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An international establishment experiment with wild service tree (*Sorbus torminalis* (L.) Crantz) in Germany, Great Britain, Denmark, Sweden and Norway

NYA ÄDLA LÖVTRÄD 2023

WHY *SORBUS*?

Combine high-quality timber production, biodiversity conservation and forest aesthetics:

- Some *Sorbus* species are abundant, most are rare
- Flowers, fruits and autumn foliage enhance forest aesthetics
- *Sorbus* contributes to ecosystem biodiversity
- High timber prices (> 1,000 €/m^3, veneer > 2,500 €/m^3)
- Much research on genetics
- Little research or experience on silviculture and conservation management

WILD SERVICE TREE - *SORBUS TORMINALIS*

Figure 1 Natural range. Wild service tree is a sub-canopy species associated with oak forest and coppice-with-standards.

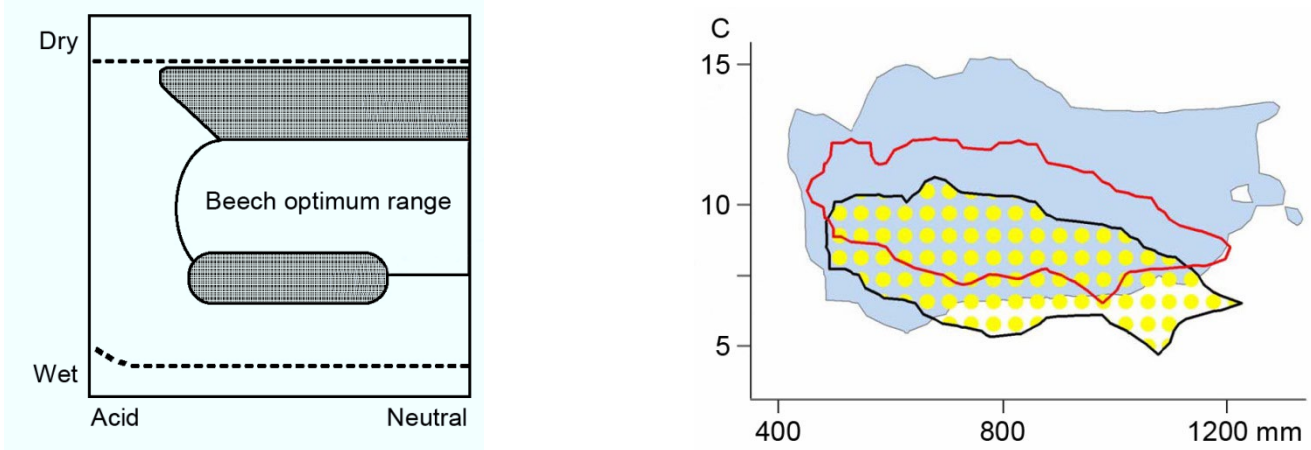


Figure 2 Site requirements (left, grey shading) and climatic envelope (right, blue shading). Wild service tree is light demanding, drought tolerant and thrives best in mixed forest.

WHY *SORBUS TORMINALIS* NORTH OF ITS NATURAL RANGE?

Assisted migration for climate change adaptation of forests and silviculture
(the future in S Sweden = the present in Frankfurt + NE France).
High value production, diversify forest investments, forest diversity (aesthetics, biodiversity).
Wild service tree is rarely planted and there is no research on plantation grown WST.

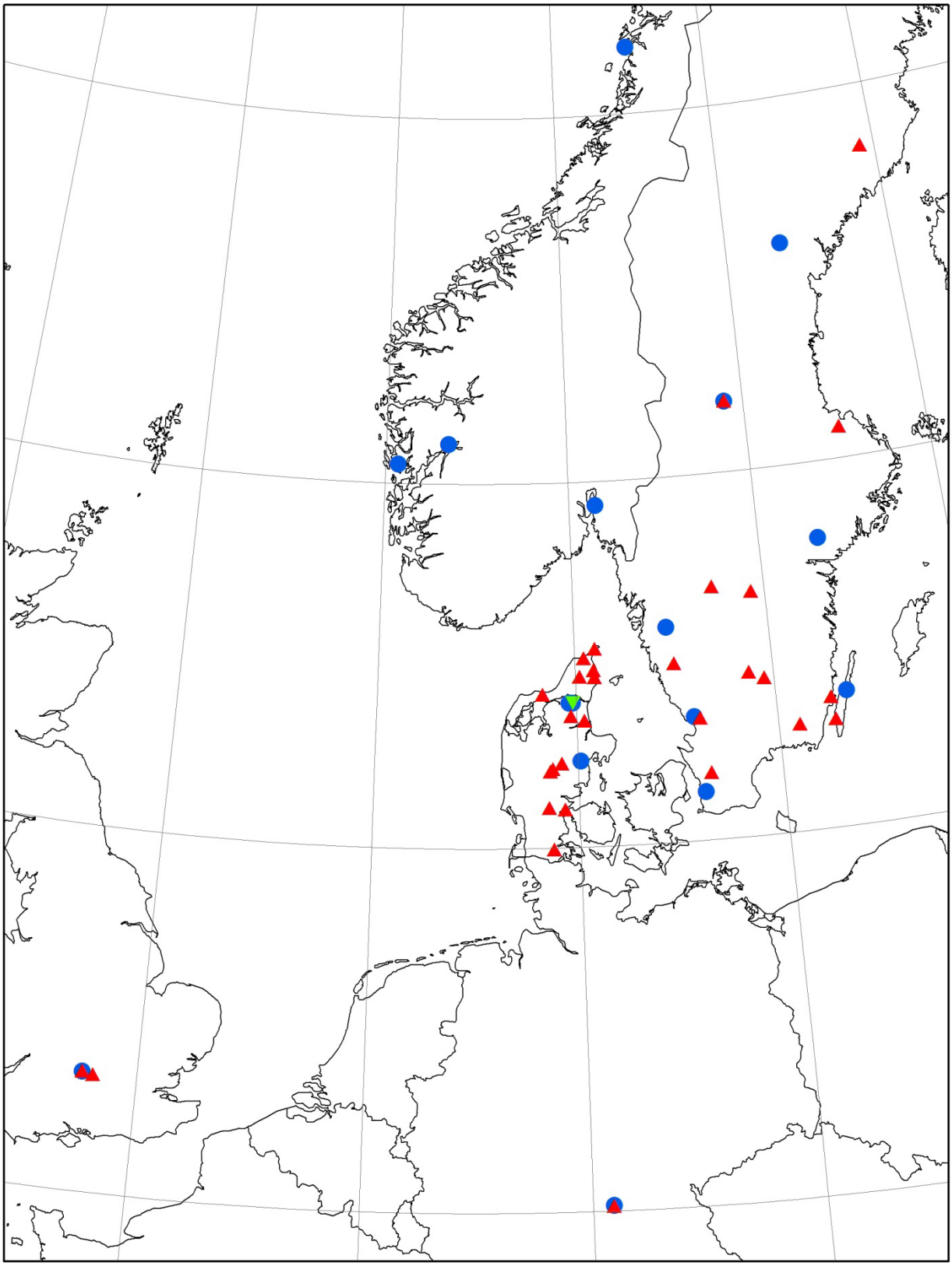


Figure 3 Location of the 47 experimental blocks in the international wild service tree experiment in Germany, Great Britain, Denmark, Sweden and Norway. The experiment was established spring 2012 with nursery stock of Sailershausen origin and range from 50° N (Sailershausen) to 66° N (Alstahaug). Legend: ● = agricultural land, ▲ = forest land, ▼ = chalk quarry. Each block includes four or six plots of contrasting establishment techniques.

