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AVAILABILITY OF SOIL AND ORGANIC FERTILIZER MICRONUTRIENTS

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Several problems are encountered in the evaluation of the micronutrients availability in soils or some organic materials : metal speciation (t. I), very low level concentration in plants (t. II, III, IV), antagonistic effects with other minor or major elements (t. V, VI), rapid variations of the trace elements mobility in the rhizospheric sites.

In the soil solutions, micronutrients exist at very low level concentration, chiefly as organic mineral complex molecules (t. VII). Several extraction solutions are utilized : hot water, acetic acid, ammonium acetate, acetic acid mixtures, neutral salts, mineral acids at various rates of dilution and, more recently, complexing molecules as EDTA, DTPA, EDDHA. (t. VIII, IX).

Biological methods including Aspergillus Niger test (t. X) or the critical level evaluation of metal in the plant tissues are also frequently employed (t. XI, XII).

In some organic fertilizers as sewage sludge or town refuse composts, complexing agents are chiefly utilized but in some cases mineral acids (as diluted HCl) can be successfully employed for the prediction of the minor element availability (t. XIII).

On of the greatest actual difficulties encountered in the study of micronutrients is that different methodologies have been utilized for analysis in the world : the standardization of these methodologies should be rapidly realized.

Table II : Major and minor element range concentration values in plants.

Eléments majeurs en g/kg de matière sèche :	
- N	20
- P	4
- K	20
Méso-éléments en g/kg de matière sèche :	
- Mg	3
- Ca	16
- S	2
Oligo-éléments en g/kg de matière sèche :	
- Fe	0,10
- Mn	0,05
- Zn	0,03
- Cu	0,01
- B	0,02
- Mo	0.0015
- Co	0,00015

Table XI : Mean values of critical deficiency levels of micronutrients in plants (ppm/dry matter).

Bore	20
Cuivre	3 - 5
Fer	20
Manganèse	20
Molybdene	0,07 - 0,10
Zinc	15
Cobalt	0,05
Selenium	0,1
Vanadium	0,002

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Table III : Comparison between the amount of available mineral fertilizer in soil and the amount absorbed by a maize yield (18,5 D.M./ha).

Elément	Quantité de l'élément absorbée durant la culture (kg/ha)	Quantité de l'élément "disponible" dans le sol (kg/ha)	Rapport de la quantité "disponible" à la quantité absorbée
P_2O_5	70	600	8,6
K_2O	255	600	2,4
MgO	50	400	8,0
Cu	0,060	20	333,3
Mn	0,530	40	75,5
Zn	0,410	20	48,8

Table XII : Critical phytotoxicity levels of some micronutrients in two soils differing in their cation exchange capacity.

	Métal introduit sous forme de sel		Métal introduit sous forme de boue	
	Ray-grass	Radis	Ray-grass	Radis
Sol limoneux				
. Zinc	500	$0 < x < 125$	125	125
. Nickel	25	$0 < x < 25$	50	$0 < x < 25$
. Plomb	$x > 200$	$x > 200$	$x > 200$	$x > 200$
. Mercure	$x > 5$	$x > 5$	2	$x > 5$
. Cadmium	1	> 10	> 10	5
Sol sableux				
. Zinc	250	$0 < x < 125$	125	125
. Nickel	$0 < x < 25$	$0 < x < 25$	> 100	75
. Plomb	150	100	> 200	150
. Mercure	> 5	> 5	> 5	> 5
. Cadmium	2	5	> 10	> 10