Centre wallon de Recherches agronomiques

PhytEauWal: development of biofilters and sharing of Best Management Practices for pesticides

Walloon Agricultural Research Center (CRA-W)
Pesticides Research Department

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financed by Ministry of Walloon Region (DGA, DGRNE), SPF Public Health, SPGE, Phytofar, Phytodis and Credit Agricole

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Principle of biofilters

Tracer pesticides cocktail

Molecules	Types
IPRODIONE	FUNGICIDES
METALAXYL	FUNGICIDES
AZOXYSTROBINE	FUNGICIDES
METCONAZOLE	FUNGICIDES
CYPERMETHRIN	INSECTICIDE
CARBOFURAN *	INS/NEM
ATRAZINE *	HERBICIDE
SIMAZINE *	HERBICIDE
LENACIL *	HERBICIDE
DIURON *	HERBICIDE
FLUPYRSULFURON-METHYL	HERBICIDE
NICOSULFURON	HERBICIDE
METOLACHLOR	HERBICIDE
ETHOFUMESATE	HERBICIDE
MCPP	HERBICIDE
ISOPROTURON	HERBICIDE
CHLORIDAZON	HERBICIDE

*** Tracer cocktail used since 2002**

Efficiency of the biofilters

- Analysis of pesticides residues in the elutes (= losses)
- Efficiency (%) is calculated as :

$$\left(1 - \frac{\text{amount of a. s. losses}}{\text{amount of a. s. loaded } *}\right) \times 100$$

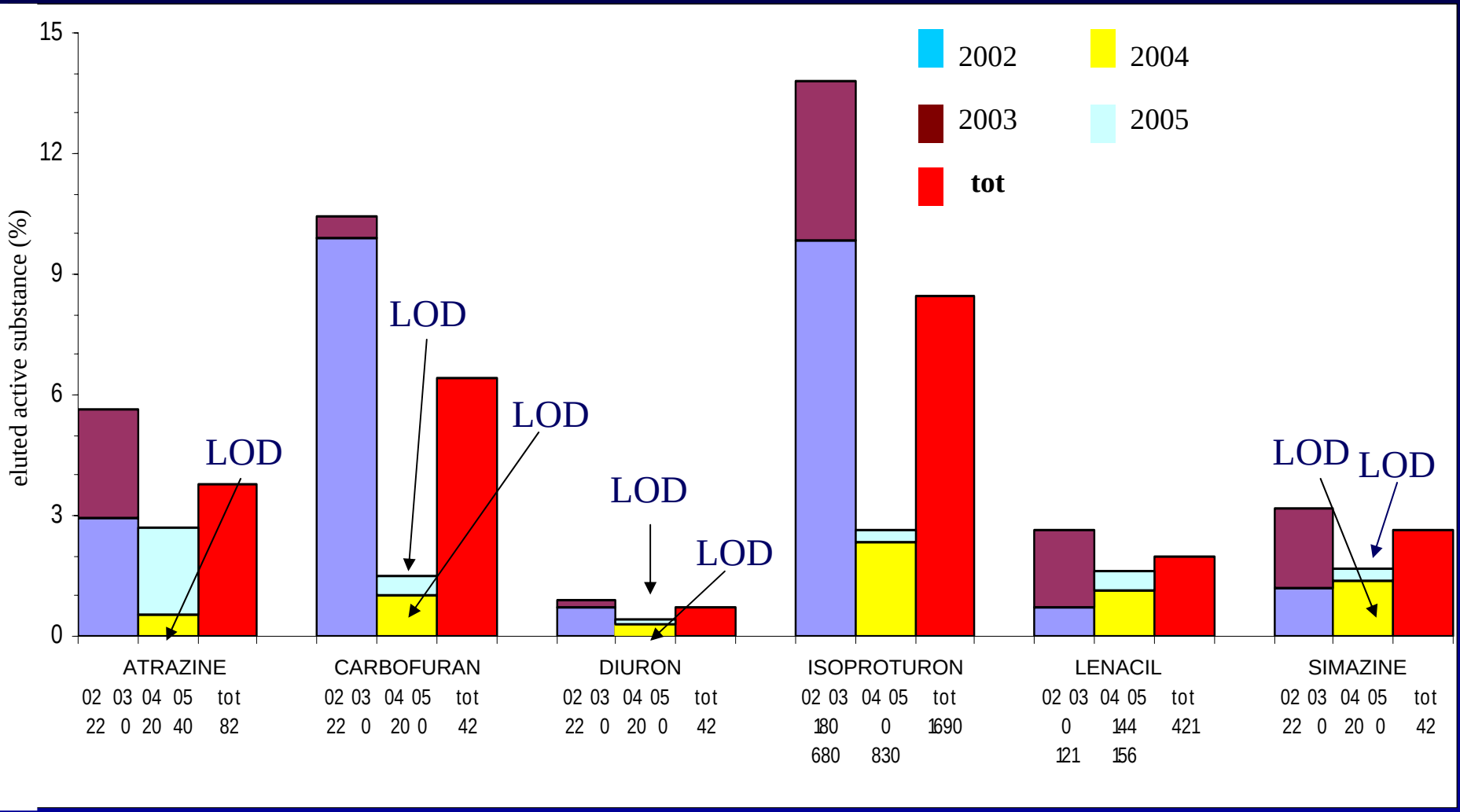
* total quantity of pesticides loaded onto the biofilter : tracer pesticides + pesticides added by the user himself