TREATMENTS

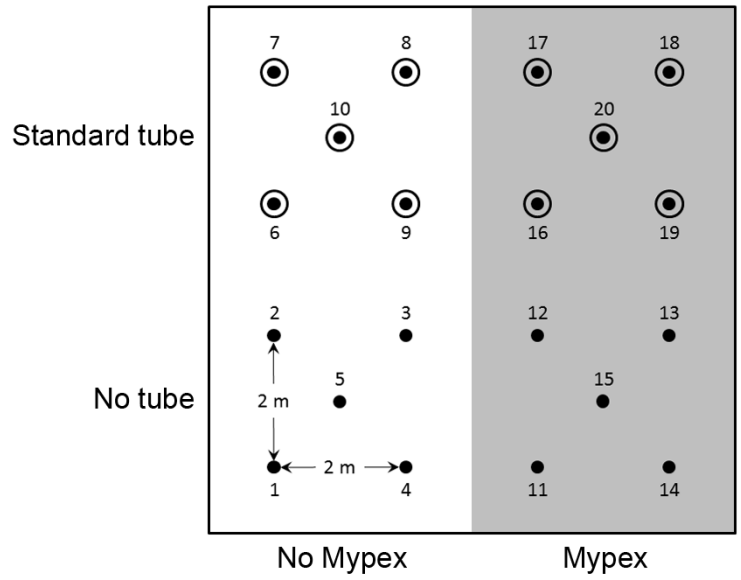


Figure 4 Block and plot lay-out for the four main treatments of the international wild service tree experiment, indicating the standard location of plots and the spacing and numbering of trees in each block.

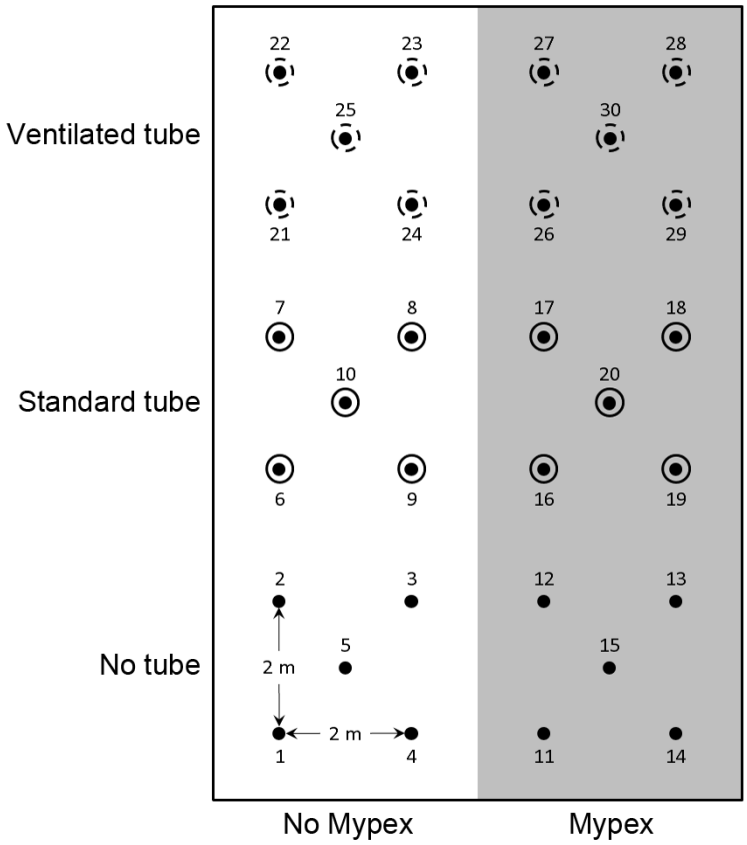
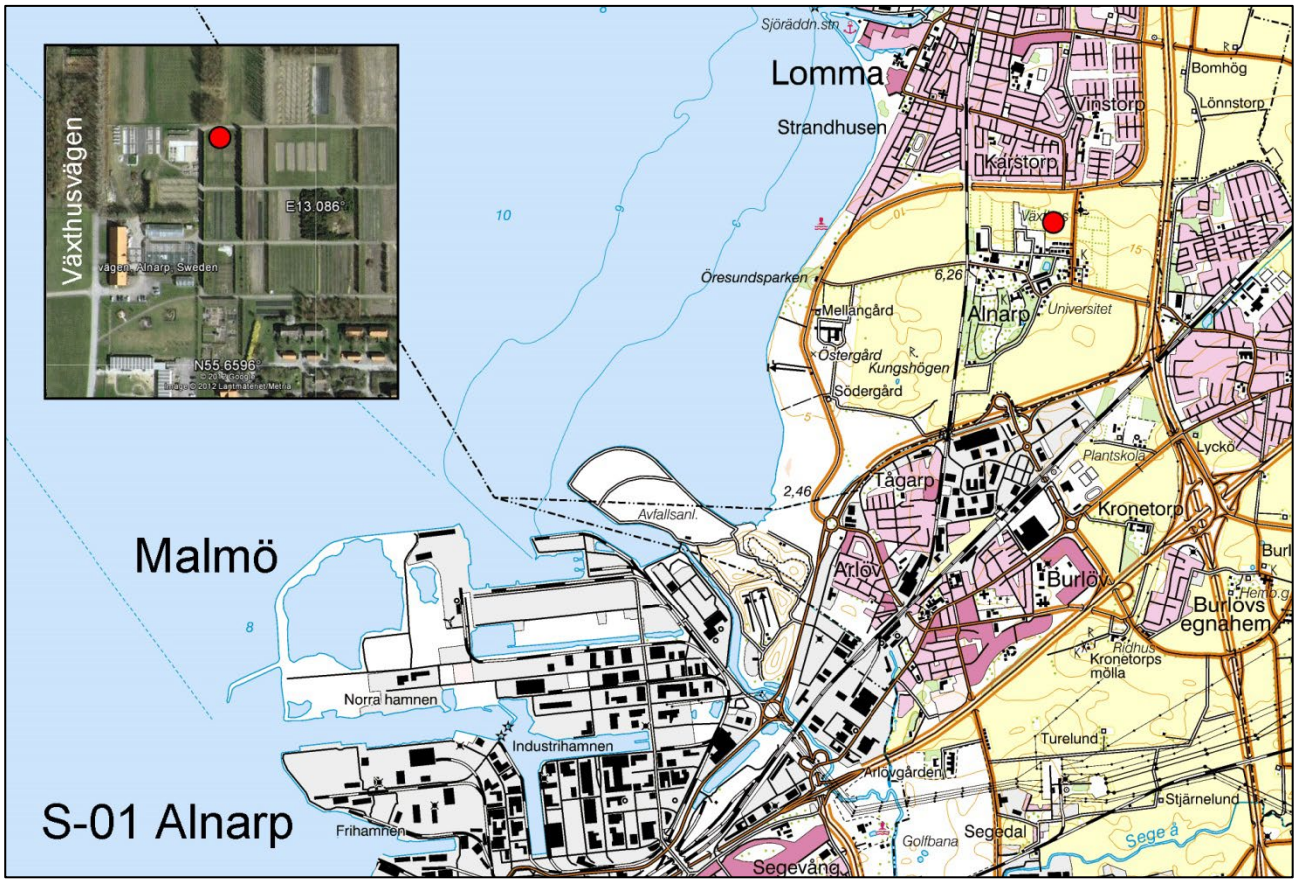


