



Magnesium deficiency and foliar fertilization of *Abies nordmanniana*

Rune Vesterager Asmussen
Danish Christmas Tree Association

How is this guy?

- Rune Vesterager Asmussen
- Danish Christmas Tree Association
- Technical consultant
- Educational background
 - B.Sc. Forest and Landscape Engineer
 - M.Sc. Forest and Nature Management
- Contact info:
 - Mail: rva@christmastree.dk
 - Phone: +45 26 25 42 66



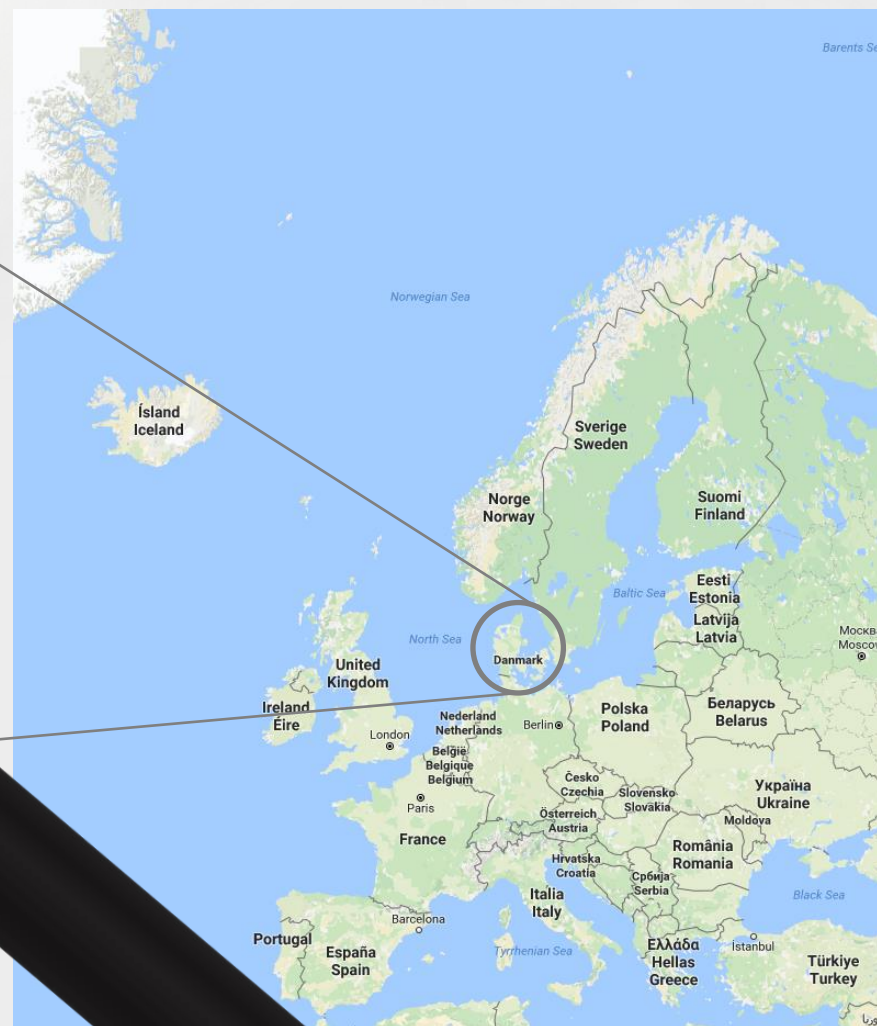




Background

- Magnesium deficiency has caused severe problems in DK
Plant mobile nutrient: Shortage → discoloration and loss of older needles
- Loss of needles disqualifies/degrades the tree
- Solid fertilizers are effective but not (enough) in some situations
- Symptoms are becoming less frequent but is still an issue
- Can we reduce the symptoms by use of foliar fertilization?
 - Very limited specific and quantified information on foliar fertilization of conifers in Denmark
- Field trial in 2016

Field trial – the geography



Field trial – the details

- Two sites in DK
- Main focus: $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in different concentrations
- Two commercial liquid fertilizers
- Three applications after bud break
- First application in end of June and then by approx. 14 days intervals
- 45 trees/treatment in separate rows
- Treatments applied by back sprayer until “runoff”
- Visual assessments + analysis of current-year needle tissue end of October

