

# Results of the 9th Needle/Leaf Interlaboratory Comparison Test

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**Austrian Federal Research and Training Centre for Forests**

ISBN 3-901347-60-7

CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION  
INTERNATIONAL CO-OPERATIVE PROGRAMME ON ASSESSMENT AND  
MONITORING OF AIR POLLUTION EFFECTS ON FORESTS  
and  
EUROPEAN UNION SCHEME  
ON THE PROTECTION OF FORESTS AGAINST ATMOSPHERIC POLLUTION

United Nations Economic Commission for Europe	European Commission
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8<sup>th</sup> Needle/Leaf Interlaboratory  
Comparison Test 2005/2006



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ISBN 978-3-901347-66-5

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Comparison Test 2006/2007



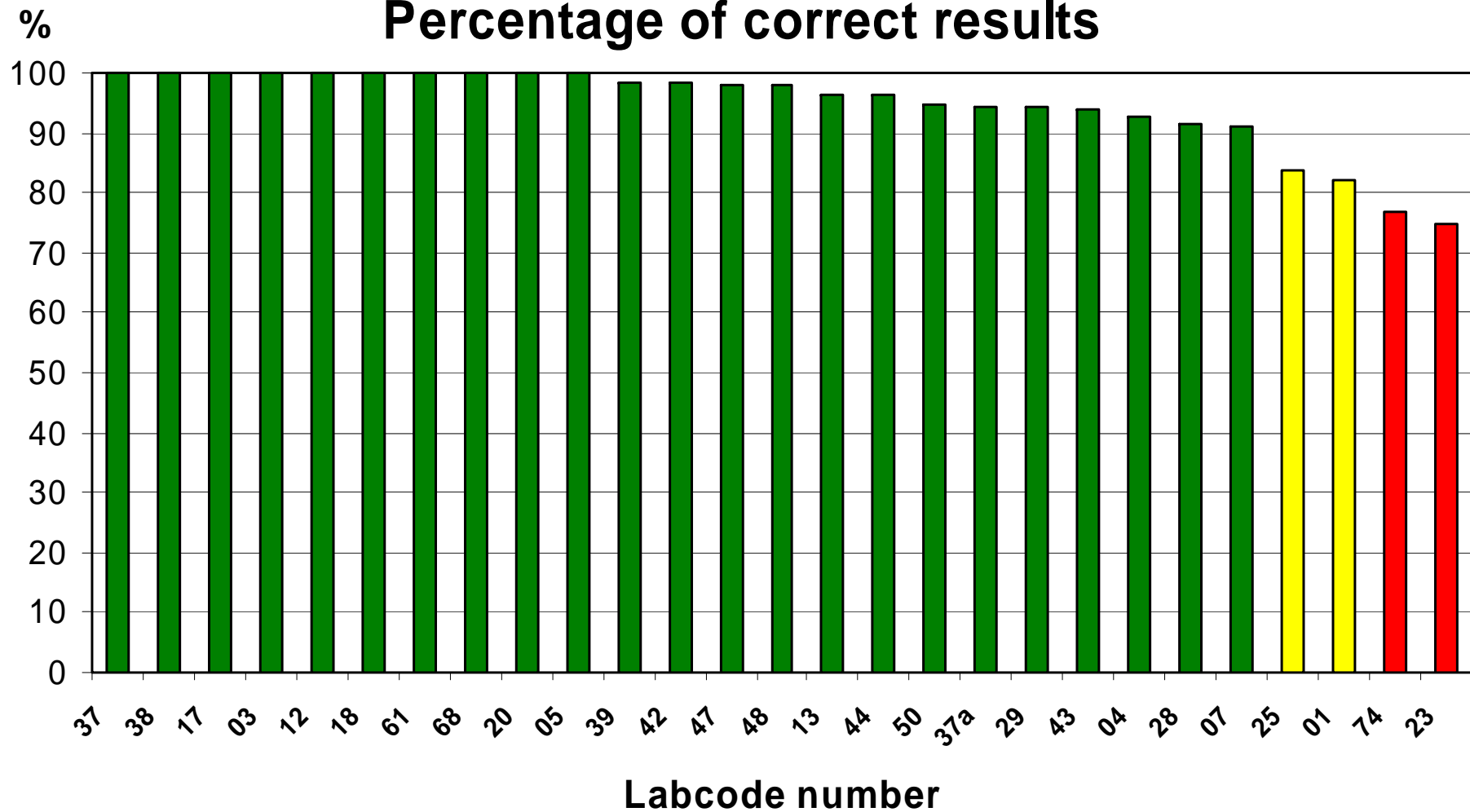
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# 9th Ringtest - **Level II** laboratories