Figure 5 Block and plot lay-out for the four main and two additional treatments of the international wild service tree experiment, indicating the standard location of plots and the spacing and numbering of trees in each block.



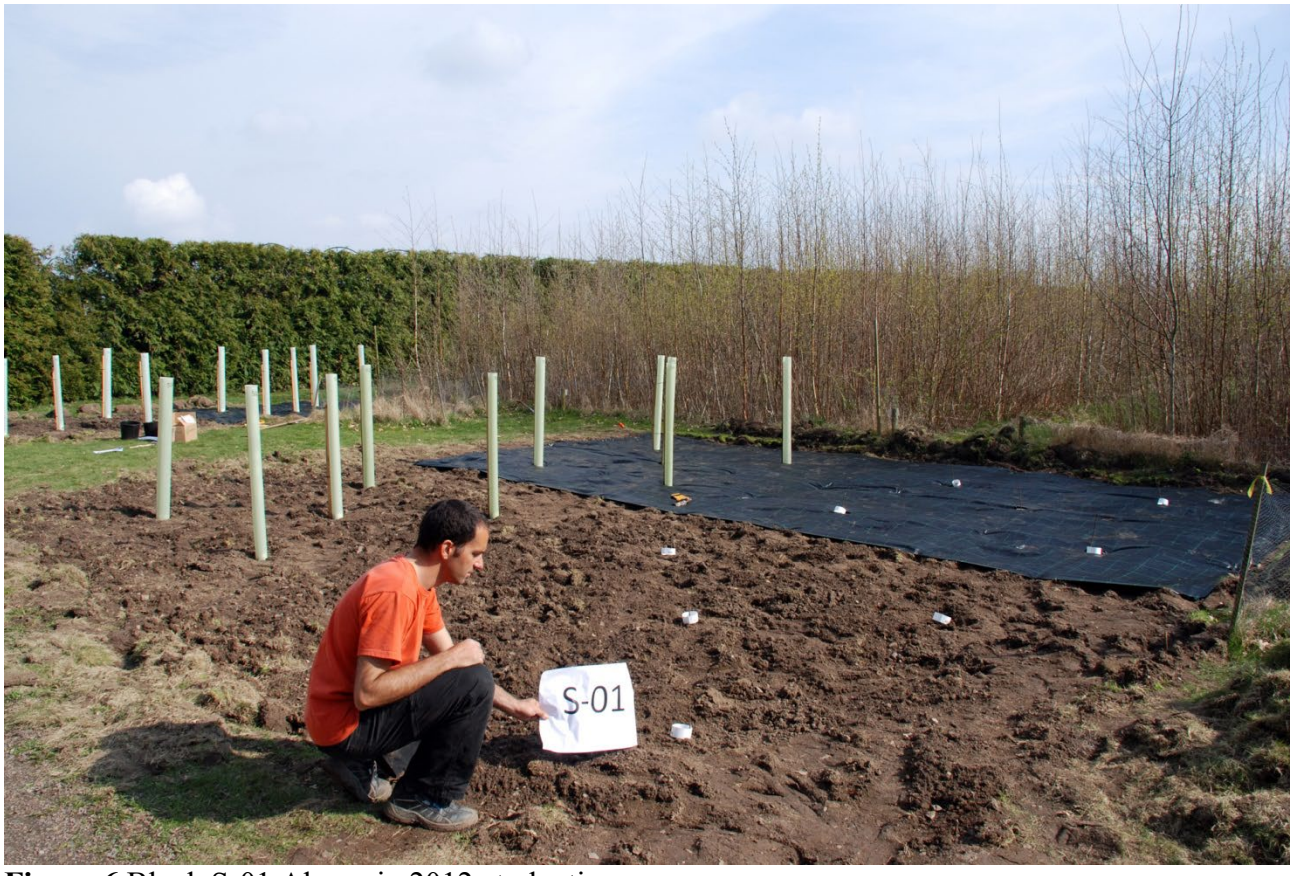


Figure 6 Block S-01 Alnarp in 2012 at planting.

PRELIMINARY RESULTS - SURVIVAL AND GROWTH

- Very high survival rate, no sites failed (some late die-off due to drought, canker or other factors).
- Growth rate substantially higher with Mypex weed control.
- Growth rate for the fastest tree on each plot was unaffected by presence or absence of Tubex.
- Unventilated Tubex triggered bark cracks towards S and SW in hot summers.
- Early height growth rate for the fastest tree on each plot peaked at 13-14 % silt.
- 10-year height growth rate for the fastest tree at each site increased with soil fertility (base saturation / pH) and decreased with increasing northern latitude (no significant effect of site type (forest/farm-land).
- Large variation in height growth (seeds from wild population, no sorting of seeds, no sorting of nursery stock, poor quality nursery stock (root development)).

