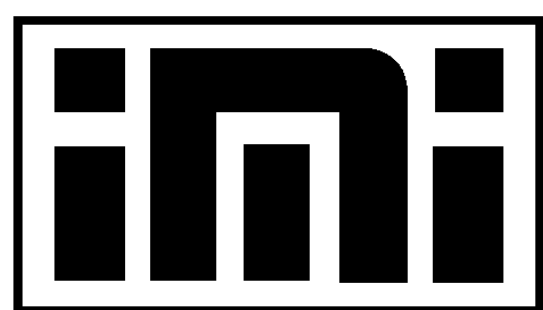


PERSISTENCE AND MOBILITY OF GREEN HERBICIDES IN AGRICULTURAL SOIL



S. Stipičević (1), G. Mendaš (1), M. Dvorščak (1), K. Barić (2),
A. Pintar (2), T. Jurina (3), N. Udiković-Kolić (4)

(1) Institute for Medical Research and Occupational Health, Zagreb, Croatia
Phone: +385 1 4682 500; E-mail: stipicevic@imi.hr

(2) University of Zagreb, Faculty of Agriculture, Zagreb, Croatia

(3) University of Zagreb, Faculty of Food Technology and Biotechnology, Zagreb, Croatia

(4) Ruđer Bošković Institute, Zagreb, Croatia



The triketone herbicides mesotrione and tembotrione and the pyrazole herbicide topramezone have recently been registered for use with maize as a substitute for restricted triazine herbicides. Triketone and pyrazole herbicides are considered to be safe for the environment and end-users due to lower rates of application and shorter persistence in soil compared to triazines. In this work, mesotrione, tembotrione and topramezone were applied to maize post-emergence at a registered and double higher rate.

– OBJECTIVE –

- To validate the application of novel herbicides as a *green* substitute for triazines under the most common agronomic conditions

In particular

- To assess the herbicidal efficacy
- To determine the vertical distribution of residues in soil up to 40 cm of depth during maize cultivation
- To obtain the herbicide dissipation rate in the microbiologically active topsoil under field and laboratory conditions in relation to the application rate
- To evaluate the topsoil affinity for herbicide adsorption
- To estimate the herbicide leachability potential in soil under heavy rainfall regime (85 mm in the first week of herbicide application)

Herbicide	Basic structure	R ₁	R ₂	R ₃
Mesotrione			NO ₂	H
Tembotrione			Cl	CH ₂ OCH ₂ CF ₃
Topramezone			CH ₃	

TOPSOIL
0-20 cm

pH = 7.4
C_{org} = 1.19 %
Texture = silt-loam
Density = 1390 kg/m³
Porosity = 48 %
Water capacity = 40 %