Degradation of pesticides into the biofilter

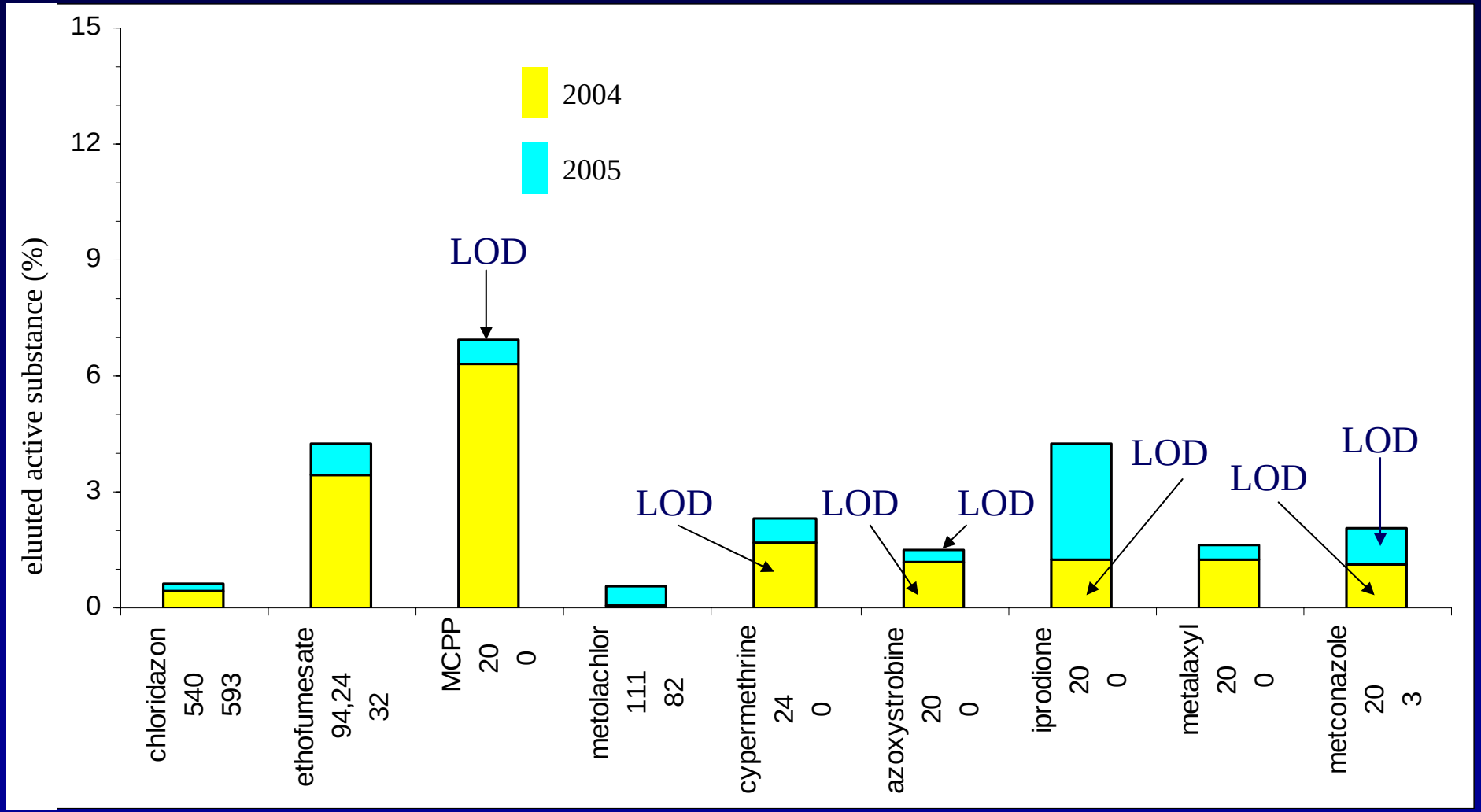
- Analysis of pesticides into the substrate
- Degradation rate (%) is calculated as :

$$\left(1 - \frac{\text{amount of a. s. in the substrate}}{\text{amount of a. s. loaded} - \text{amount of a. s. eluted}}\right) \times 100$$

