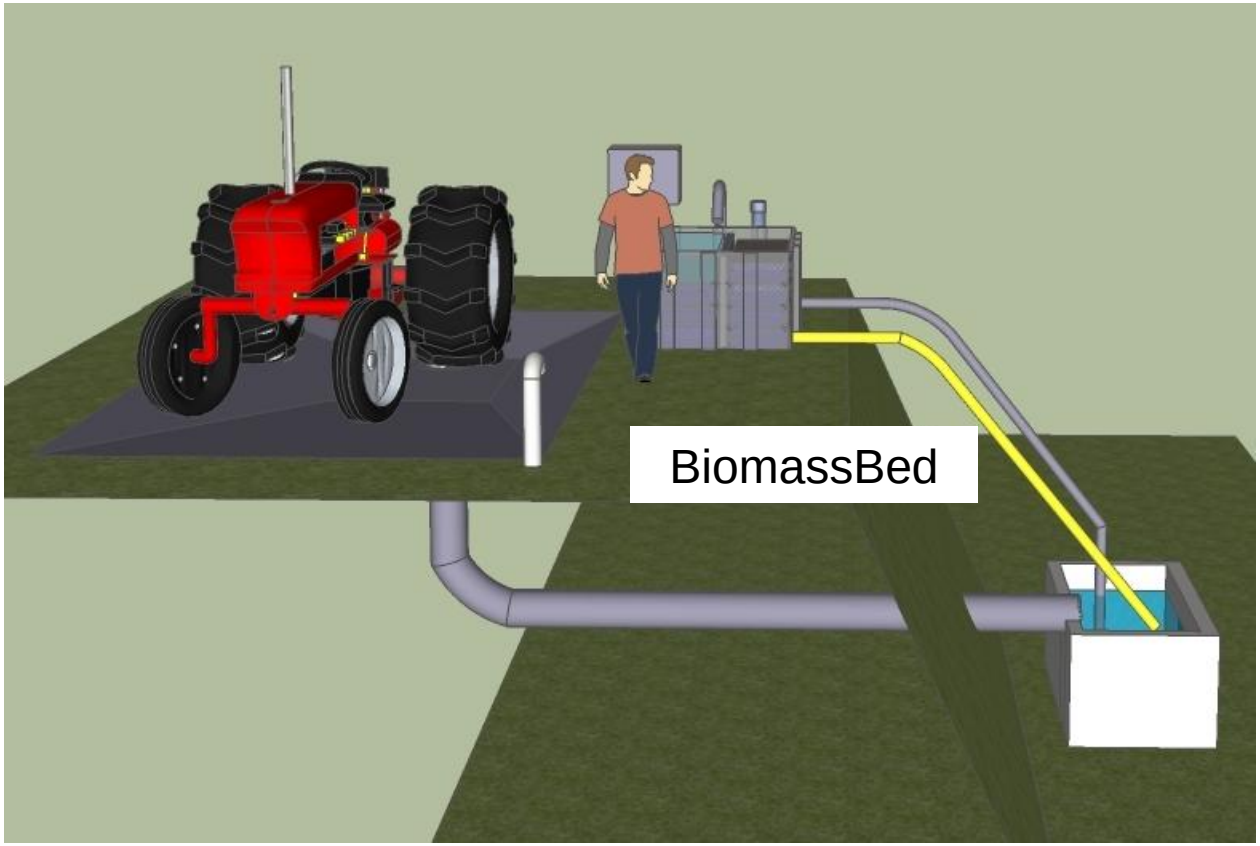
Bio-cleaning of contaminated water by fungicides applied in vineyard