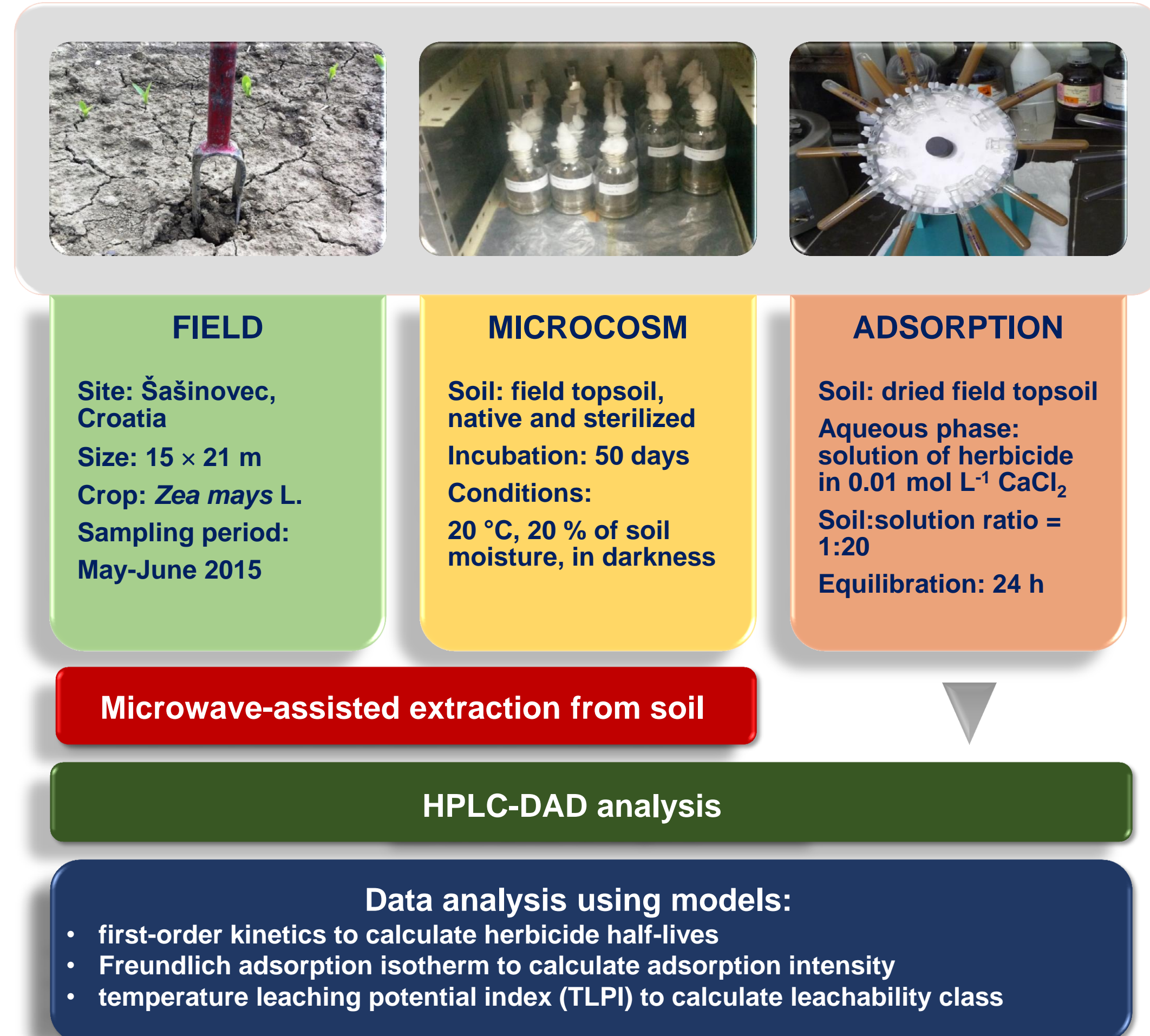
SUBSOIL
20-40 cm

pH = 7.5
C_{org} = 1.16 %
Texture = silt-loam
Density = 1363 kg/m³
Porosity = 49 %
Water capacity = 42 %

– CONCLUSIONS –

- Novel herbicides are mobile but easily biodegradable molecules in neutral, poorly humid and porous silt-loam soil, with a low leaching potential through soil horizons
- Under relatively warm and humid field conditions, complete dissipation from the first 40 cm of soil may occur in 8 days (topramezone) or 15 days (triketones) from their application
- The dissipation rate of all three herbicides was not significantly affected with enhanced application rate, but their biodegradation rate was lowered, confirming a detrimental effect of enhanced herbicide rates
- Topramezone showed a broader weed control spectrum at lower application rate, but also faster field dissipation, slower biodegradation rate and higher soil mobility compared to triketones, which classifies topramezone as a similarly harmful molecule as triazines
- Triketone herbicides mesotrione and tembotrione seem to be promising herbicides in integrated agricultural systems