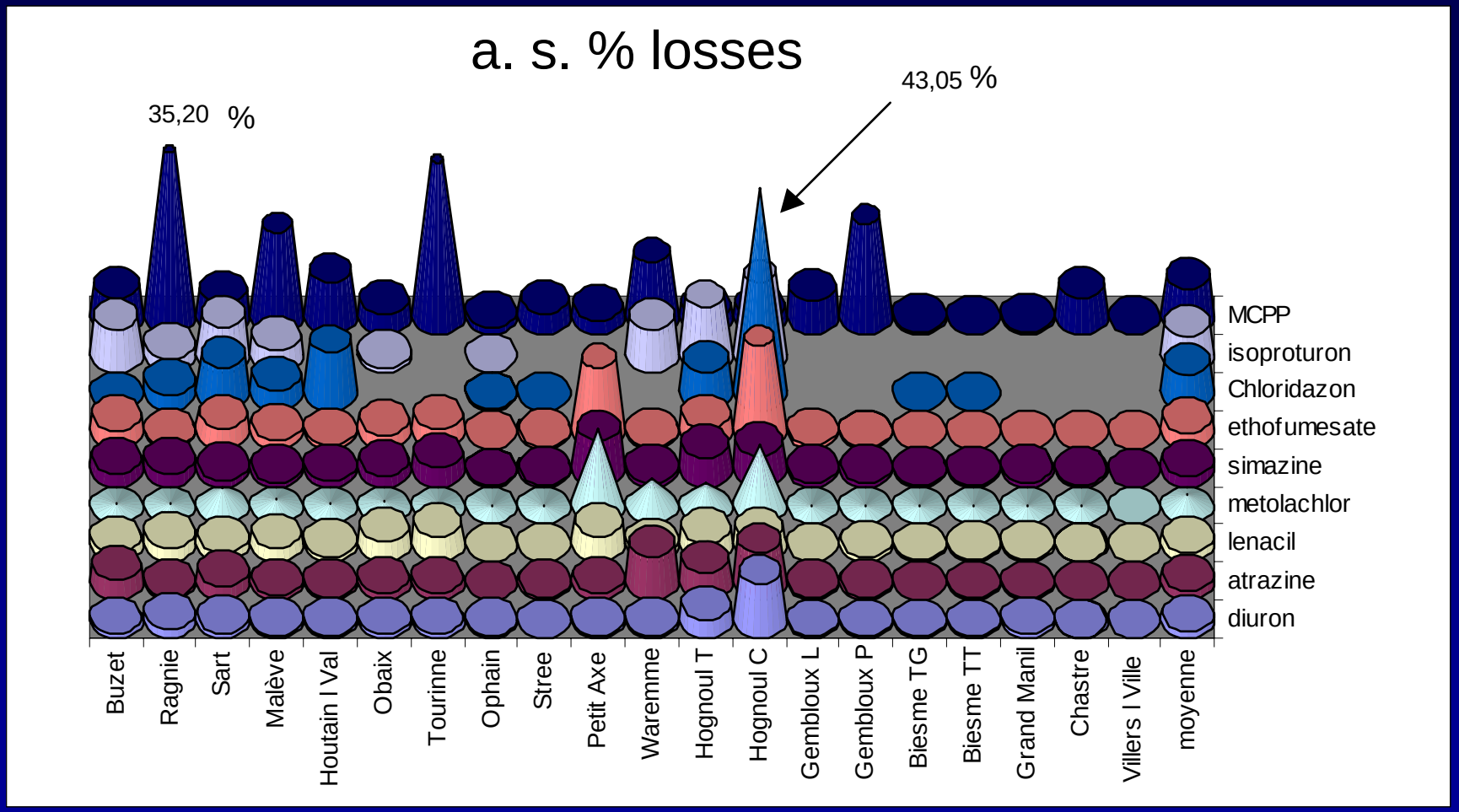
Efficiency : example for biofilter of Buzet