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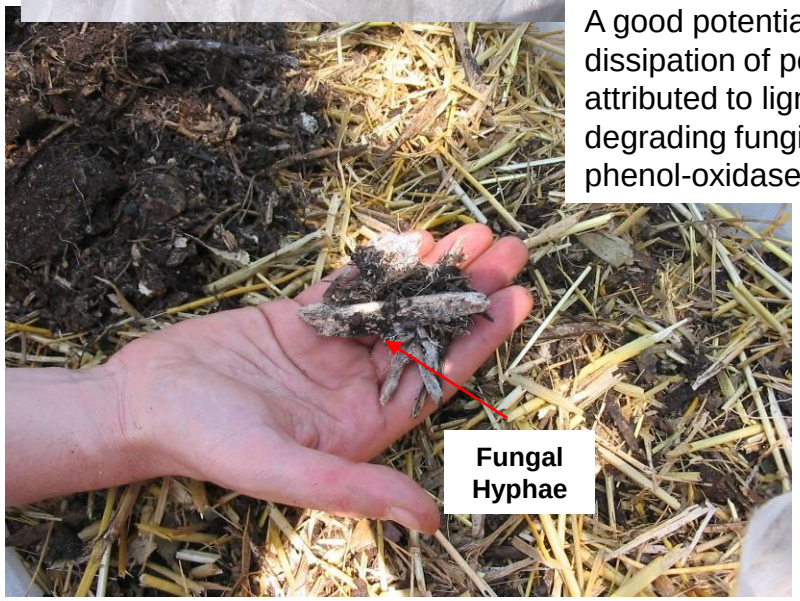
Viticulture is one of the most important agricultural practice in Mediterranean Area and it requires intensive use of fungicides.

…preparing bio-mixture at the vineyard

A good potential in dissipation of pesticides is attributed to lignin degrading fungi and their phenol-oxidase activity

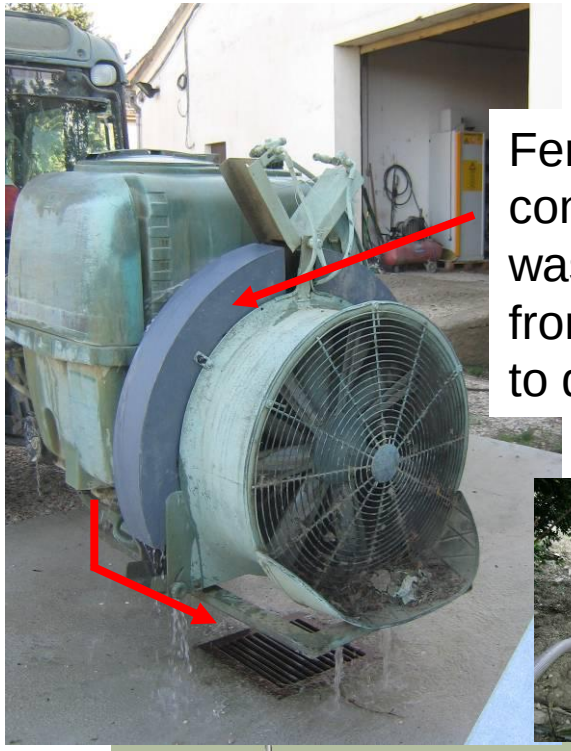


An organic biomass of pruning residues and straw was considered as a natural substrate for growth and proliferation of such microflora and used as bio-sorbent in the BiomassBed

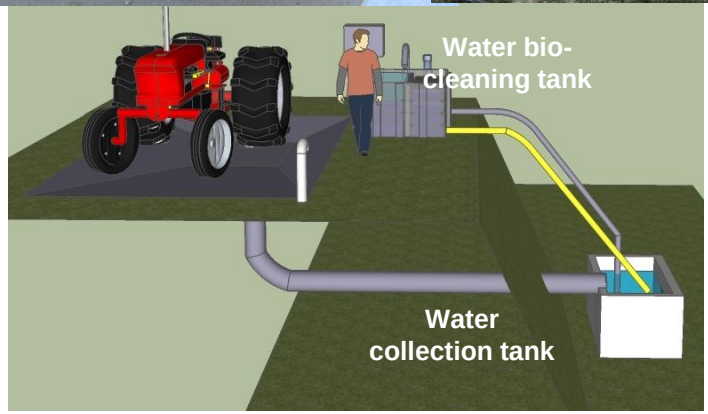
…filling BiomassBed and managing washing water

7.5 kg of organic biomass each box

60 kg of organic biomass in the BiomassBed



Fenders to convey washing water from nozzles to drain



Treatments in vineyard

Volume of residual formulates in tank 6-15L (washed with about 100L of water)

Only organic funigicides were downloaded in the BiomassBed to avoid inhibition of microbial activity by copper