– EXPERIMENTAL –

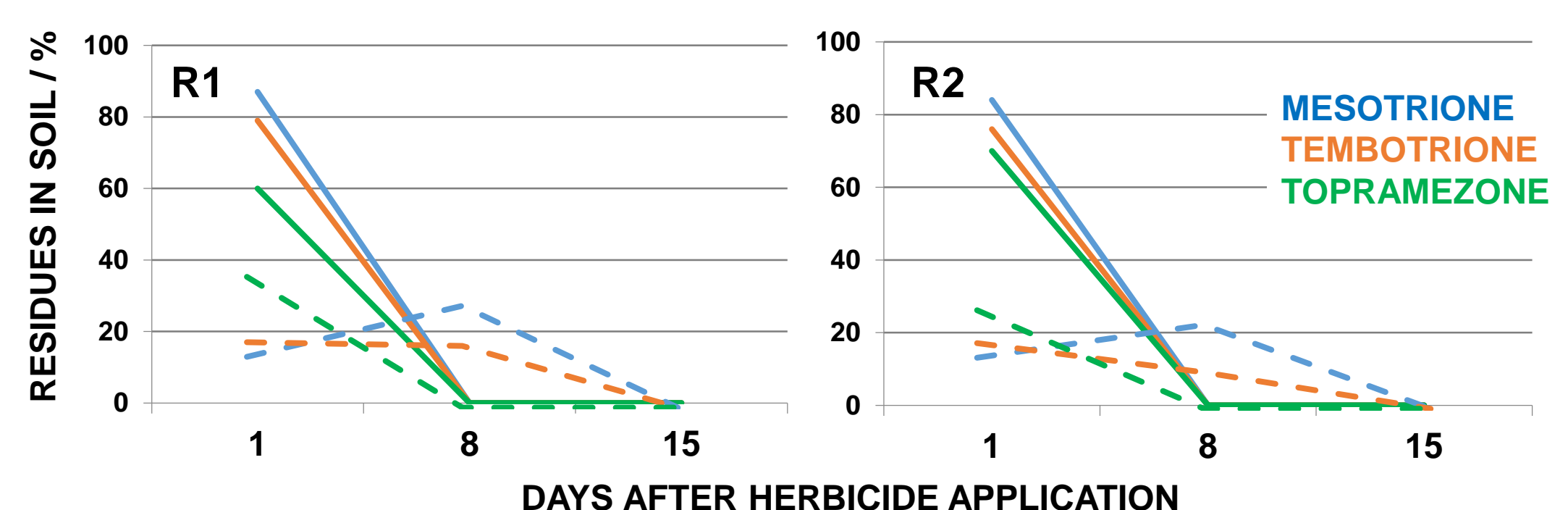


– RESULTS –

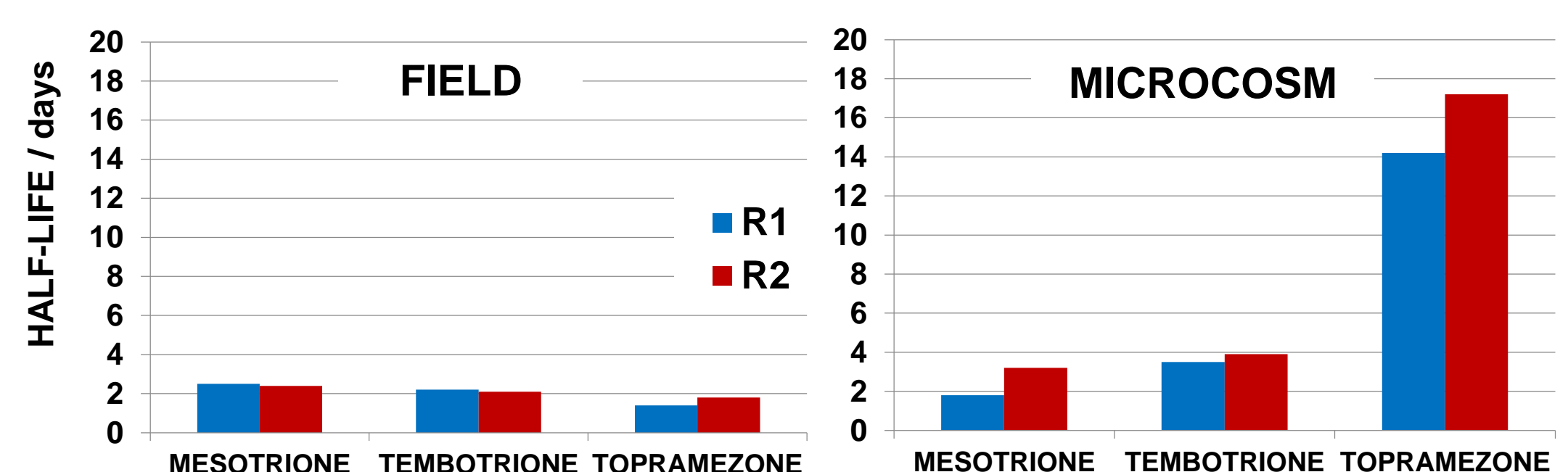
TREATMENTS AND HERBICIDAL EFFICACY

Treatment	Rate (g/ha)	Mass fraction (µg/kg)	Weed control (%)	
			Broadleaved	Grass
MESOTRIONE (Callisto 480 SC, Syngenta)	R1 120	43	99	21
	R2 240	86	99	46
TEMBOTRIONE (Laudis, Bayer)	R1 99	36	97	36
	R2 198	71	73	40
TOPRAMEZONE (Clio, BASF)	R1 75	27	100	99
	R2 150	54	100	100