## Percentage of correct results



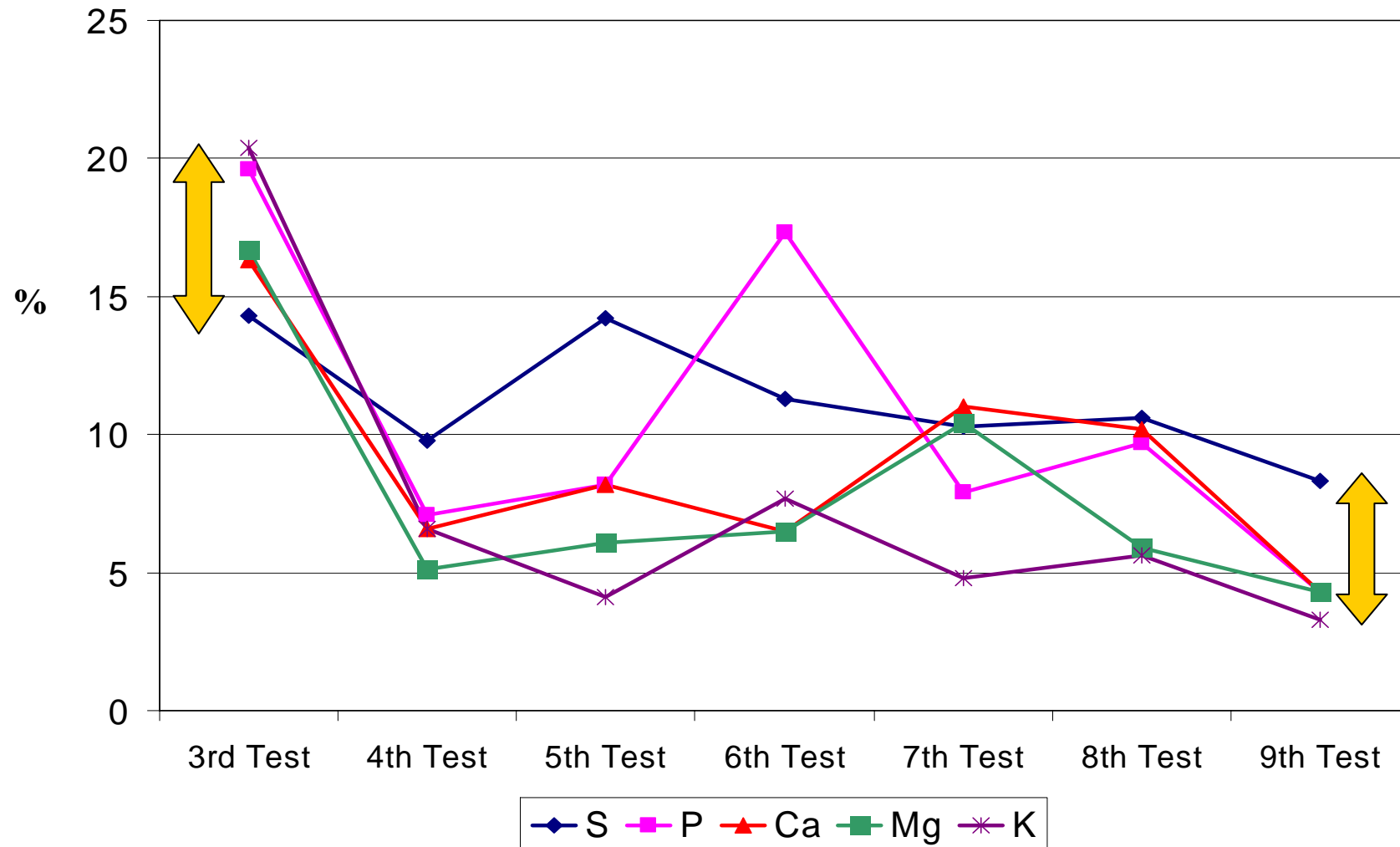
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# Percentage of „non tolerable“ results

mand. Element	+/-	6th Test	7th Test	8th Test	9th Test
N	10	3,0	3,2	7,3	6,1
S	20	11,3	10,3	10,6	8,3
P	15	17,3	7,9	9,7	4,3
Ca	15	6,5	11,0	10,2	4,3
Mg	15	6,5	10,4	5,9	4,3
K	15	7,7	4,8	5,6	3,3