The two sites

East-Central Jutland

Løndal Forestry, Silkeborg

Sandy soil

Provenance: Silkeborg Nordskov

Container plants from 2012

Average height by 10/2016: 95 cm

Severe magnesium deficiency



Western Zealand

Stenstrup Forestry, Sorø

Loamy soil

Provenance: Ambrolauri tlugi

Bare root plants from 2012

Average height by 10/2016: 66 cm

Mild magnesium deficiency



Treatments in the trial

Two focus points: Concentration and formulation

Treatment	Product in the treatment	Concentration Fertilizer	Concentration Magnesium
1 (control)	- none -	- none -	- none -
2	MgSO ₄ •7H ₂ O	2 %	0,2 %
3	MgSO ₄ •7H ₂ O	4 %	0,4 %
4	MgSO ₄ •7H ₂ O + urea/carbamide	4 % + 0,5 %	0,4 %
5	MgSO ₄ •7H ₂ O + Agropol (non-ionic surfactant)	4 % + 0,05 %	0,4 %
6	MgSO ₄ •7H ₂ O	6 %	0,6 %
7	BioMagnesium60 (liquid product, BioNutria)	6,4 %*	0,4 %
8	YaraVita Magtrac (liquid product, Yara)	1,3 %*	0,4 %

* Treatment 7 and 8 has a corresponding Mg-concentration to treatment 3

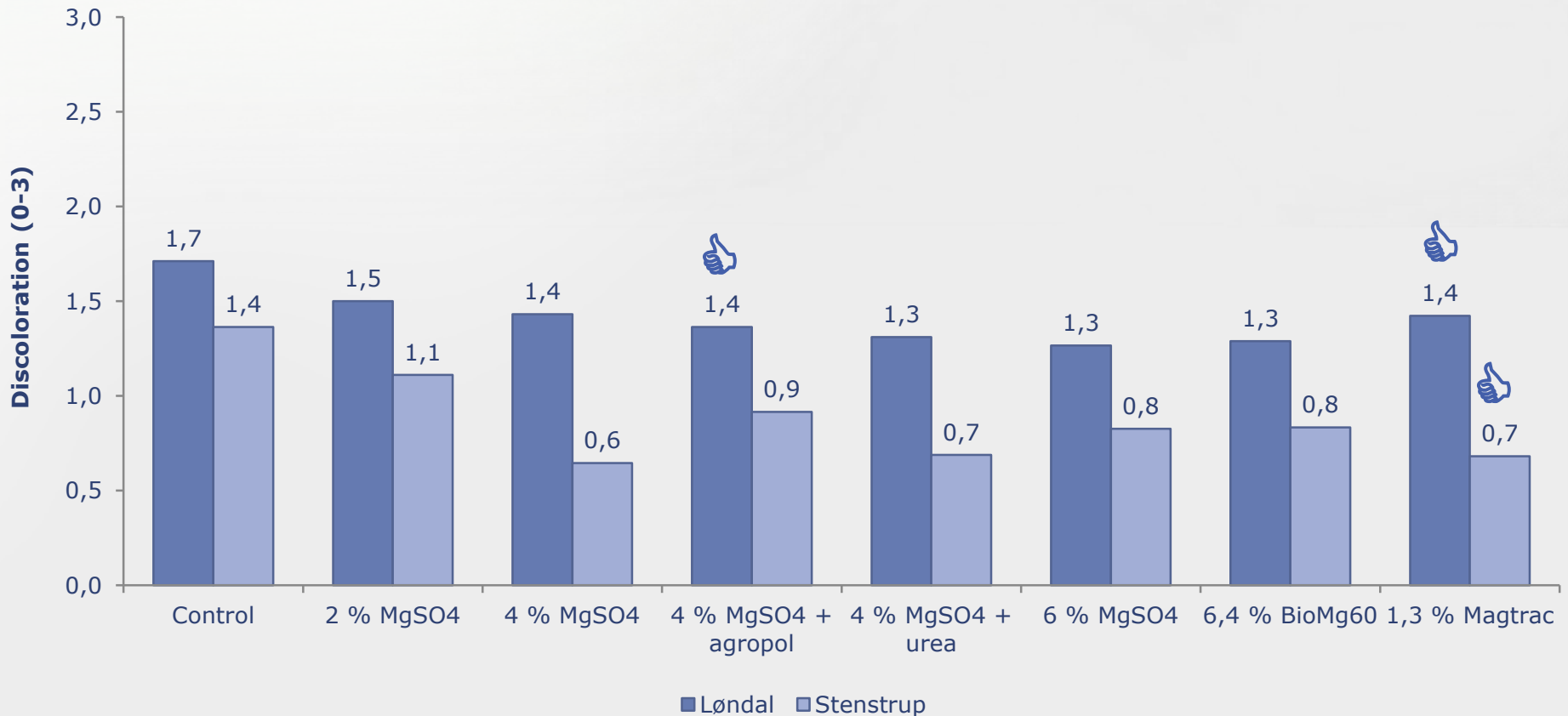
Assessments - discoloration



Score	Discoloration
0	No discoloration
1	Minor discoloration (only the tip of older needles)
2	Some discoloration (most of the older needles)
3	Severe discoloration (all the older needles)