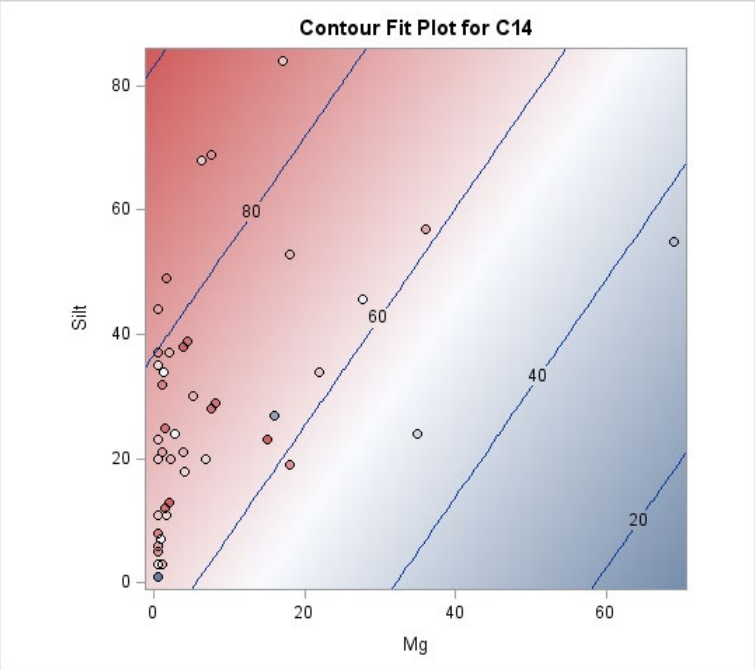


Figure 7 Contour plots for 2-year survival (%) depending on the contents of silt (%) and Mg (mg/100 g) in the upper 1 m of the topsoil.

Figure 8 Bark damage in Tubex tube due to over-heating in the tube during summer. The crack is located on the southern side of the tree. Alnarp 2022.

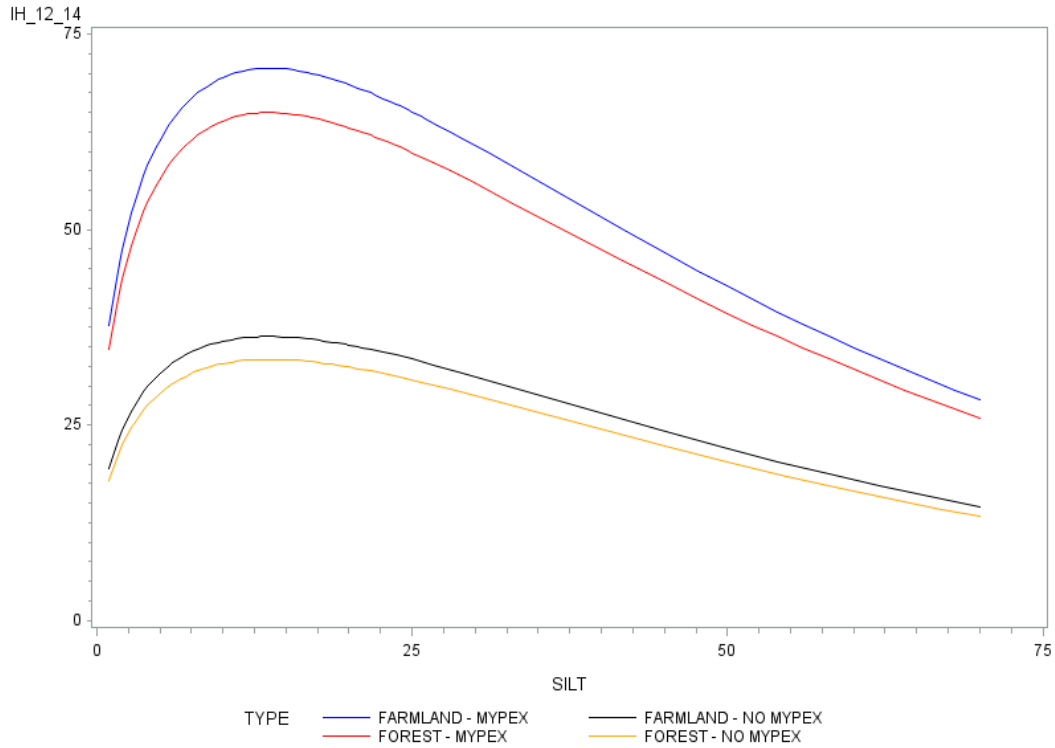


Figure 9 Predicted two-year height growth rates for wild service tree ('fast trees') planted on forest land and agricultural land, with or without weed suppression by Mypex (Mg forest land = 5.53 mg/100 g, Mg agricultural land = 11.44 mg/100 g).

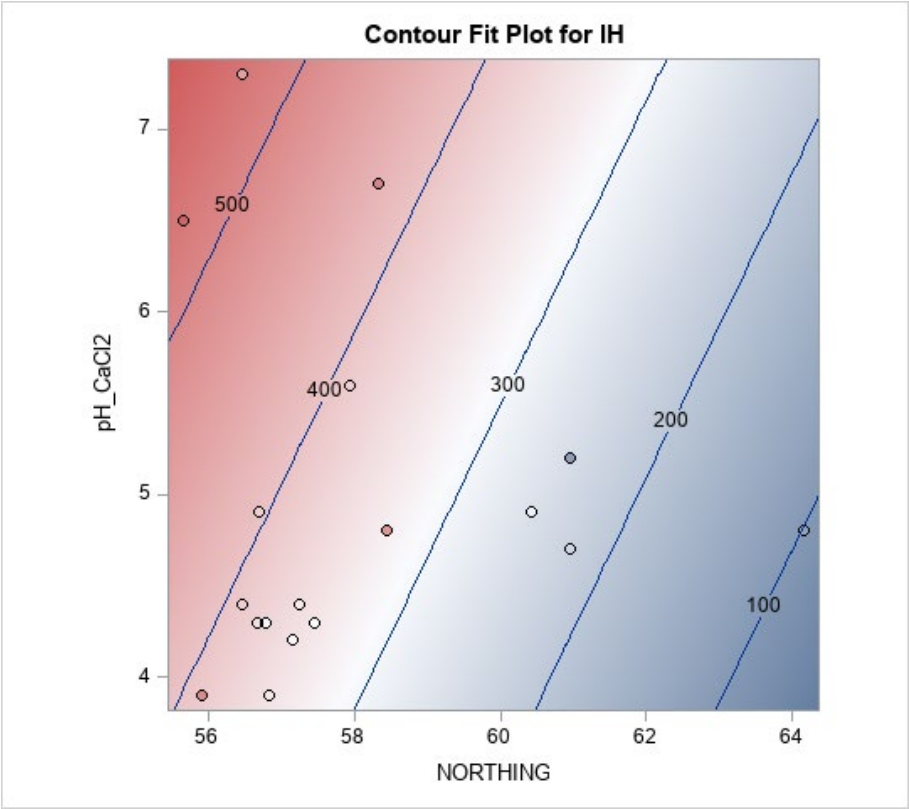


Figure 10 Contour plots for 10-year height growth (IH, cm) depending on soil pH in the upper 1 m of the topsoil (measured in $CaCl_2$) and latitude (°N).