Efficiency : example for biofilter of Buzet

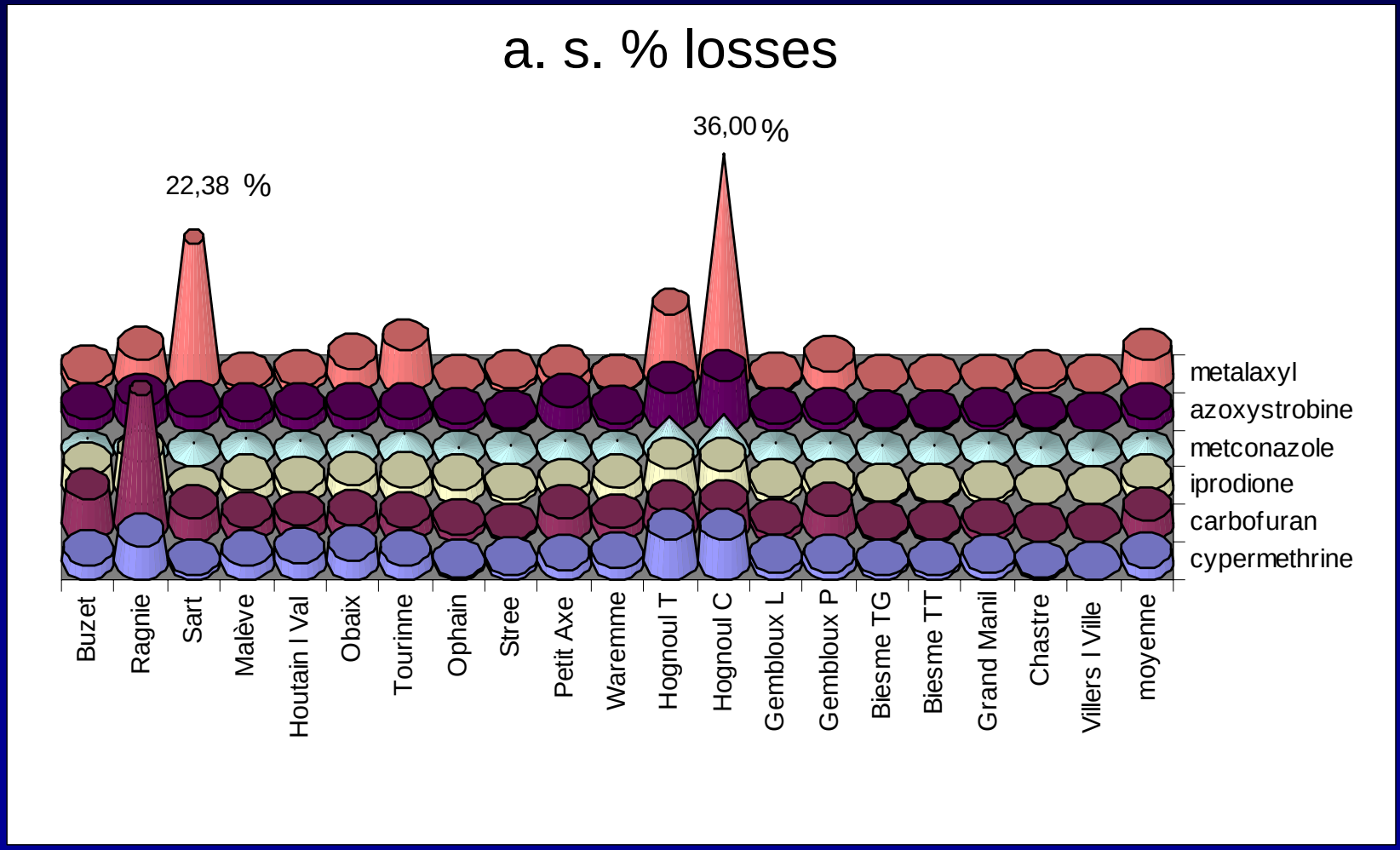


Efficiency of biofilters for herbicides



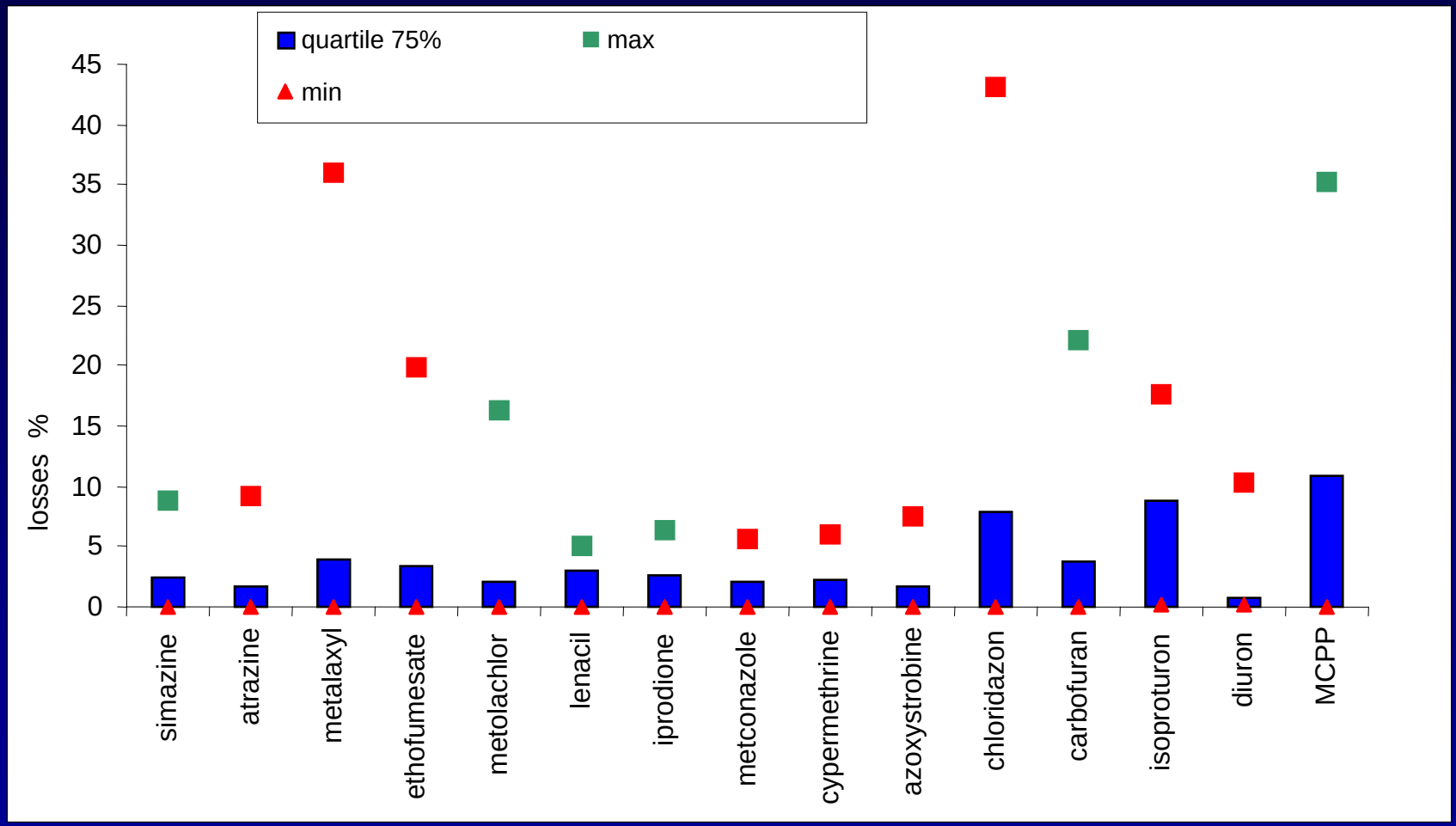
- Most important losses for MCPP (solubility in water = 734 mg/L)