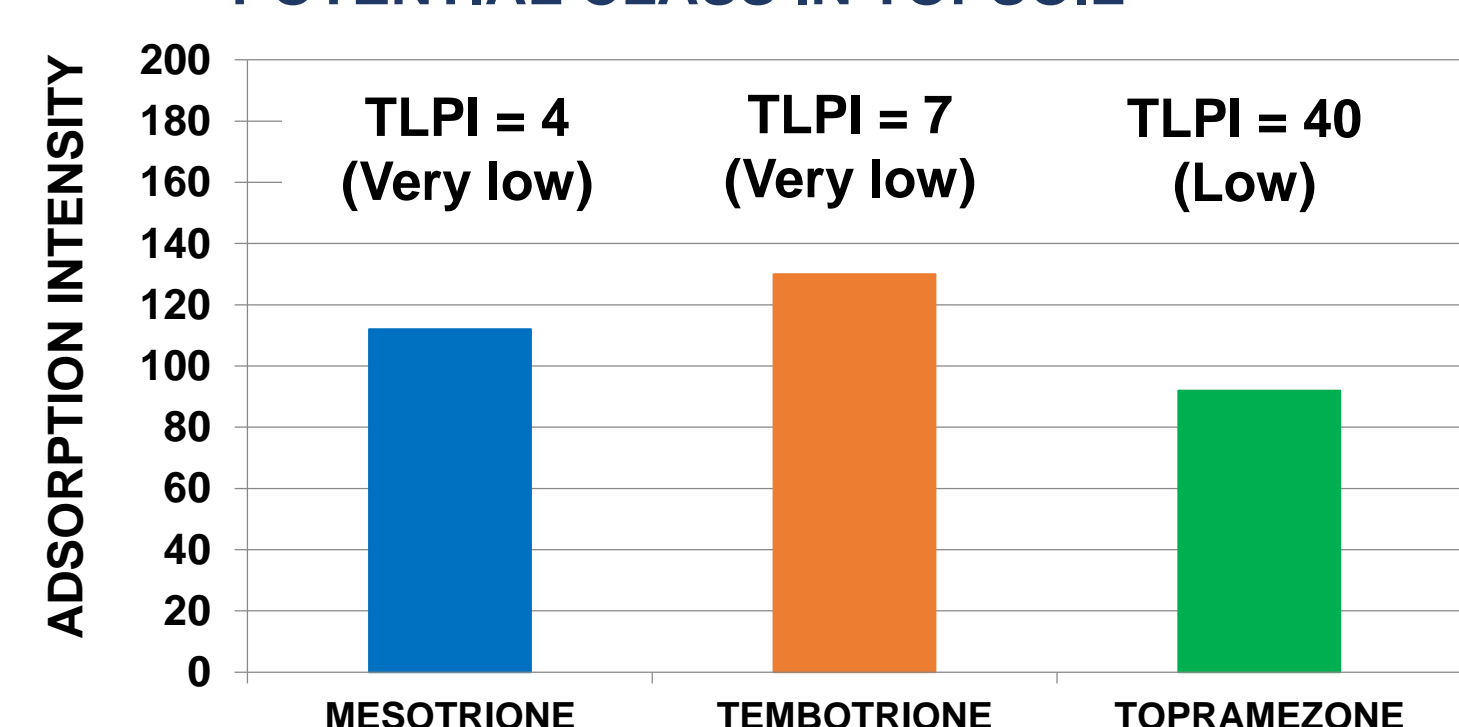
VERTICAL DISTRIBUTION OF RESIDUES IN SOIL DURING MAIZE CULTIVATION: TOPSOIL (SOLID LINE), SUBSOIL (DASHED LINE)



HERBICIDE PERSISTENCE IN TOPSOIL



HERBICIDE MOBILITY AND LEACHABILITY POTENTIAL CLASS IN TOPSOIL



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