Figure 10 The world's thickest wild service tree. Moesgaard, DK (2009: DBH = 148 cm, H = 24 m).

ACKNOWLEDGEMENTS for funding of *Sorbus* activities

2010-12 Danish Fund for Practical Forestry Experiments
2013-14 C.F. Lundström's Foundation
2014-16 Hildur and Sven Wingquist's Foundation
2022-23 Hildur and Sven Wingquist's Foundation

SLU *Southern Swedish Forest Research Centre*

Nya ädla lövträd 2023

Juglans ailantifolia. Photo: Hans Chr. Graversgaard

We eat the nuts while we wait for the timber

(*Vi äter nötterna medan vi väntar på virket*)

Experiment J-05 Alnarp

by

Jens Peter Skovsgaard, Ulf Johansson, Jan-Eric Englund & Luca Muraro

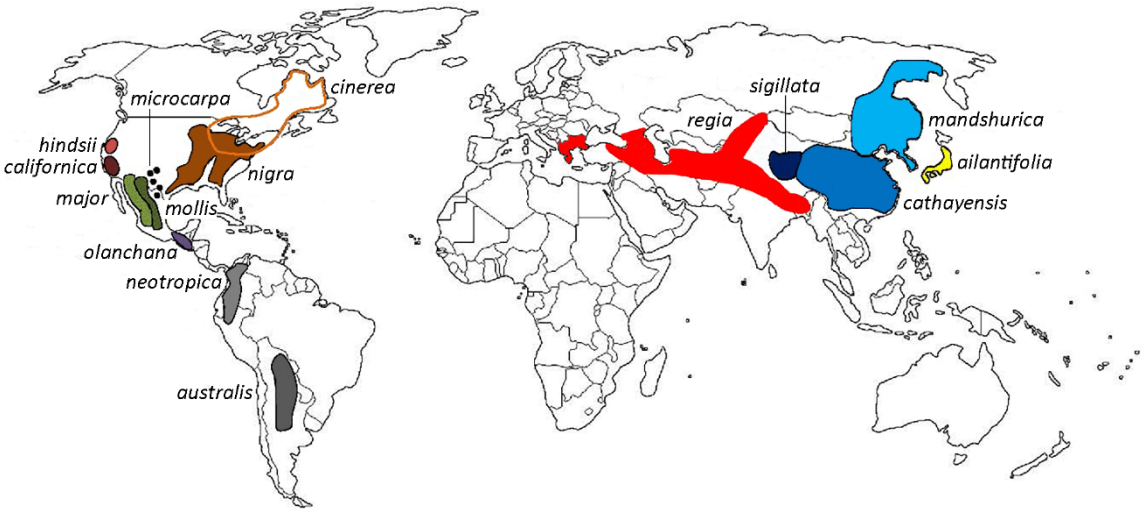
WHY WALNUT?

+ High growth rates, straight stem, strong apical dominance – hybrid walnut = *heterosis*
+ High timber prices (premium timber traded at roadside prices up to twice as high as those of oak; 'a hardwood with added income potential'; 'a homegrown tropical timber')
+ Market deficit for walnut wood for furniture and other fine wood products (+ socioeconomic multiplicator effect)
+ Climate change / increasing temperature = better growth conditions for walnut
– Pruning is needed to produce premium-quality timber (3-4 m log is enough; target stem diameter / dbh = 50-60 cm)
– Production risk is higher than for native tree species due to the 'unknown' species effect / increased risk of inadequate silviculture
– Site risk: many sites in Sweden are already good for walnut, but which are best?

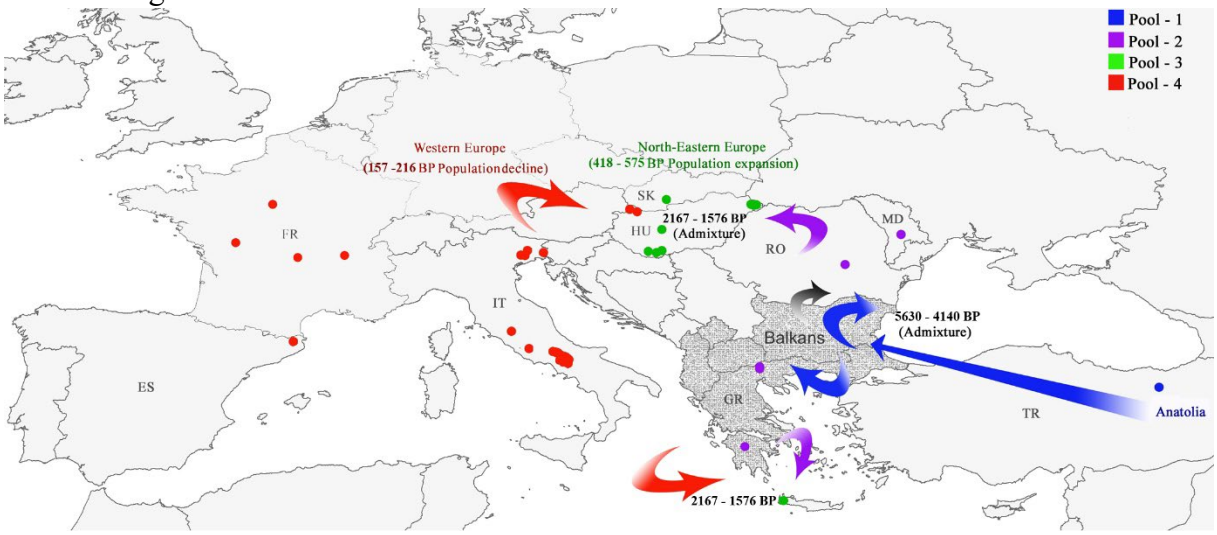
WALNUT ECOLOGY

Deep taproot + long shallow lateral roots
Intolerant of competition
Deep and rich soils, good drainage, +N

WALNUT SPECIES

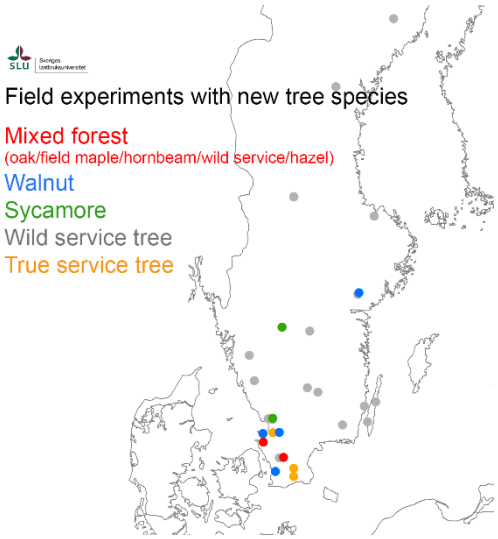


Natural ranges of distribution for walnut



Holocene migration of *Juglans regia* in Europe (Pollegeoni et al. 2017)

THE EXPERIMENTS / EXPERIMENT J-05



Walnut experiments (J-series):
J-01 at Påarp / Västra Karup (planted 2015; not presented here).
J-05 at Alnarp, Våxtorp, Hedenlunda Björktorp (planted 2021).