## Progress in Quality - "non tolerable" results



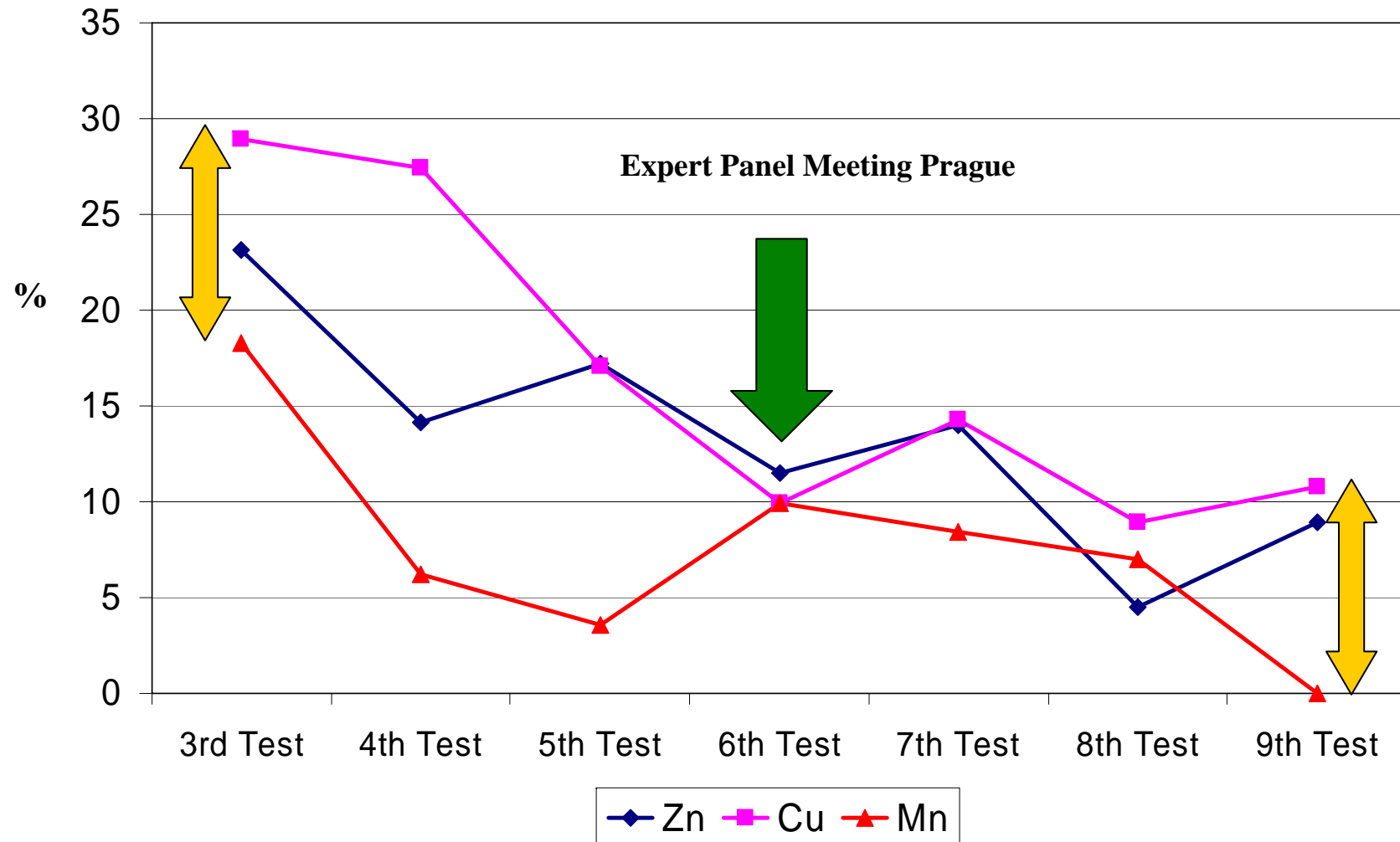
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# Percentage of „non tolerable“ results

opt. Element	+/-	6th Test	7th Test	8th Test	9th Test
Zn	15	11,5	14,0	4,5	8,9
Mn	15	9,9	8,4	7,0	0,0
Fe	20	8,8	10,3	7,1	9,9
Cu	20	9,9	14,3	8,9	10,8
Pb	30	27,8	38,0	34,7	24,0
B	20	23,8	21,1	12,8	8,3
Cd	30	12,0	11,1	10,3	7,1
C	5	15,6	7,8	4,3	11,1



## Progress in Quality - "non tolerable" results



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# Trends in analytical methods

- Element analyzers for N and C
- Closed acid digestion method & ICP-AES for S, P, K, Ca, Mg, Fe, Zn, B, Cu
- Closed acid digestion method & ICP-MS or Flameless AAS for Cd, Pb and Cu
- X-ray fluorescence for S, Ca, Mg, K, Zn and Mn





# Problematic methods

- Dry ashing methods for pretreatment (not recommended!!!)
- Nephelometric determination of sulphur
- X-ray fluorescence for phosphorous in spruce needles
- Calibration problems with element analyzers



# Future of the Foliage Ringtests

- Annual ringtest programme (10th Test is running)
- Guaranteed financing (participation fee)
- Reference and Ringtest material for labs
- Lower tolerable limits (fixed by the 10th EP- Meeting Foliage and Litterfall) for mandatory parameter S, P, K, Ca, Mg



# New Tolerable limits

- Nitrogen 10%
- Sulphur 15%
- Phosphorous 10%
- Calcium 10%
- Magnesium 10%
- Potassium 10%
- Zinc 15%
- Manganese 15%
- Iron 20%
- Copper 20%
- Lead 30%
- Boron 20%
- Cadmium 30%
- Carbon 5%

Adopted by EP-Foliage and  
Litterfall Madrid 2007



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