Efficiency of biofilters for insecticides and fungicides



Most important losses for metalaxyl

General efficiency by pesticide (20 biofilters)

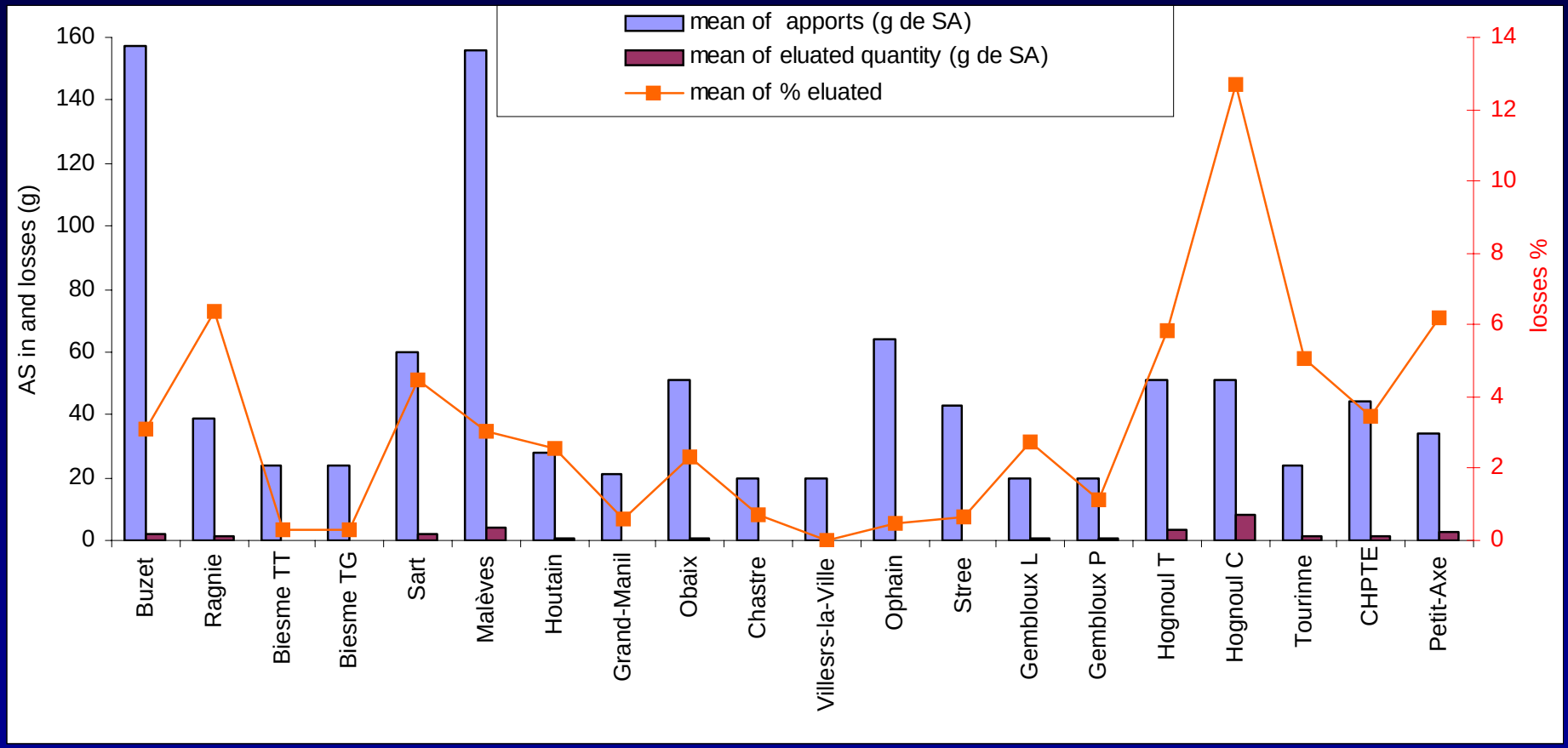


75 % of biofilters have an efficiency > 90 % for all the molecules analysed

> 96 % excepted chloridazon, isoproturon and MCPP

For each a. s. at least 1 system has a efficiency of 100 %

General efficiency by biofilter (15 a. s.)