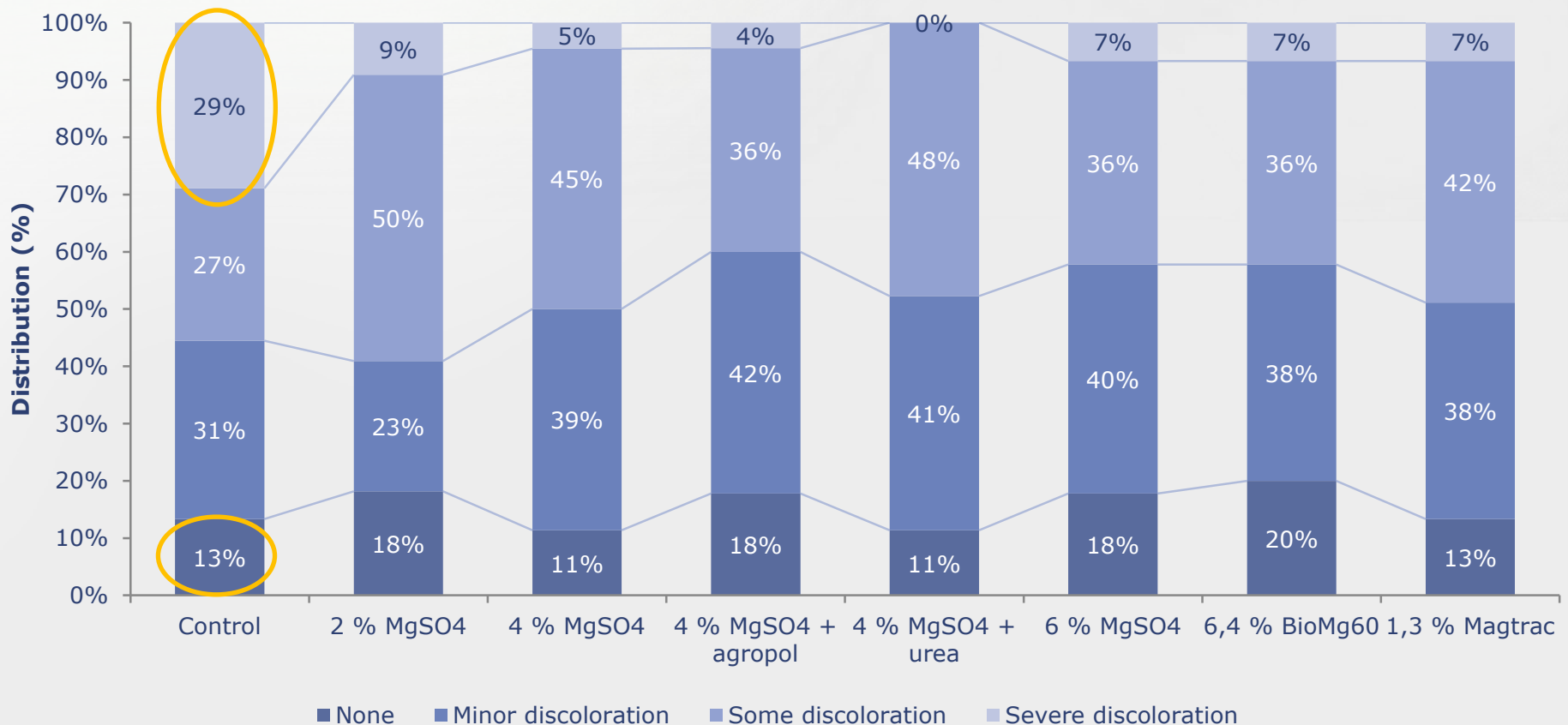
Discoloration of older needles

Means



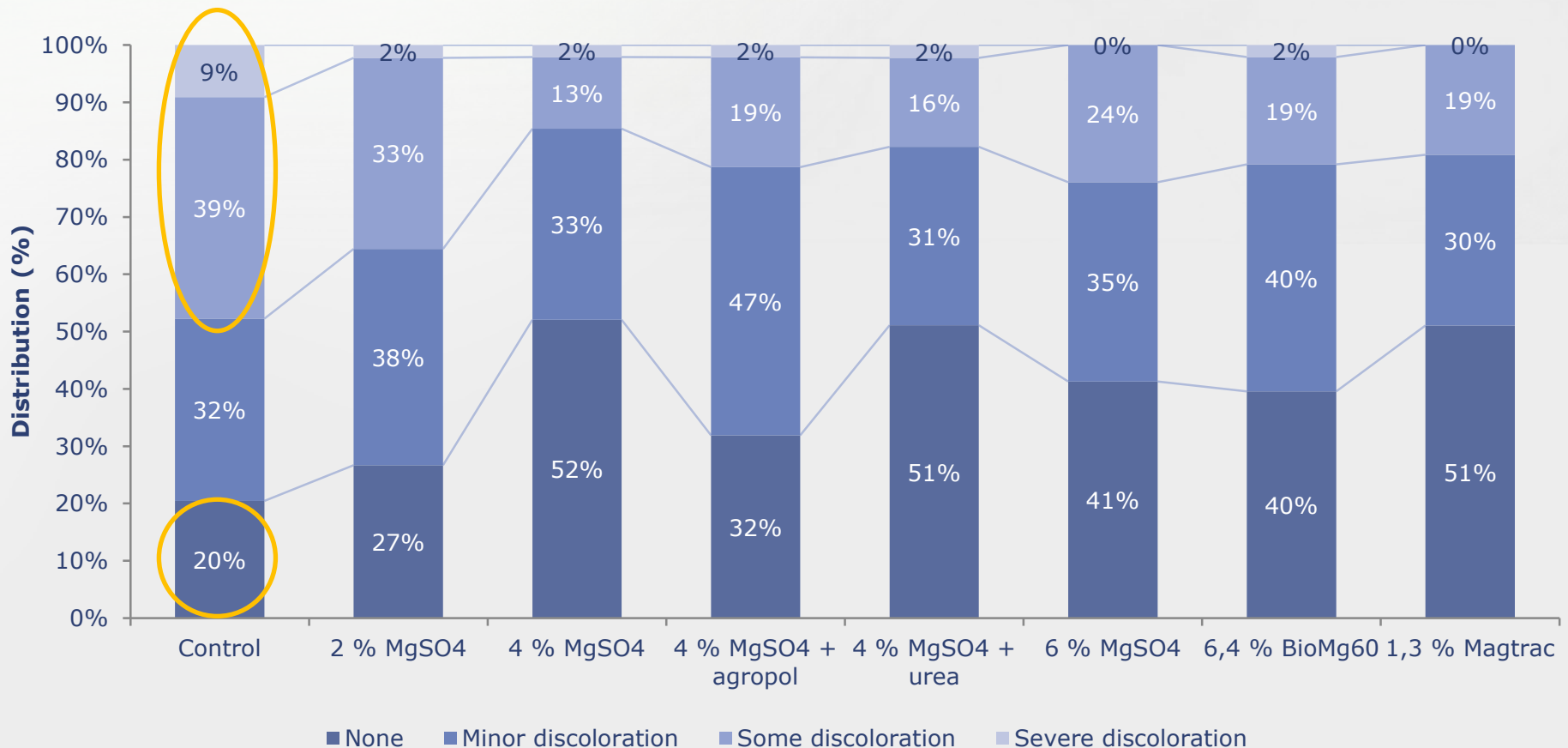
Discoloration of older needles

Distribution, Løndal (severe symptoms)