THE OBJECTIVE

Effects of
- walnut type (species / hybrid)
- seedling size
- site
- establishment practice (weed control, stumping back, irrigation)

on
- survival
- growth
- dieback at leader shoot
- stem quality

of commercial nursery seedlings of walnut when transplanted to their permanent location.

THE SPECIES

Juglans cinerea [C]
- *regia* [R]
- *mandshurica* [M]
- *ailantifolia / sieboldiana* [S]
- x *intermedia* NG23 (♀ = *J. nigra*, ♂ = *J. regia*) [1]
- x *intermedia* NG38 (♀ = *J. nigra*, ♂ = *J. regia*) [2]
- *major* x *regia* MJ209 (♀ = *J. major*, ♂ = *J. regia*) - two different sizes [3 = small, 4 = large]

THE SITES

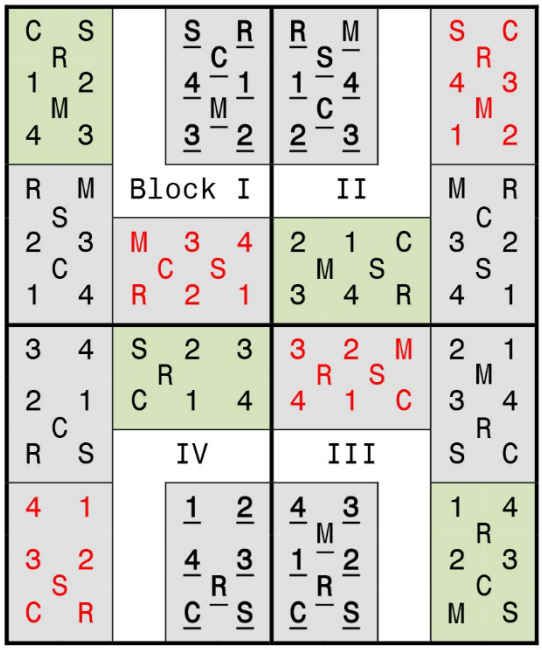
Site	Soil (% clay-silt-sand)	Precipitation	Penta
Alnarp	Glacial till 15-30-60	610	290
Våxtorp (discontinued)	Postglacial sand 5-15-80	695	355
Hedenlunda Björktorp	Glacial till 40-55-5	550	265

THE TREATMENTS

Treatment	Weed control	Stumping back	Irrigation
A	No	No	No
B	Yes	No	No
C	Yes	Yes	No
D	Yes	No	Yes (+2 l/tree/day; 2021 and 2022)

THE LAYOUT

Randomized block design replicated four times at each of three locations / sites.



Legend

Line: thick line = block border, thin line = plot border

Plot shading: green = no weed control, grey = weed control, white shading = unplanted buffer

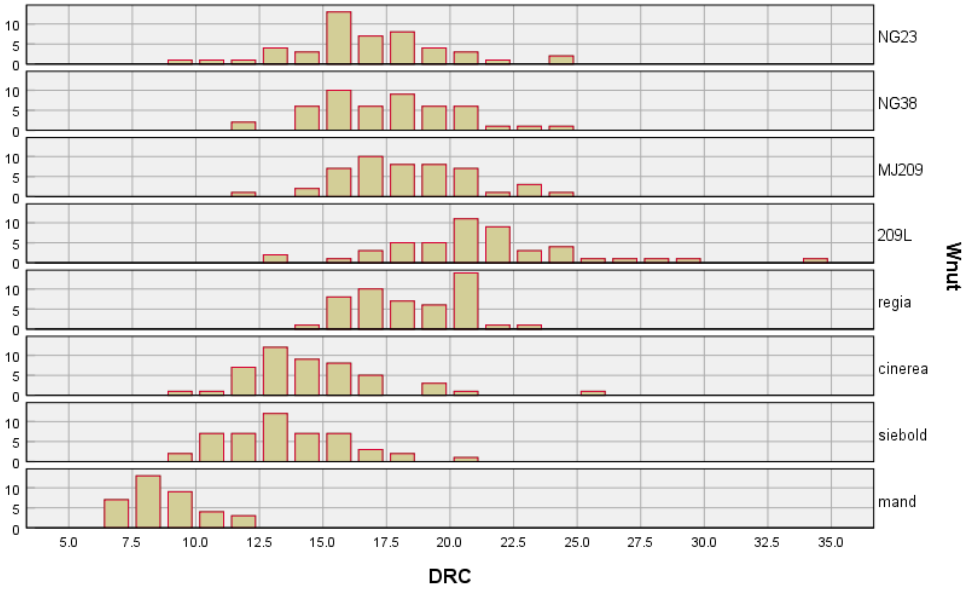
Font colour: black = no stumping back, red = stumping back immediately after planting

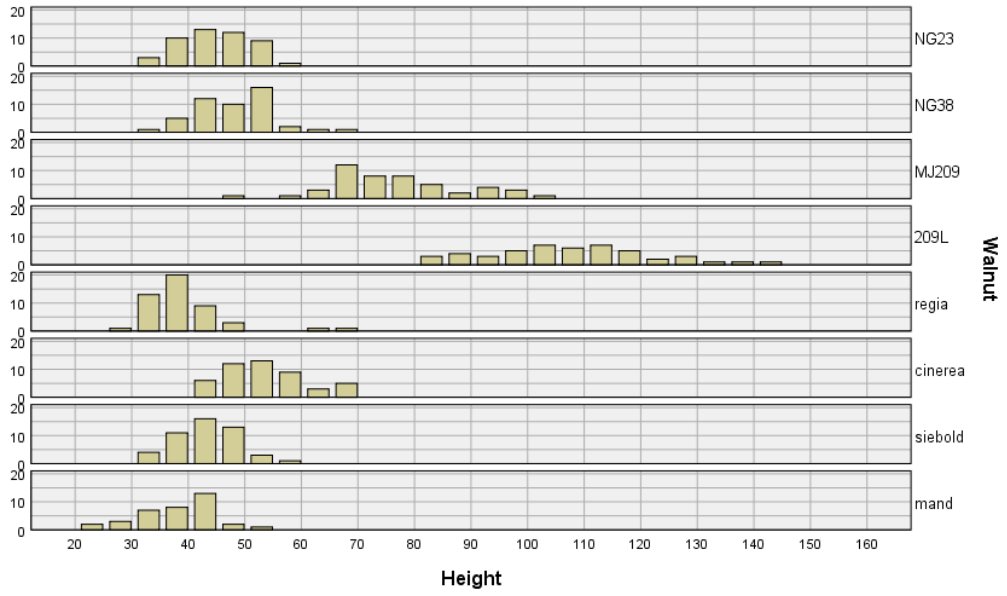
Font type: ordinary font = ambient precipitation (no irrigation), bold underlined = ambient precipitation + irrigation (2 l/tree/day during the growing season)