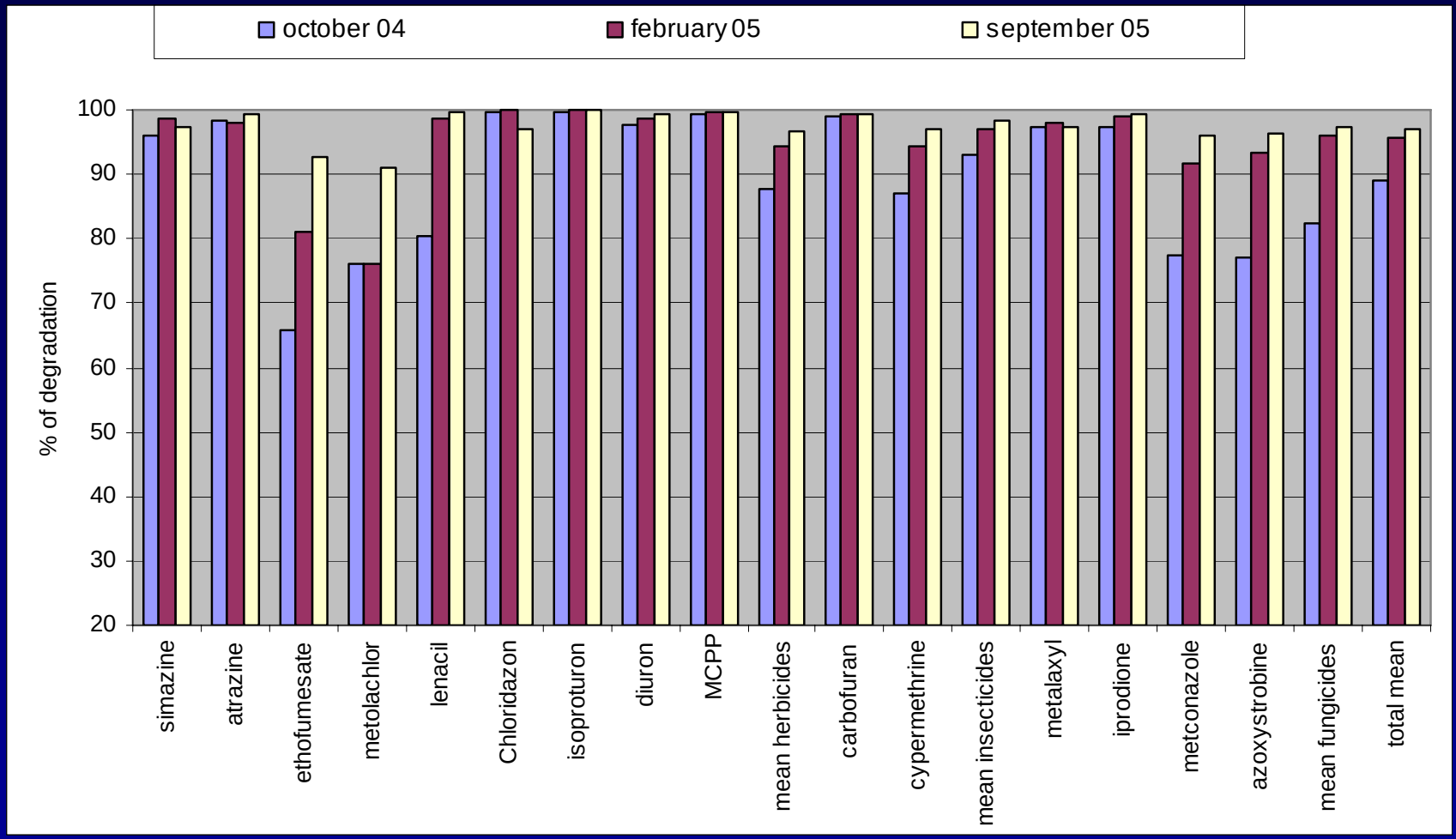


Efficiency > 87 % for all biofilters

> 95 % for 16 biofilters / 20

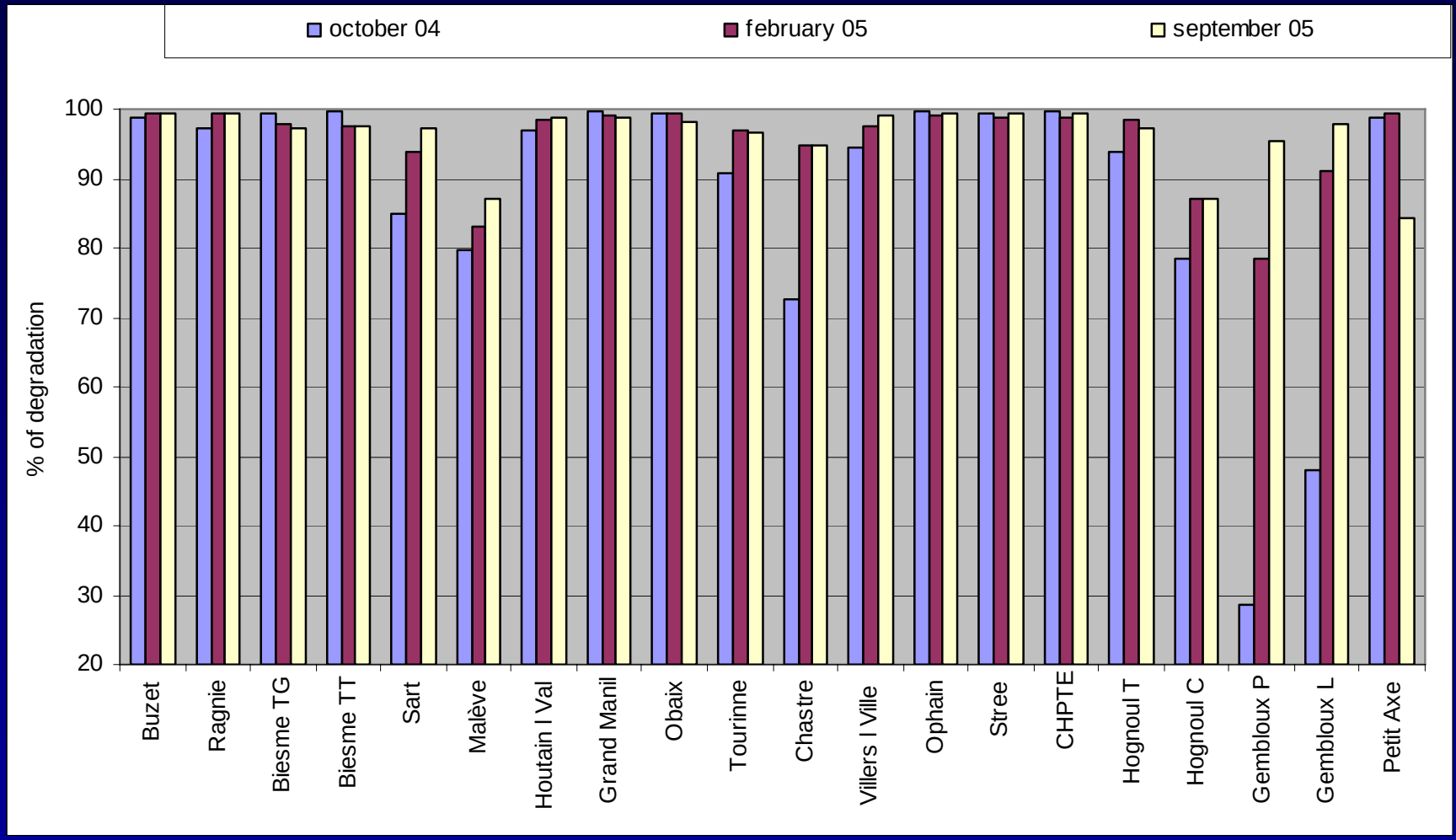
Good efficiency even with high pesticides amount (tested up to 12500 g for 4 years)

Degradation by pesticide



75 % of biofilters present a degradation > 91% (minimum = metolaclor)

Degradation by biofilter



75 % of a. s. present a degradation > 84% (minimum = Petit Axe)

Evolution of degradation

Degradation for 75 % of biofilters (quartile 75)

Pesticides degradation			
	Autumn 2004	Spring 2005	Autumn 2005
All a. s.	90 %	95 %	98 %
Minimum	60 %	76 %	91 %

Some other results

Comparison of substrate composition has shown that :

- **The best results for efficiency as well as for degradation are obtained with composted cow manure in place of peat**
- **Straw is better than flax**
- **Peat is better than composted garden material**

Statistical analyse by principal components also show that

- **High level of N (NH4) decrease the efficiency**
- **Soils with higher sand level seems to increase efficiency and degradation**

Conclusions

- **Biofilters reduce highly the quantity of pesticides from rinsing and cleaning water of sprayers**

- **Good efficacy obtained after 2 years for herbicides is confirmed after 4 years and also for some insecticides and fungicides**

- **Absorption in the biofilter**
  Efficiency > 90 % for all a. s. analysed

- **Degradation in the biofilter increase with time**
  > 90% for all a. s. after 18 months

Biofilter = useful tool
for the prevention of water pollution

Phyteauwal

is new project promoting good agricultural practices in the farmyard and in the field

– **Promotion of the :**

- use of rinsing tank
- use of low drift nozzles and buffer zones
- use of biofilters, phytobacs or other remediation solutions

Phyteauwal

- **To install biofilters or phytobacs**
  - **by voluntary farmers and other professional pesticides users**
  - **by farmers and other professional pesticides users inside the protection area of drinkable water catchments**

- **To advise the pesticides users inside the protection area of drinkable water catchments**
  - **In function of crops, soil quality, soil humidity, spraying time…**
  - **In function of physico-chemical properties of active subtances.**

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Many thanks for your attention