2008

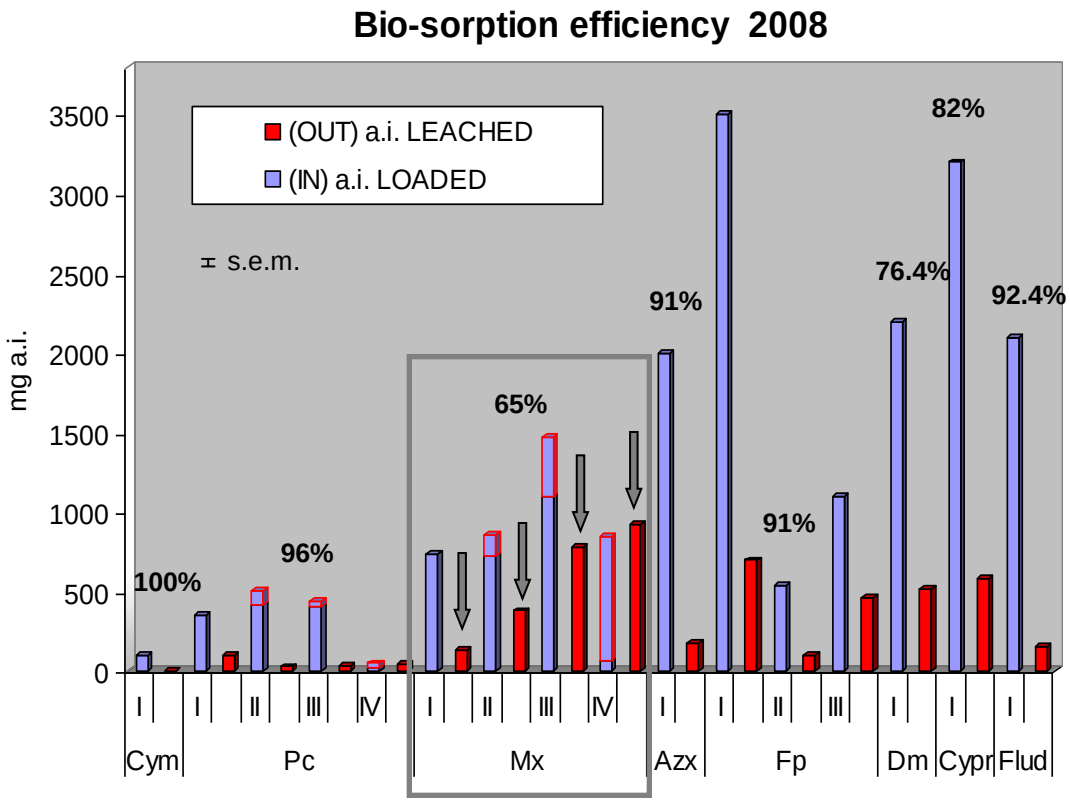
	n° of applications
- Cymoxanil	1
- Penconazole	4
- Metalaxyl M	4
- Azoxystrobin	1
- Folpet	3
- Dimethomorph	1
- Cyprodinil	1
- Fludioxonil	1

2009

	n° of applications
- Cymoxanil	2
- Penconazole	3
- Metalaxyl M	2
- Mandipropamid	4
- Dimethomorph	1
- Pyraclostrobin	1

Treatments (organic fungicides mixtures) 2008	Residues in washing water (mg)	Time between treatments (d)
30/04 cymoxanil	100	0
15/05 metalaxyl+penconazole	740+350	15
27/05 metalaxyl+penconazole	730+420	10
06/06 metalaxyl+folpet+penconazole	1100+3500+410	9
09/06 metalaxyl+folpet+penconazole	70+540+23	3
20/06 azoxystrobin+folpet	2000+1100	10
16/07 dimetomorph	2200	24
25/07 cyprodinil+fludioxonil	3200+2100	8
Treatments (organic fungicides mixtures) 2009		
28/04 cymoxanil	1900	0
06/05 dimetomorph	2200	8
14/05 mandipropamid+penconazole	680+240	7
26/05 mandipropamid+penconazole	1300+440	12
05/06 metalaxyl+penconazole	1000+500	9
16/06 mandipropamid+metalaxyl	420+250+520	10
30/06 pyraclostrobin	1100	13
22/07 cymoxanil	1300	21
28//07 mandipropamid	1600	6