THE TREES

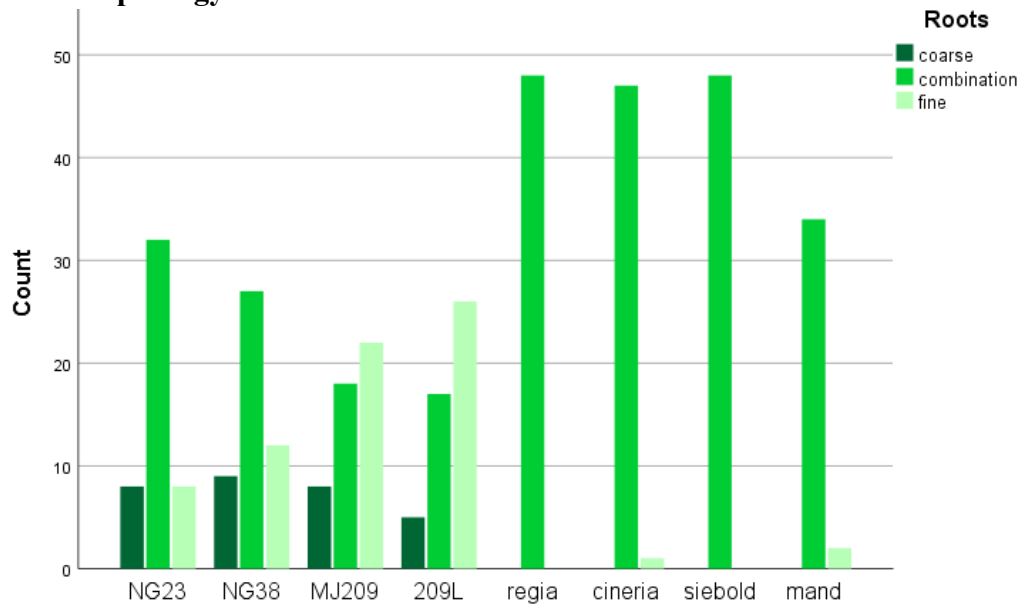
Nursery seedlings from Sweden (MAN), Denmark (CIN, REG, SIE) and France (hybrids).

