AND CARRIERS OF HERBICIDE IMAZAMOX FOR SMART CONTROL OF *STRIGA* AND *OROBANCHE* SPP. WEEDS

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INTRODUCTION

• Parasitic plants as *Striga* and *Orobanche* spp. are controlled by the systemic herbicide imazamox, which has to act at early stages of weed seeds germination in the root zone.

• Imazamox is an ionic herbicide with high water solubility and soil mobility: high risk of water contamination and loss of efficacy.

OBJECTIVES

• Formulations of imazamox with modified nanosilicates and its application in the root zone favor the smart delivery of the herbicide and a better control of the parasitic plants.

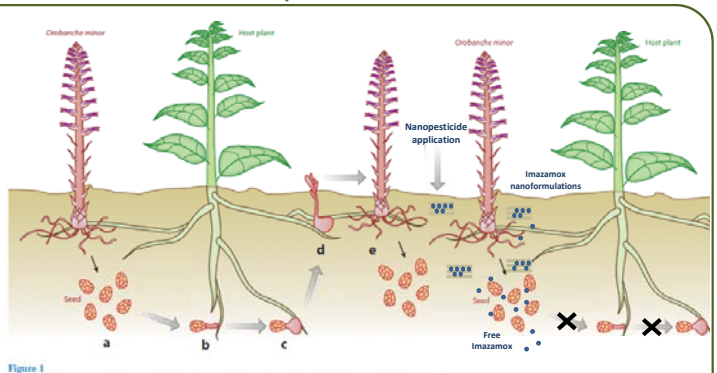


Figure 1
Life cycle of a root parasitic plant, *Orobanche minor*. (*a*) Seed germination is elicited by host-derived stimulants, including strigolactones. (*b*) Seedling attaches to host root with haustoria. (*c–d*) Parasite tubercles grow underground for several weeks or months before emergence of the flowering shoots. (*e*) The parasite produces a large number of seeds, which remain viable for many years in soil.
From Xie et al. 2010. The Strigolactone Story. Annu. Rev. Phytopathol. 48:93-117

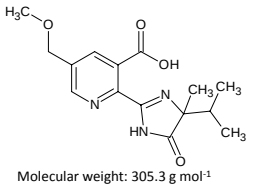
Application of imazamox as smart release formulations of nanosilicates

Modified from Xie et al. 2010. The Strigolactone Story. Annu. Rev. Phytopathol. 48:93-117

MATERIALS AND METHODS

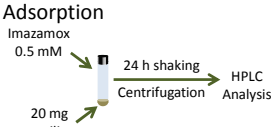
Nanosilicate: SWy montmorillonite
Inorganic cation: Fe^{3+}
Biopolymers: Chitosan

Herbicide: Imazamox



Molecular weight: 305.3 g mol^{-1}
Water solubility (pH 7, 20ºC): 626 g L^{-1}
Kow, log P (pH 5-6, 20ºC): 0.73
pKa: 2.3, 3.3, 10.8