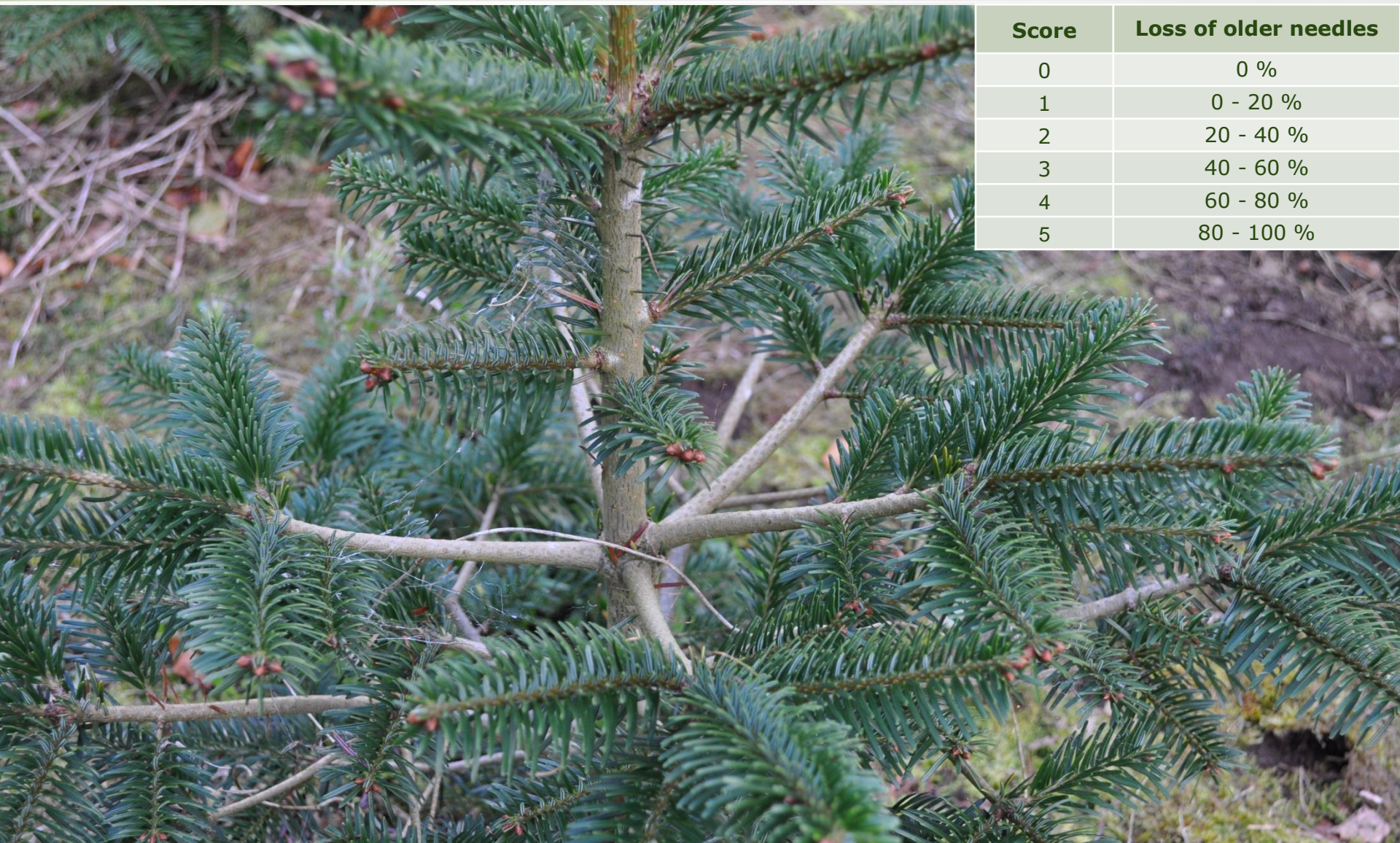


Discoloration of older needles

Distribution, Stenstrup (mild symptoms)



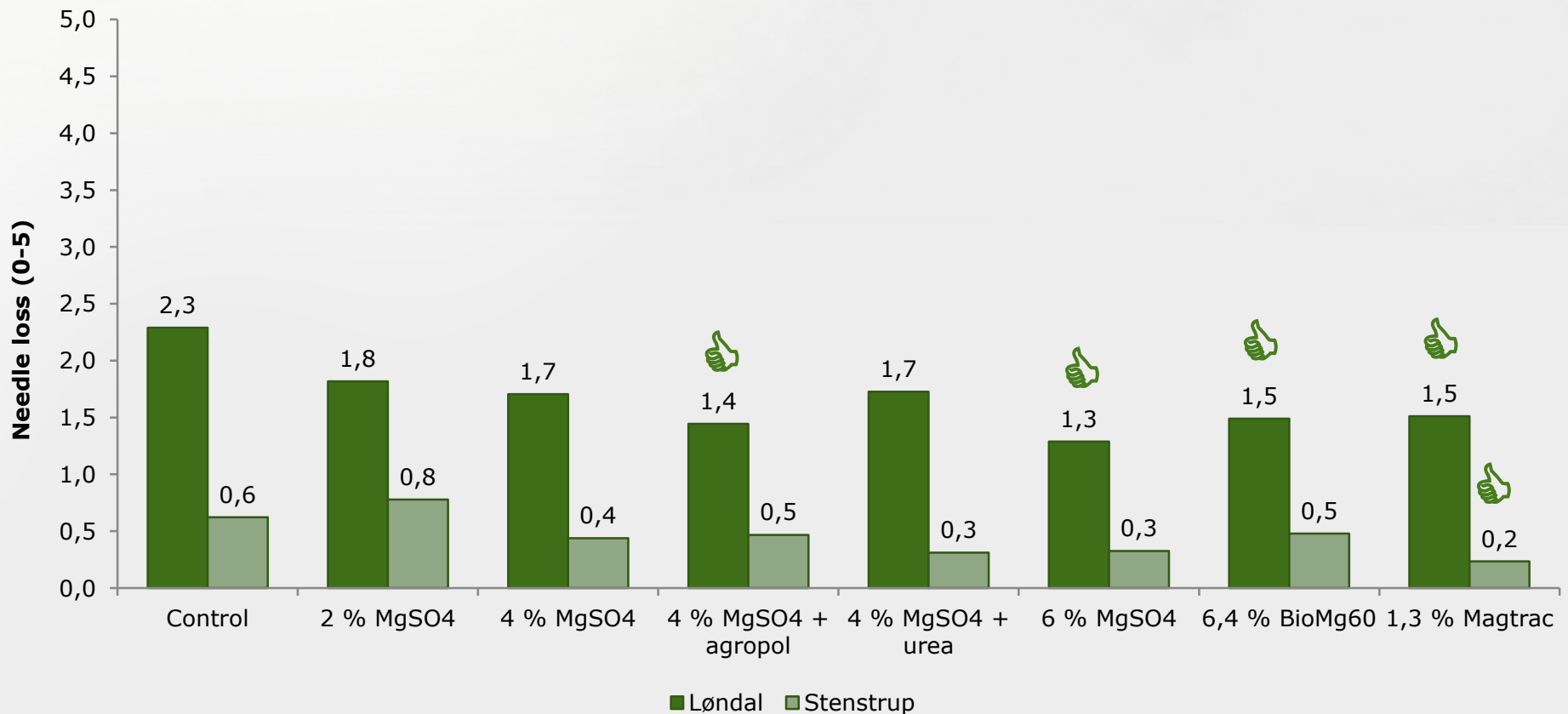
Assessment of needle loss



Score	Loss of older needles
0	0 %
1	0 - 20 %
2	20 - 40 %
3	40 - 60 %
4	60 - 80 %
5	80 - 100 %

