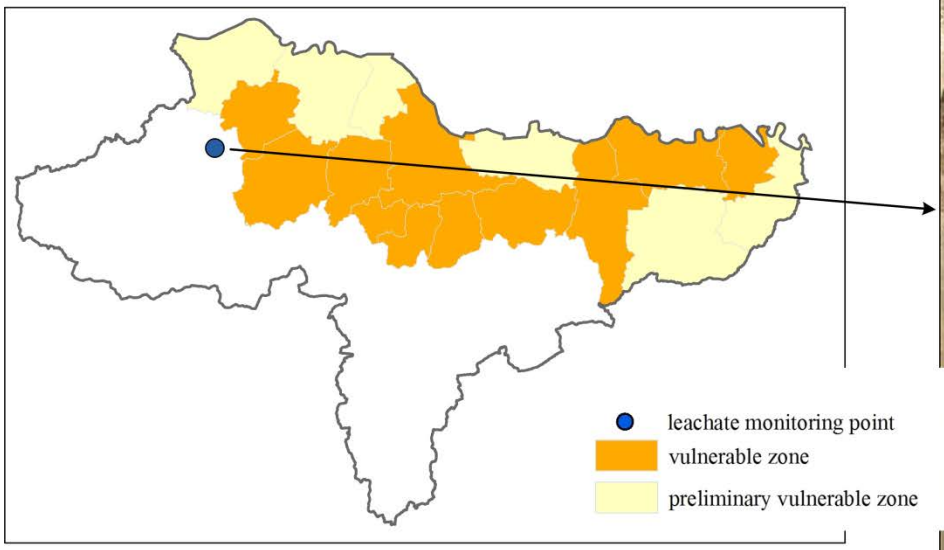

- to monitor nitrate-nitrogen leaching in diverse precipitation conditions detailed research was set in Varaždin County, northern Croatia:
  - (a) 59% of County agricultural land
  - (b) average parcel size: 0,23 ha
  - (c) 85% of agricultural production is crop production
  - (d) intensive vegetable production
  - (e) chicken and cattle farms: 1,5 LU/ha