Many thanks

to farmers who participated to this project

to sponsors (Ministry of Walloon Region DGA & DGRNE, SPF Public Health, SPGE, Phytofar, Phytodis and Credit Agricole)

Wallon Agricultural Research Centre (CRA-W)
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in collaboration with VAR and FUSAGx

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Analytical methods for determination of pesticides residues in elutes and substrates

Determination by GC-MS

simazine, atrazine, metalaxyl, ethofumesate, metolachlore, lenacil, iprodione, metconazole, cypermethrin, azoxystrobine

Determination by HPLC-DAD

chloridazon, nicosulfuron, carbofuran, isoproturon, diuron, MCPP, flupyrsulfuron-methyl

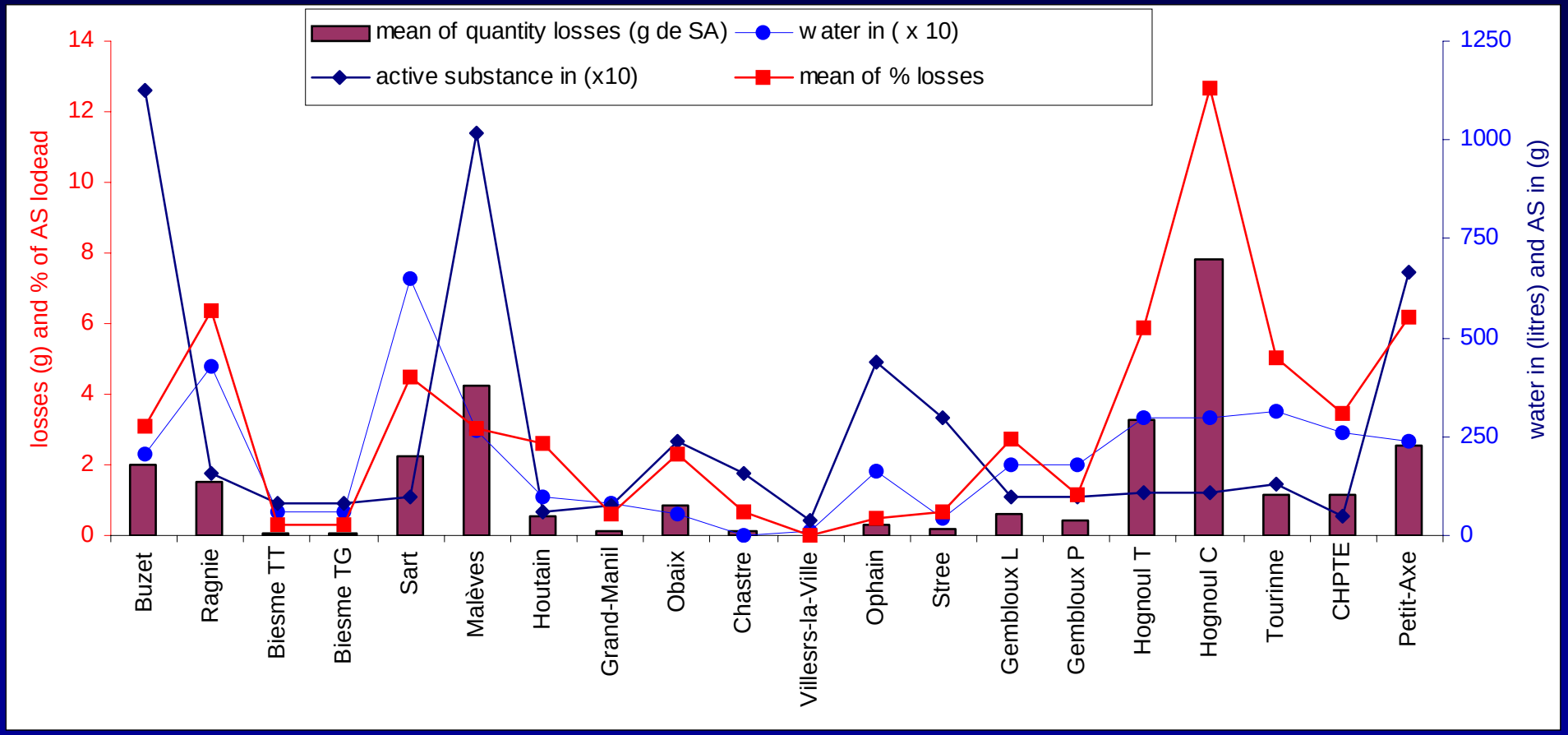
Analytical methods were validated : specificity, linearity, accuracy (recoveries), reproducibility, LOD, LOQ

Substrate analyse

	2004			2005		
	min	moy	max	min	moy	max
DM (%)	41	52	67	24	44	61
NH4 (mg/ kg)	0.9	201	2139	-	-	-
C/N	8.3	17.7	55.3	6.4	17.7	44.0
Respiro (mg/kg/h)	4	13	34	2	6	21

Water management (excess or lack) seems to have the greatest influence on biological parameters

Efficiency
Effect of pesticides amount and water volume



Losses are rather well correlated with the treated water volume