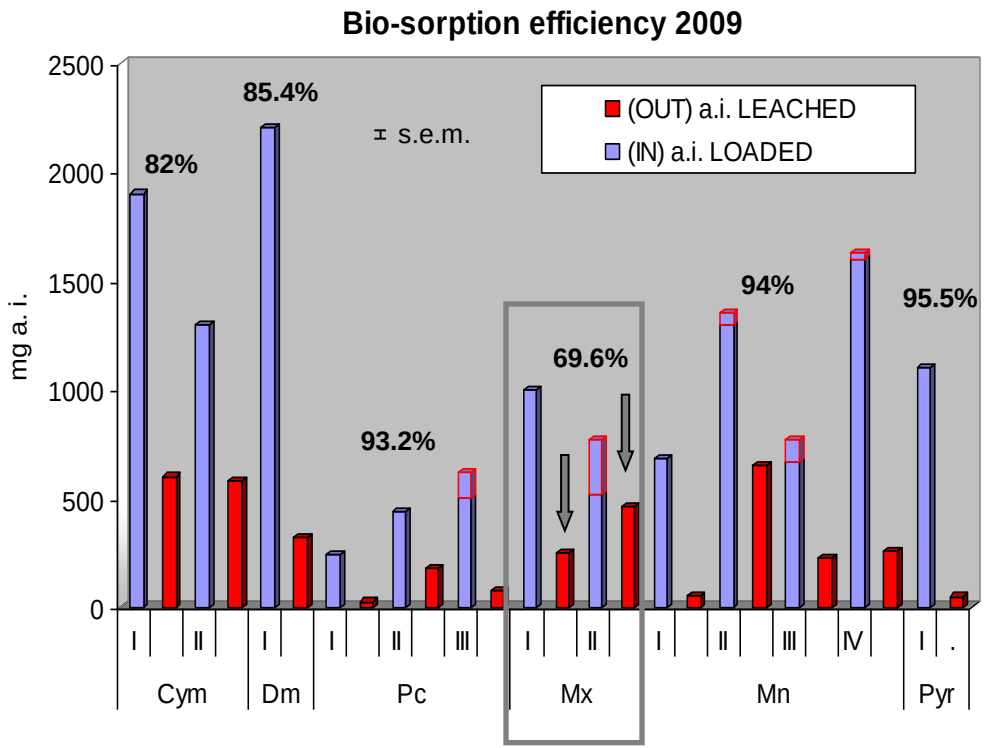
At each treatment contaminated water was re-circulated to allow fungicides retention