Loss of older needles

Means

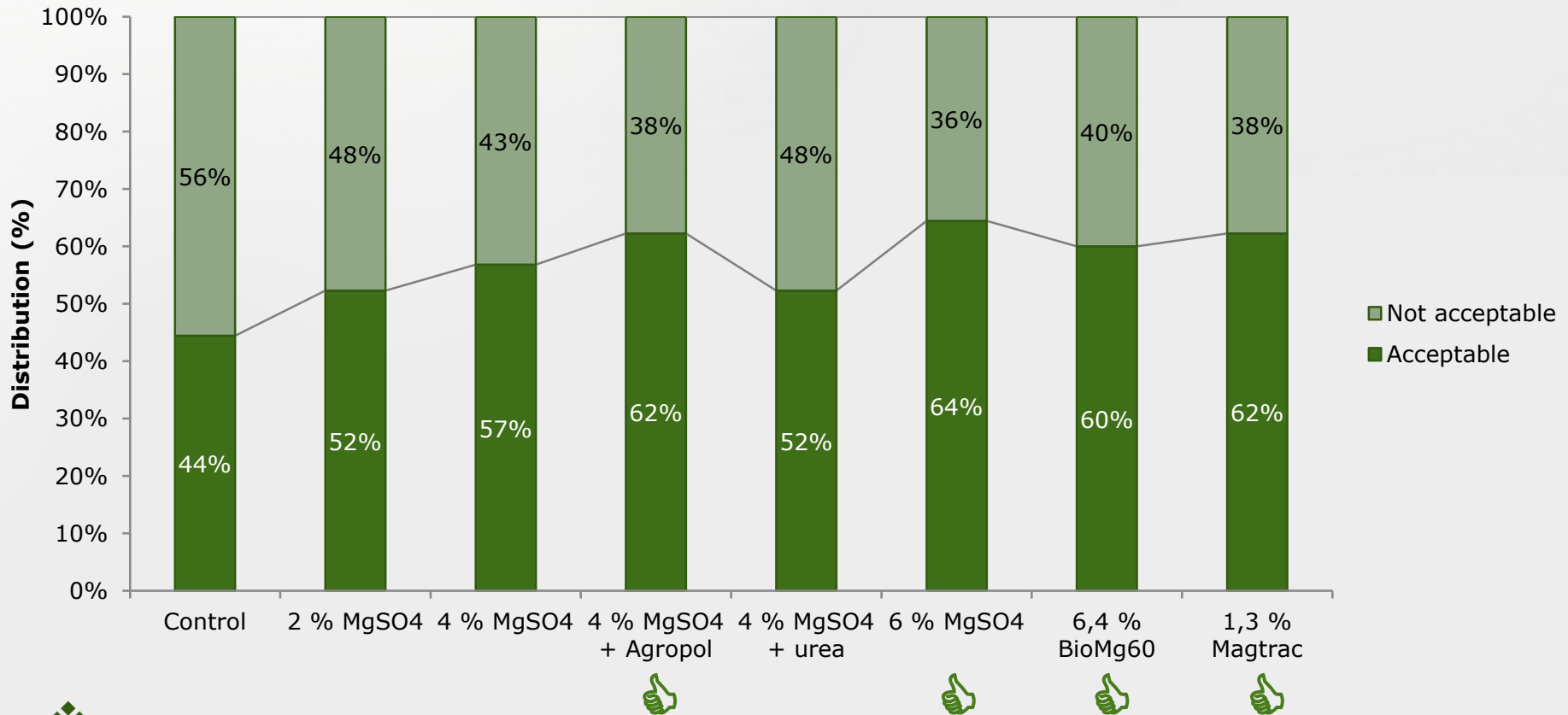


Loss of older needles

Distribution, Løndal (severe symptoms)

