

Nordmann fir seed orchards

– are they improved

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Outline

- Why seed orchards?
- What's a grafted seed orchard ?
- Breeding strategy

- Resultats new 'realised gain trials' from 2013
 - Height
 - Budbreak
 - 'CSNN'
 - 'Bare shoulders'

- Gain and risk

Why seed orchards ?

- Security for supply
sufficient amount and quality of seed
- Improve genetic quality by breeding

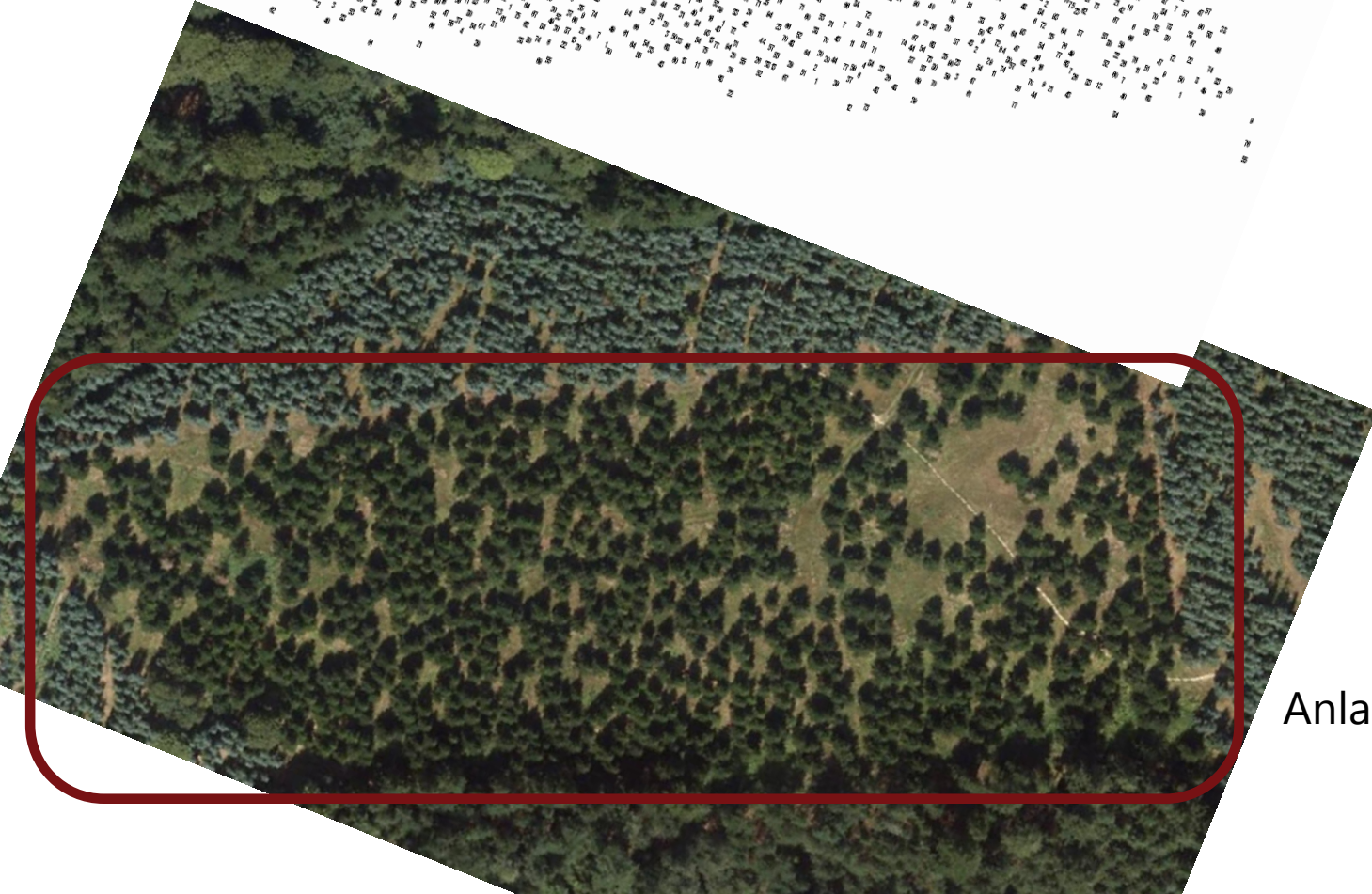
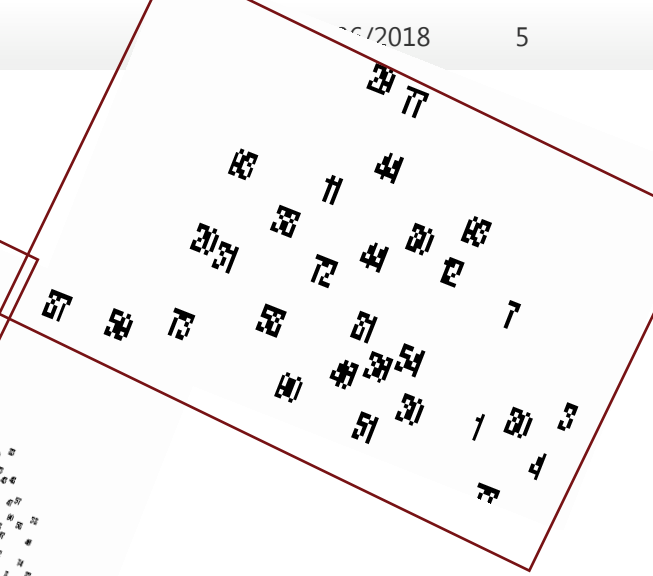
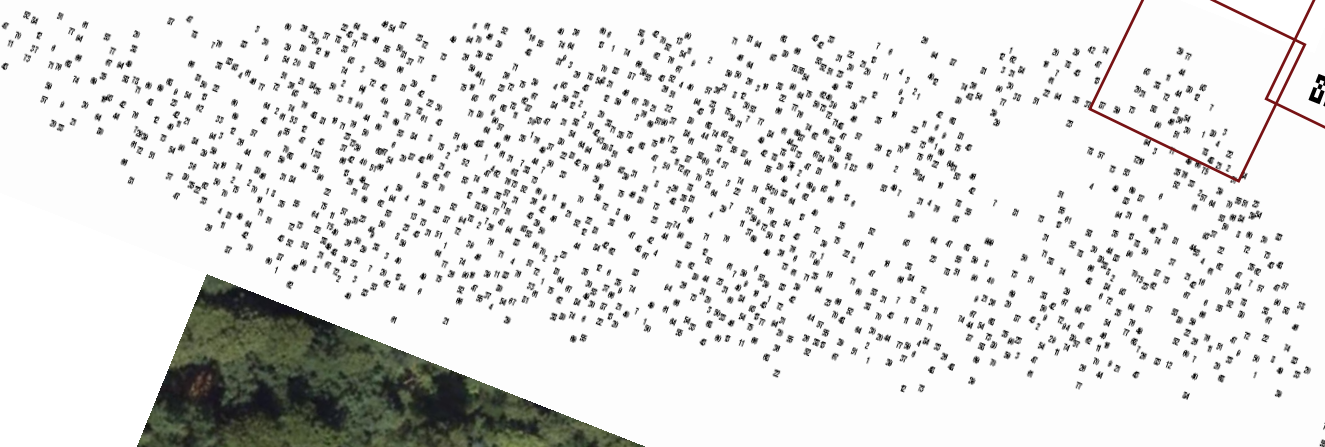
**We decided to begin breeding in 1992
– informal cooperative growers, research institutes
and state forest tree improvement station**