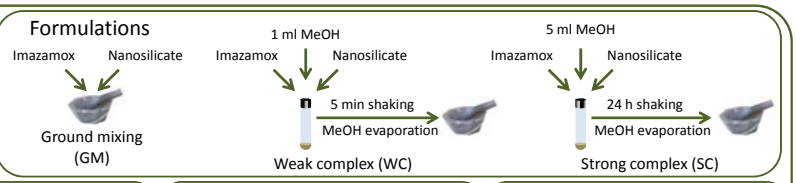
Adsorption



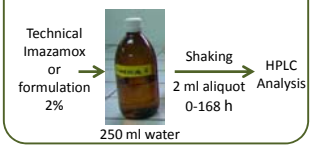
Soil

23.8% Sand	pH: 8.31
48.2% Silt	2.19% OM
28.1% Clay	22.6% $CaCO_3$

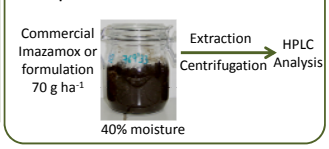
Formulations



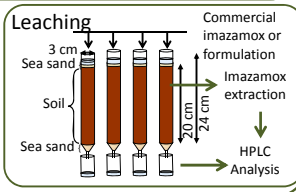
Water release kinetics



Dissipation

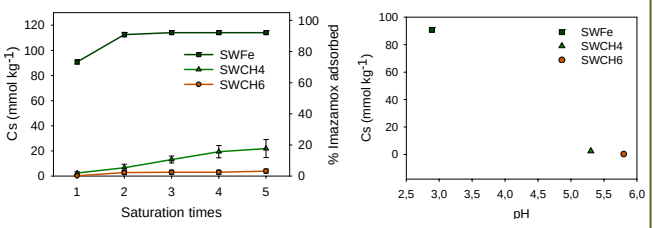


Leaching



RESULTS AND DISCUSSION

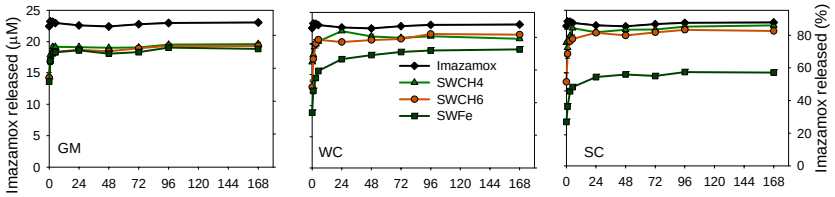
Adsorption



Imazamox is adsorbed on SWCH4 and SWCH6 mainly on external surfaces covered by the biopolymer , by polar and hydrophobic bonds, whereas on SWFe is also adsorbed at the interlayers by polar, even ionic forces.

The greater adsorption of imazamox observed on SWFe is due to the acidity provided by Fe^{3+} that promotes the protonation of imazamox.

Water release

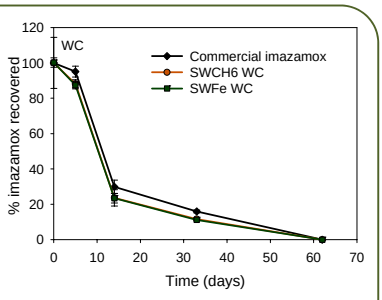


The herbicide release decreased from the WC and SC formulations made with SWFe as compared with the formulations prepared with SWCH4 and SWCH6.

WC formulations showed a good performance to release imazamox, ranging from 73 to 82 %, and to be used as smart delivery systems.

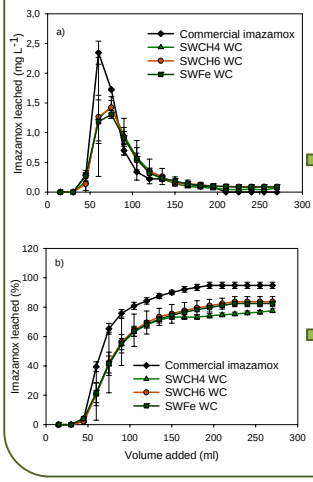
Dissipation

No significant differences were observed on the herbicide dissipation between the commercial imazamox and the herbicide in the formulations.



Imazamox	$t_{1/2}$ (d)	r^2
Commercial	11.7 (9.6-15.0)	0.911
SWCH6	10.1 (8.3-12.9)	0.913
SWFe	10.0 (8.2-12.6)	0.917

Leaching curves



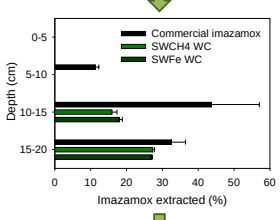
Results show good performance of imazamox-nanosilicate formulations for decreasing herbicide losses:

a) Peak maximum concentration is reduced to the half of the commercial

b) Total leaching is reduced 10-15% with the formulations as compared to the commercial imazamox

Soil column residue

Leaching experiment stopped after 20% imazamox leached out, showed the following soil column distribution



Lower recovery (65%) found as formulation suggests the entrapment or irreversible bound herbicide to clay nanoparticles.

CONCLUSIONS

• Imazamox-nanosilicate WC formulations have shown that can be used as smart release systems of the herbicide, reducing herbicide losses and with no effect on soil dissipation.

• Further studies are needed to check the availability of imazamox from the formulations in the root zone , and their efficacy on the control of *Striga* and *Orobanche* spp. weeds

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