Acceptable loss of needles $\leq 20\%$

Not acceptable loss of needles $> 20\%$

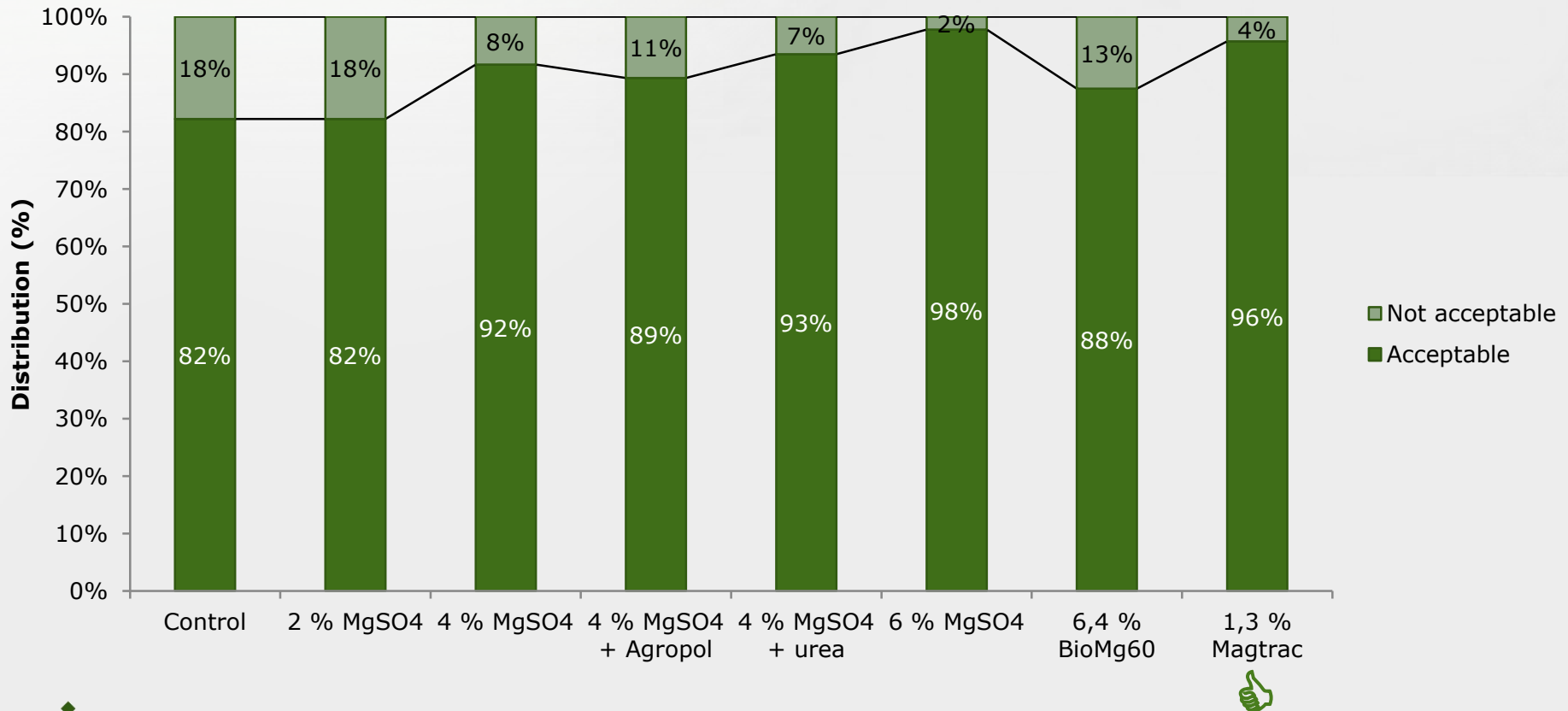


Loss of older needles

Distribution, Stenstrup (mild symptoms)