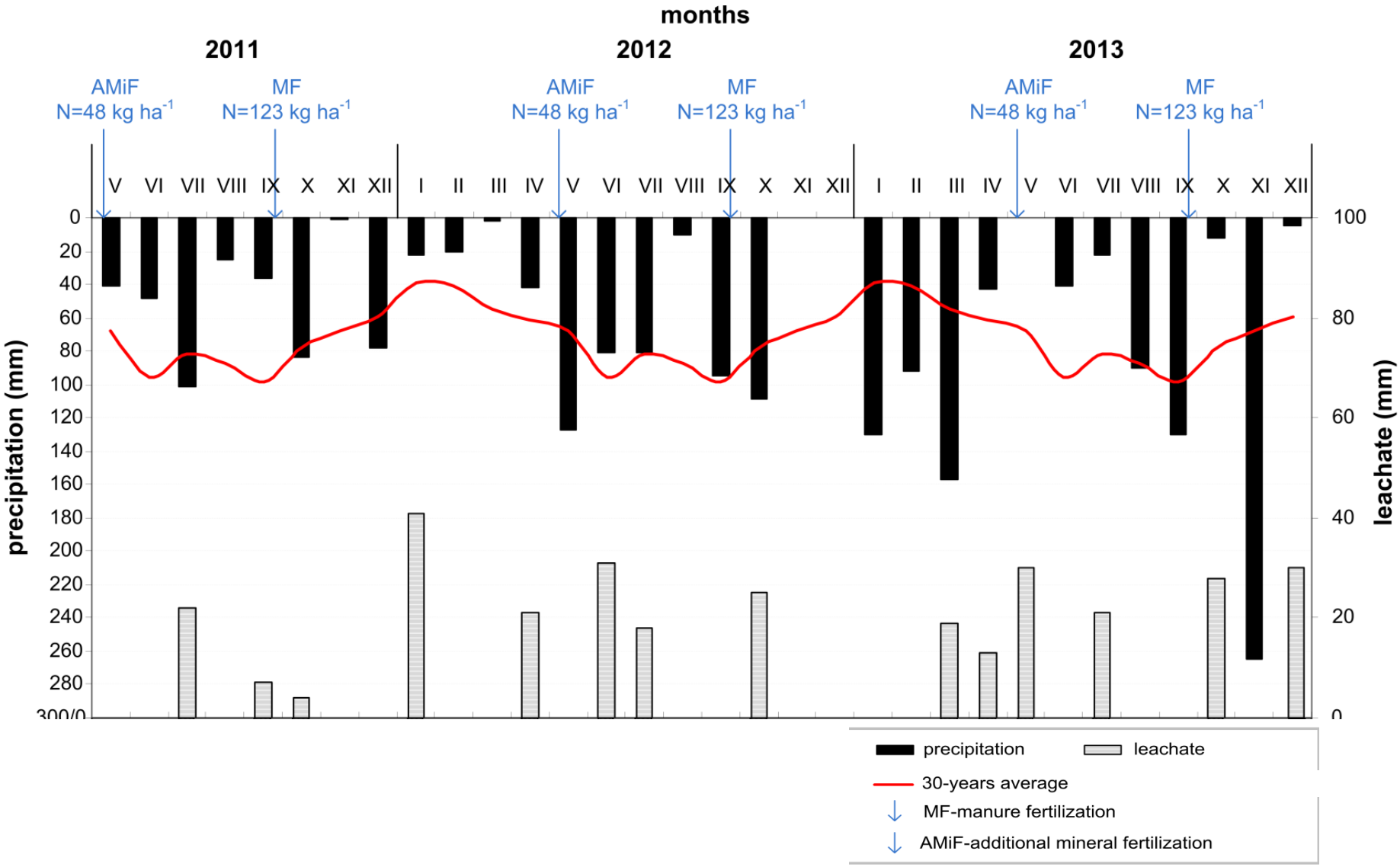

Objective

- to quantify and investigate annual and seasonal differences in leachate amount and N-leaching losses over a 3-year period under conventional silage maize production in northern Croatia
- optimization of land management and diminishing negative agricultural effects on resources pollution


Lysimeter installation



- leachate samples are collected by pumping in period May 2011-December 2013 according to determined dynamics: after abundant rainfall or twice a month
- NO_3–N concentrations (HRN ISO 14255:2004)
- collected data on nutrient input
- ANOVA analysis



months
2011
2012
2013
AMiF N=48 kg ha-1
MF N=123 kg ha-1
V VI VII VIII IX X XI XII I II III IV V VI VII VIII IX X XI XII I II III IV V VI VII VIII IX X XI XII
precipitation (mm)
leachate (mm)
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300/0
100 80 60 40 20 0
precipitation
leachate
30-years average
MF-manure fertilization
AMiF-additional mineral fertilization

Year	Sampling date	Leachate (mm)	NO_3-N (mg l^{-1})
2011	08.07.2011.	23	41
	02.09.2011.	14	39
	23.09.2011.	1	38
	10.10.2011.	1	56
	26.10.2011.	8	38
2012	05.01.2012.	43	36
	27.04.2012.	22	41
	15.06.2012.	33	38
	20.07.2012.	19	38
	24.10.2012.	26	54
2013	05.03.2013.	19	13
	09.04.2013.	13	8
	24.05.2013.	30	12
	11.07.2013.	21	40
	14.10.2013.	28	37
	19.12.2013.	30	14
	average	**21**	**34**

- ANOVA results confirm there is a statistically significant difference (F (2,12)=5,77, p=0.018) in NO_3-N concentrations between hydrological dry and wet years
- A Tukey post-hoc test revealed that NO_3-N concentrations were statistically significantly lower in wet conditions in 2013 (22 ± 15.2) comparing to dry conditions in 2011 (42.4 ± 7.7 mg/l, p = .027) and in 2012 (41.4 ± 7.3 mg/l, p = .035)


Conclusions

- in given precipitation and soil conditions, leaching rate on annual level is twice as higher in dry then in wet conditions
- leachate amount in hydrological significant precipitation period for study area (autumn) corresponds to the leachate amount on annual level in wet conditions
- average NO_3-N concentration in research period was approximately 3 times higher than MAC
- maximum NO_3-N concentration was recorded in dry year and minimum in wet year


statistical analysis confirms that fertilizer amount is abundant in given soil and precipitation conditions, especially in hydrological dry year and fertilization management should be adapted to those conditions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Thank you!