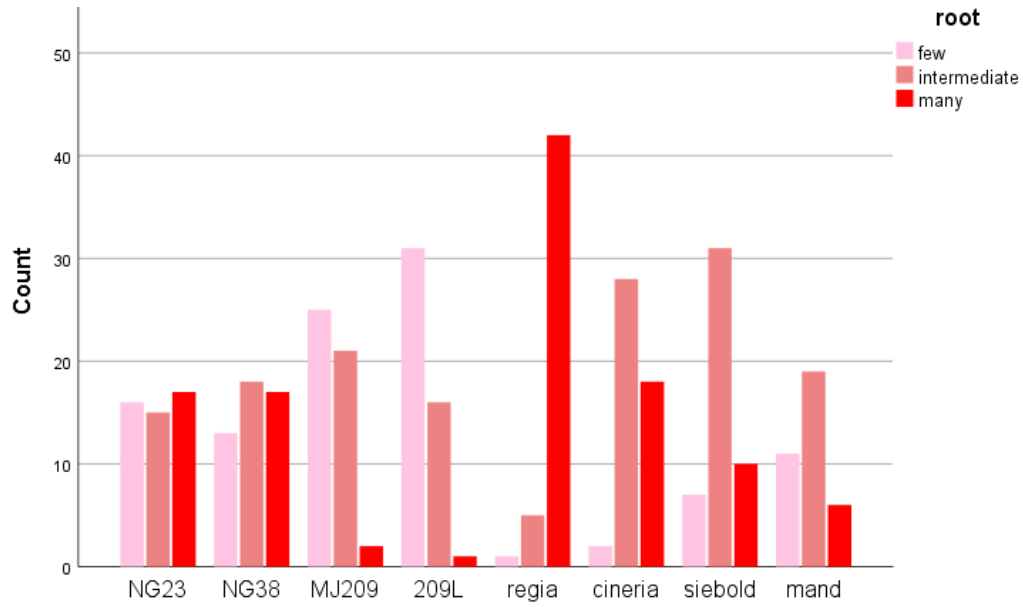
Size classes



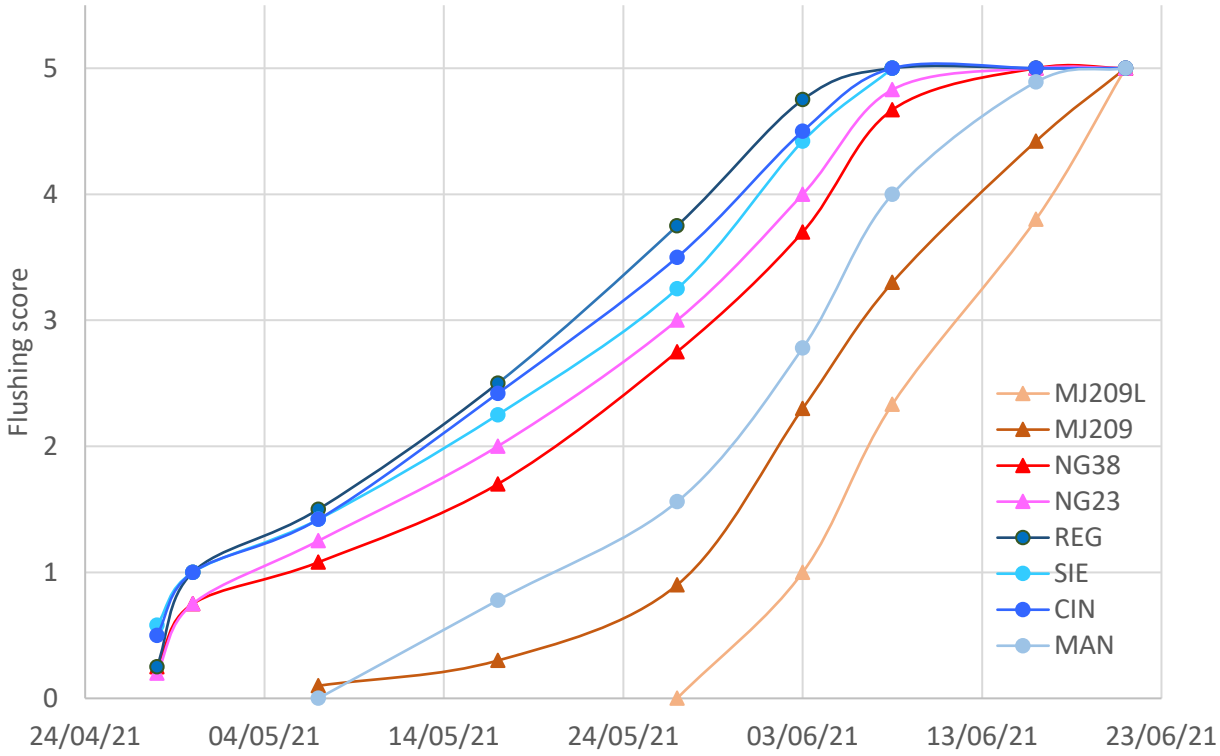


Root morphology

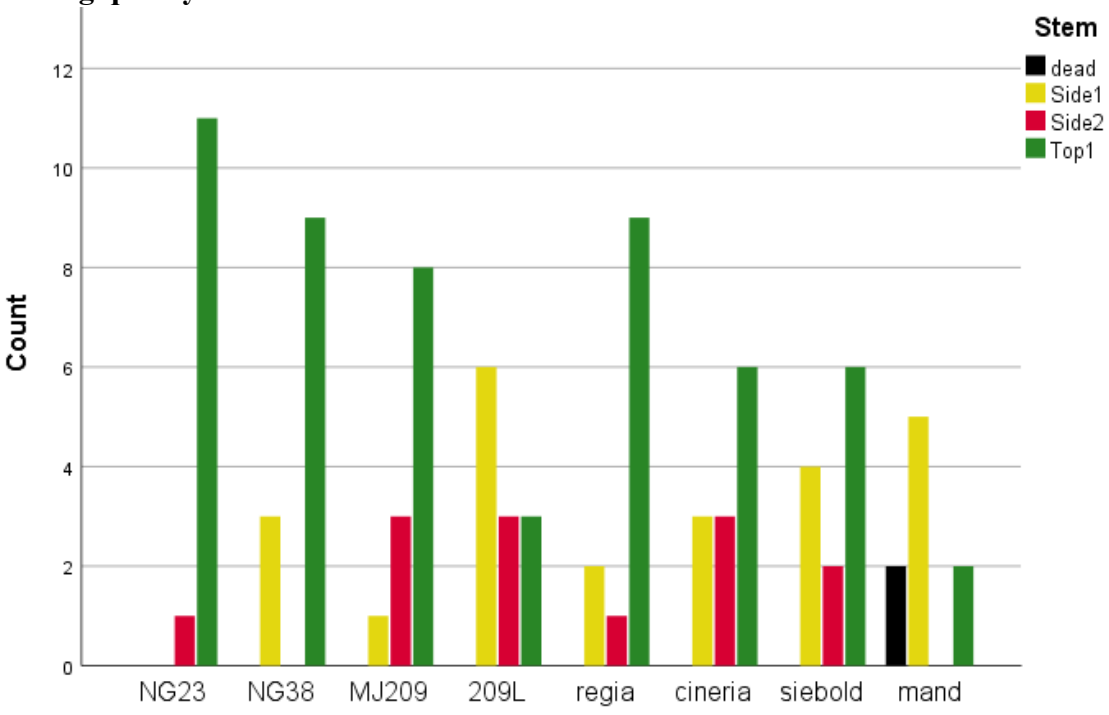




Flushing progression



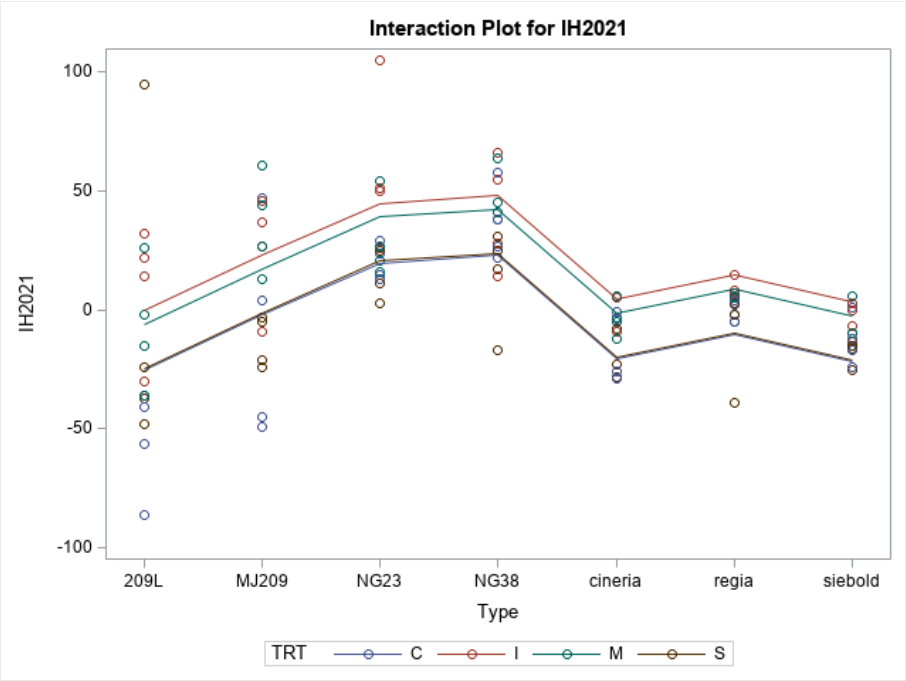
Flushing quality



Dieback of leader shoot

In J-05 at Alnarp dieback of the leader shoot was recorded only on MJ209L (by 21 June 2021). The dieback was present when the seedlings arrived in Alnarp and developed in the nursery (incomplete shot maturation / hardening) or during cool storage prior to delivery.

THE GROWTH



Net change in tree height 2021. C = control, I = irrigation, M = Mypex, S = stumping back.

Net change in tree height 2022. C = control, I = irrigation, M = Mypex, S = stumping back.

Conclusions

The height growth (= the annual net change in total tree height = growth – dieback) of hybrids was more variable than that of pure species.

2021 Substantial dieback. Growth: Irrigation+Mypex > Mypex >> Stumping-back+Mypex = Control. Winner: NG38.

2022 Little dieback. Growth: Irrigation+Mypex ≈ Mypex ≈ Stumping-back+Mypex >> Control. Winner: NG38, and hybrids generally > pure than pure species.