Acceptable loss of needles $\leq 20\%$

Not acceptable loss of needles $> 20\%$



Assessment of scorching

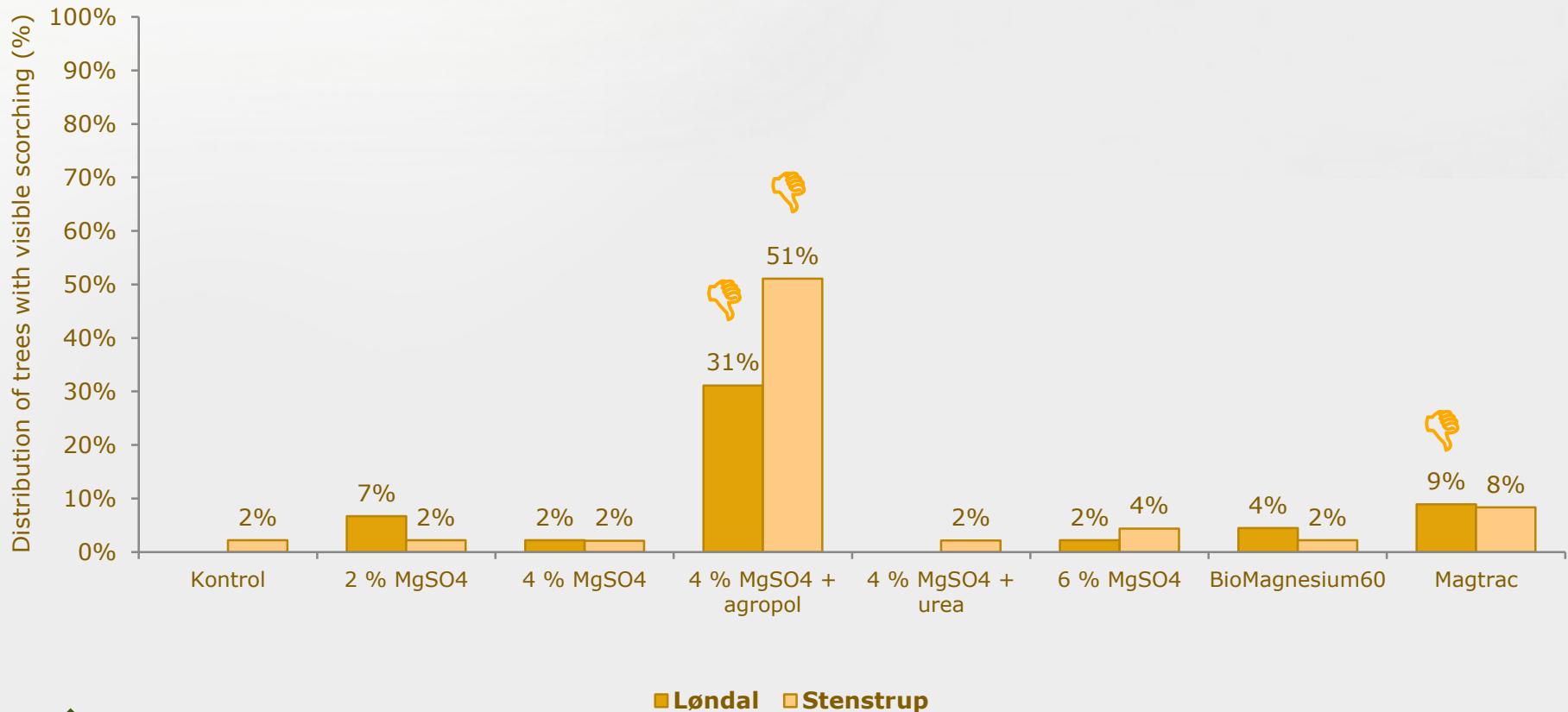


Score	Scorching
0	None
1	Minor scorching (needle tip/a few needles on the tree)
2	Moderate scorching (large part of each needle/some of the tree)
3	Severe scorching (all of the needle/entire tree)

Damages from scorching

Scorching of current-year needles

Share of trees with any level of scorching (>0)



IPC analysis of current-year needles

Recommended range in *Abies nordmanniana*: 0,06 – 0,14 %

Site	Løndal		Stenstrup	
	Needle Mg (%)	Difference	Needle Mg (%)	Difference
Control	0,078	0,0%	0,085	0,0%
2 % MgSO ₄	0,074	-5,1%	0,08	-5,9%
4 % MgSO ₄	0,074	-5,1%	0,083	-2,4%
→ 4 % MgSO ₄ + 0,05 % Agropol	0,083	→ 6,4%	0,095	→ 11,8%
4 % MgSO ₄ + 0,5 % urea	0,071	-9,0%	0,084	-1,2%
6 % MgSO ₄	0,066	-15,4%	0,083	-2,4%
→ 6,4 % BioMagnesium60	0,065	-16,7%	0,091	→ 7,1%
1,3 % Magtrac	0,067	-14,1%	0,078	-8,2%

Concentration in older needles?

Significance? Uncertainty in sampling and no repetitions

Conclusions

- Deficiency symptoms were less pronounced in foliar fertilized treatments 👍
 - The share of trees with severe symptoms was reduced 👍
- A tendency towards higher effect with increasing concentration of the fertilizer products
- Formulation seems to have an effect...
- Addition of 0,05 % Agropol caused significant scorching 👎
- No obvious effect when examining analysis of current-year needle tissue
- Potentially biased results from subjective visual assessments
- No miracle cure (👎)! However, it seems that severe symptoms can be reduced 👍

Perspectives

- We still need more knowledge on:
 - Optimal timing of foliar applications
 - Concentration and formulation >< risk of damages
 - Practical application and operating costs
 - Water volume, mixtures and application frequency, etc....
- Practical implications and recommendations?
 - No miracle cure...
 - Consider effects >< costs
 - Foliar applications are (probably) most effective in the growing season
 - Use $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in a 4 – 6 % concentration or commercial products
 - Adjust water volume according to tree size → ensure sufficient coverage!
 - Be careful when using additives and applications shortly after bud break
- The trial continues in 2017
- Article in Nåledrys no. 99 (association magazine)



Thank you for your attention 😊