I, II, III, IV= n°of applications

s.e.m. = standard error of the mean

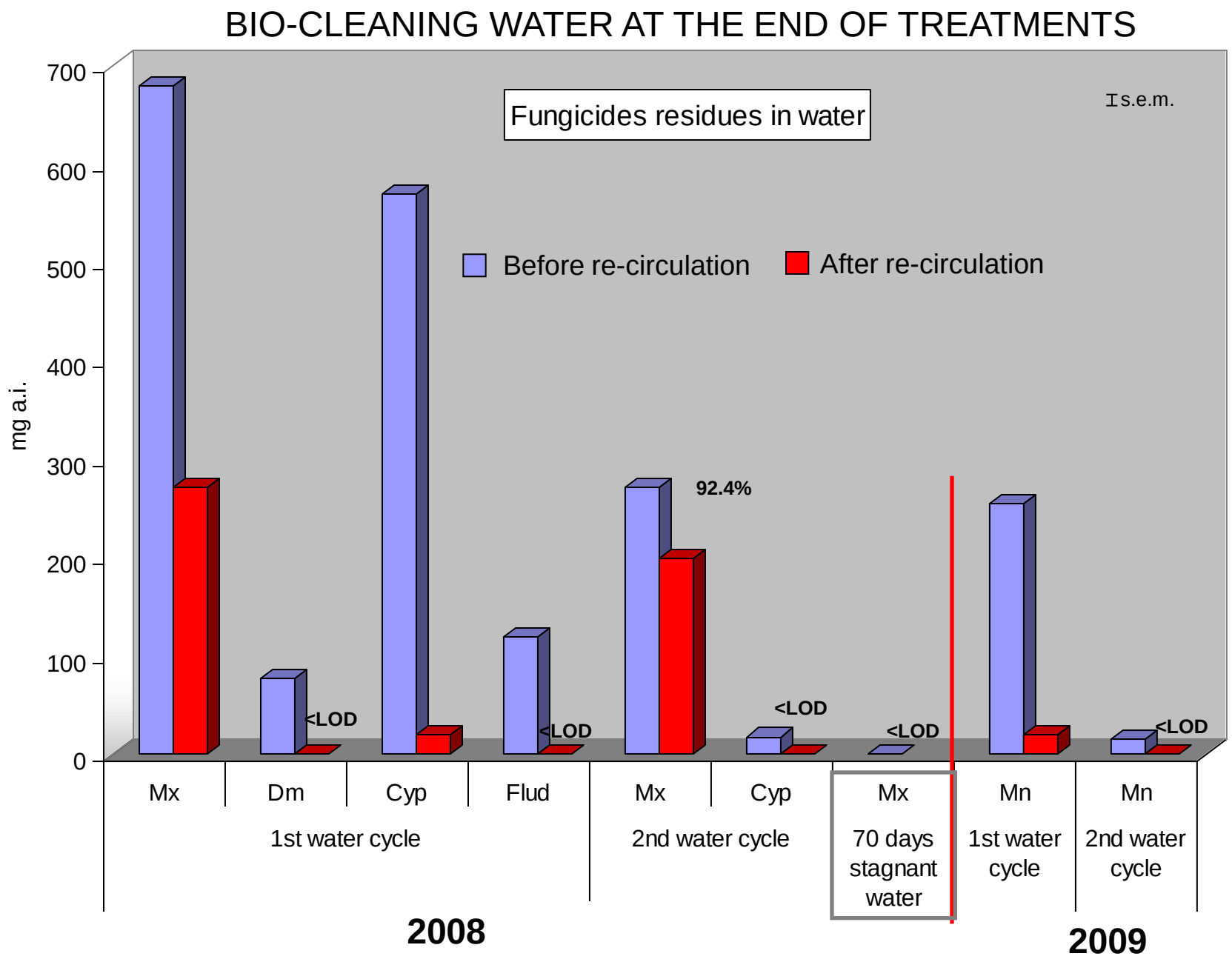
Active ingredient (a.i.)	Total a.i. LOADED (mg)	Total a.i. LEACHED (mg)
Cym (cymoxanil)	100	<LOD
Pc (penconazole)	1203	50
Mx (metalaxyl)	2640	920
Azx (azoxystrobin)	2000	180
Fp (folpet)	5140	463
Dm (dimetomorph)	2200	520
Cypr (cyprodinil)	3200	580
Flud (fludioxonil)	2100	160



I, II, III, IV= n°of applications

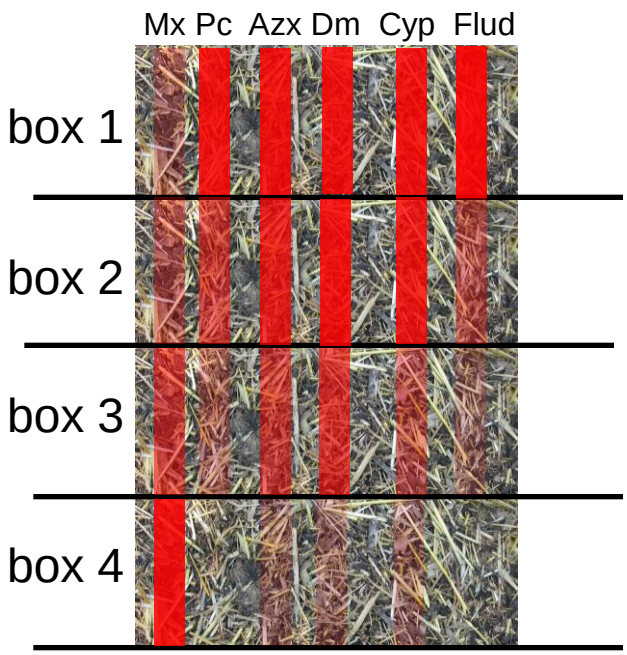
s.e.m. = standard error of the mean

Active ingredient (a.i.)	Total a.i. Loaded (mg)	Total a.i. Leached (mg)
Cym (cymoxanil)	3200	580
Dm (dimetomorph)	2200	320
Pc (penconazole)	1180	80
Mx (metalaxyl)	1520	462
Mn (mandipropamid)	4250	255
Pyr (pyraclostrobin)	1100	50

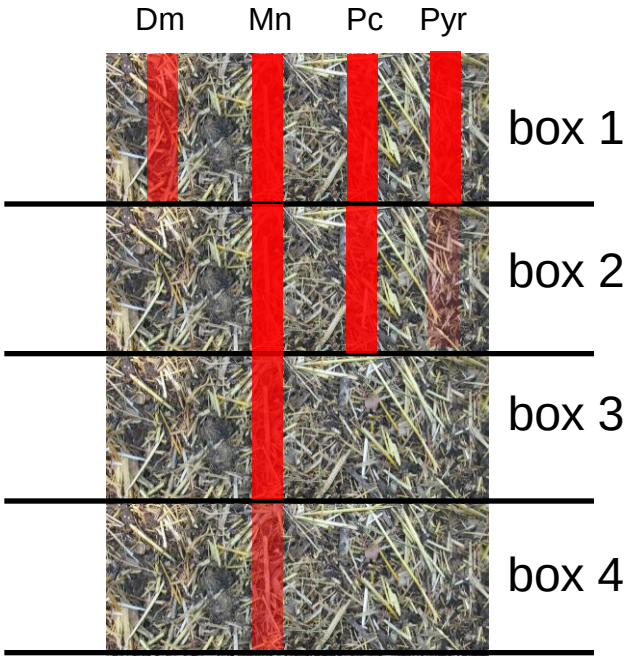

BIO-CLEANING WATER AT THE END OF TREATMENTS
Fungicides residues in water
Is.e.m.
Before re-circulation
After re-circulation
mg a.i.
700
600
500
400
300
200
100
0
<LOD
<LOD
92.4%
<LOD
<LOD
<LOD
Mx
Dm
Cyp
Flud
Mx
Cyp
Mx
Mn
Mn
1st water cycle
2nd water cycle
70 days stagnant water
1st water cycle
2nd water cycle
2008
2009

Fungicides mobility into the bio-sorbent

2008



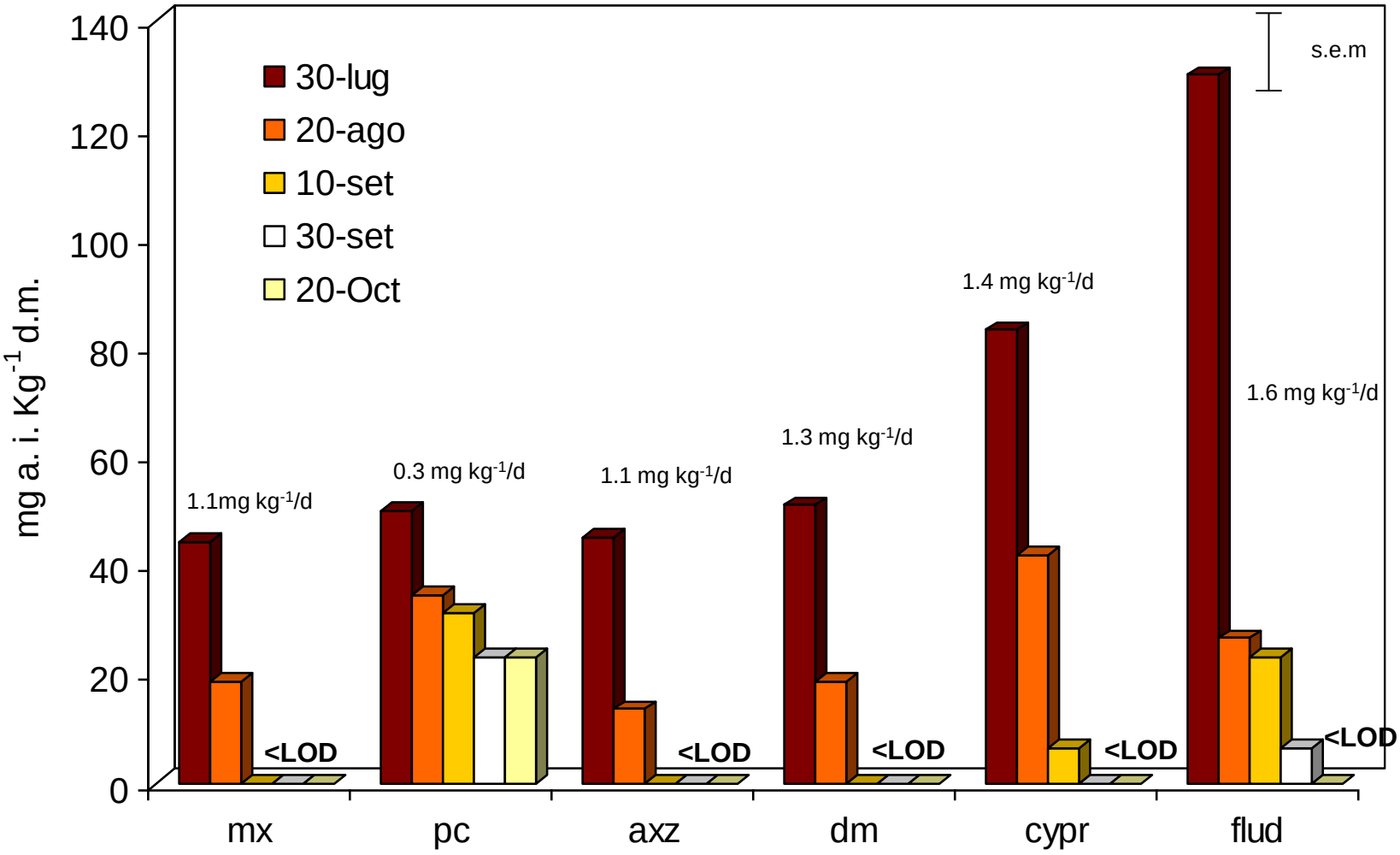
2009



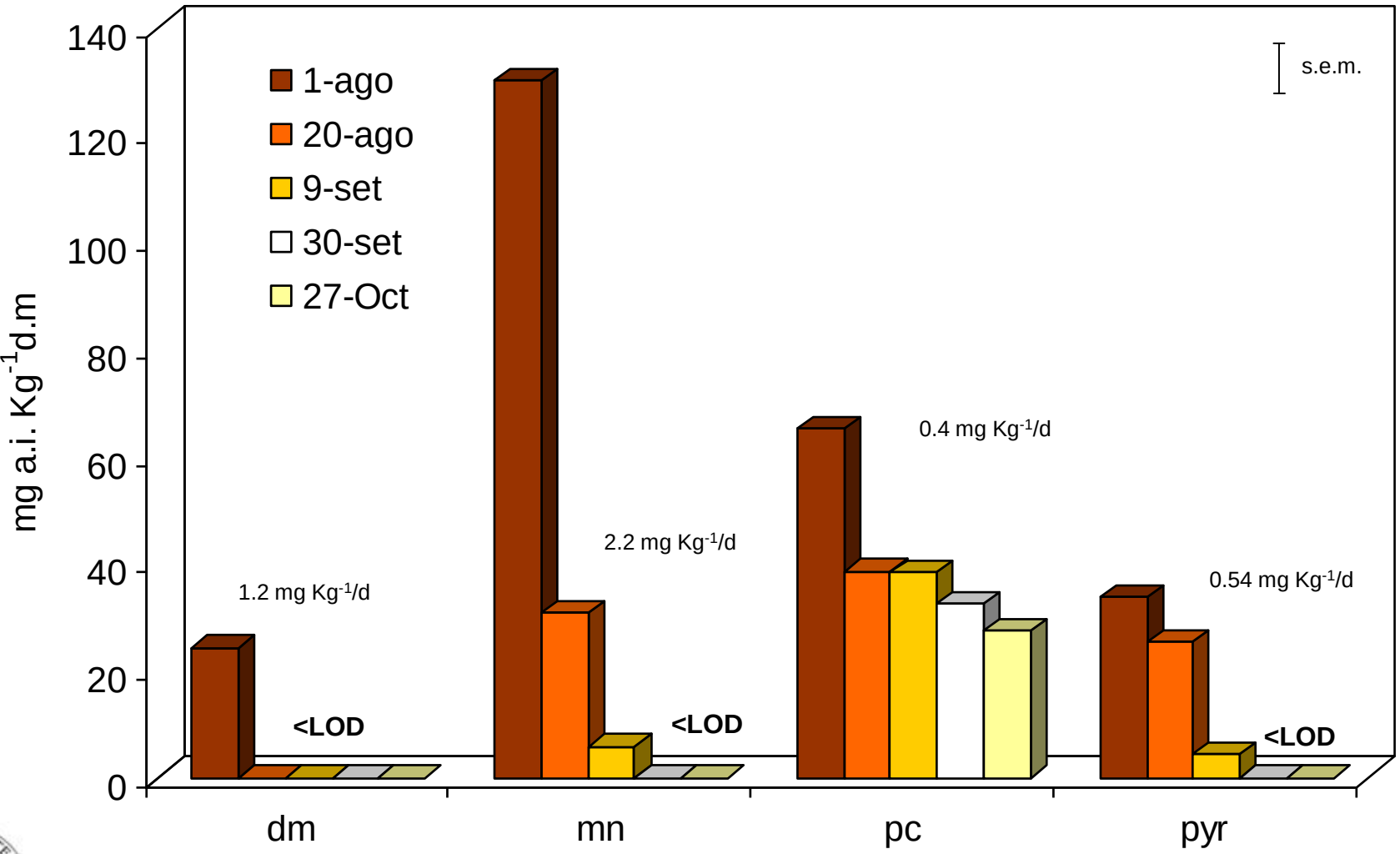
Fungicides dissipation was followed in the 1st and 4th box

Fungicides dissipation was followed in the 1st box

Fungicides Dissipation 2008

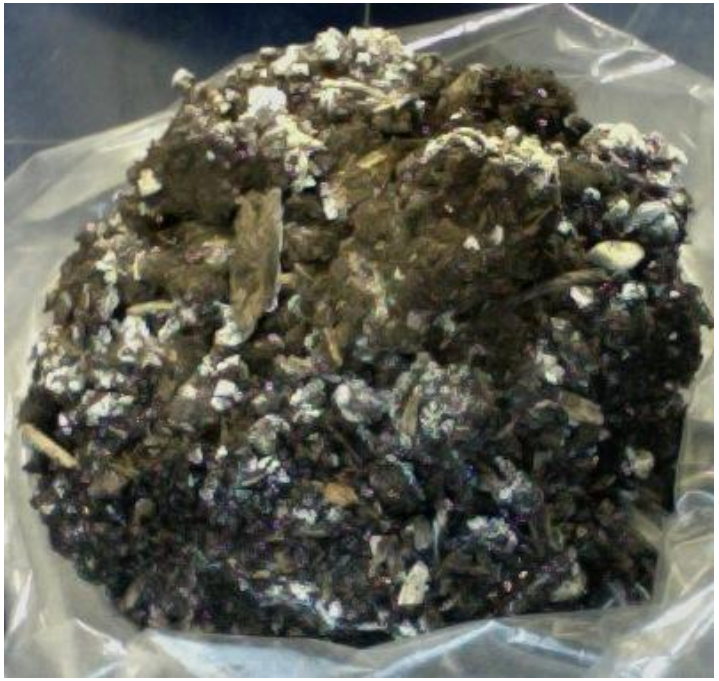


Fungicides Dissipation 2009



Bio-mixture at the end of re-circulation of water (July)

Bio-mixture after 80 days (October)



Summarizing…

- Total retention efficiency varied from 92.4% to 100% for fungicides at concentrations loaded during 2008-2009

-Two further water-cycles were needed to retain fungicides residues remained in water at the end of treatments period

- Metalaxyl M was the less retained fungicide and it has been shown to be desorbed during re-circulation of water

- Metalaxyl M dissipated within 70 days in stagnant water (combination of abiotic + biotic factors?)

- Dissipation of fungicides occurred within 40-80 days (2008) and 20-60 days (2009) with the exception of penconazole that degraded relatively slow and showed tendency to accumulate

Conclusions

Bio-mixture allowed a good efficiency in bio-sorption and dissipation of fungicides

BiomassBed + pruning residues + straw has showed good performance in bio-cleaning water from fungicides applied in vineyard…still working on the mobility of weakly adsorbed fungicides and looking for a faster degradation of triazoles!

Thank you all!