**Previously lots of troubles getting seed of
reliable origin and quality**

What's a grafted seed orchard ?



FP259 Silkeborg Nordskov



Anlagt af Naturstyrelsen

Breeding – two selection strategies



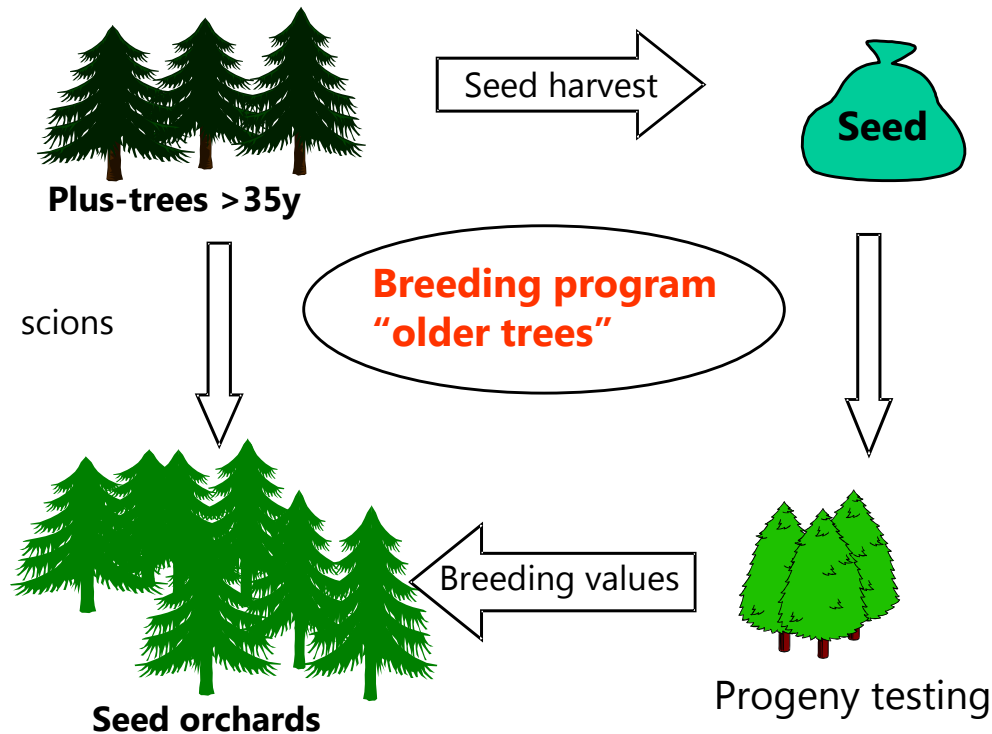
2. Young(er) - NO seed
(select best Christmas trees)

Danish stands KNOWN origin

1. Mature & seed producing
(no clue about Christmas tree characters)
Progeny testing – select the best

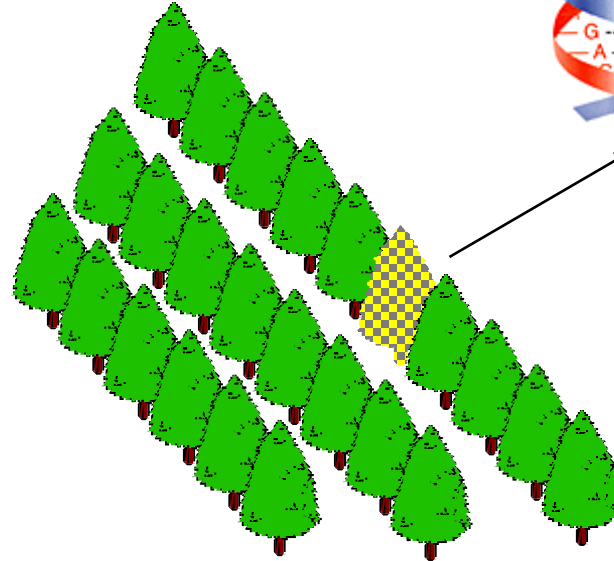
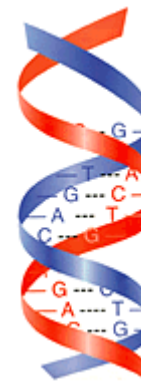
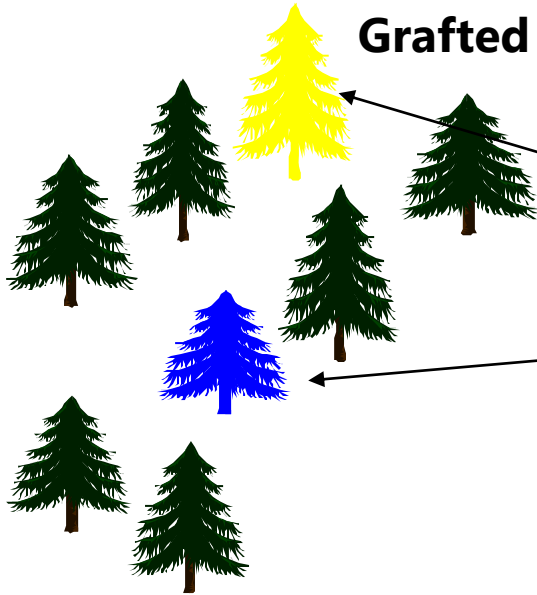
1. Breeding - testing plus-trees seed available

Procedure 10-14 years



2. Quasi field trials- DNA markører

Grafted seed orchards – phenotypic selection



Production stand

Mødre i klonfrøplantage

Fædre i klonfrøplantage	♀\♂	1	2	3	4
	1	X		X	
2	X				
3				X	
4			X	X	

- Cheap
- Gain time
- Establish experiments production stand

Year 2009: massive cone crop
– both lines

1) Young

Mainly Ambrolauri

2) Older trees

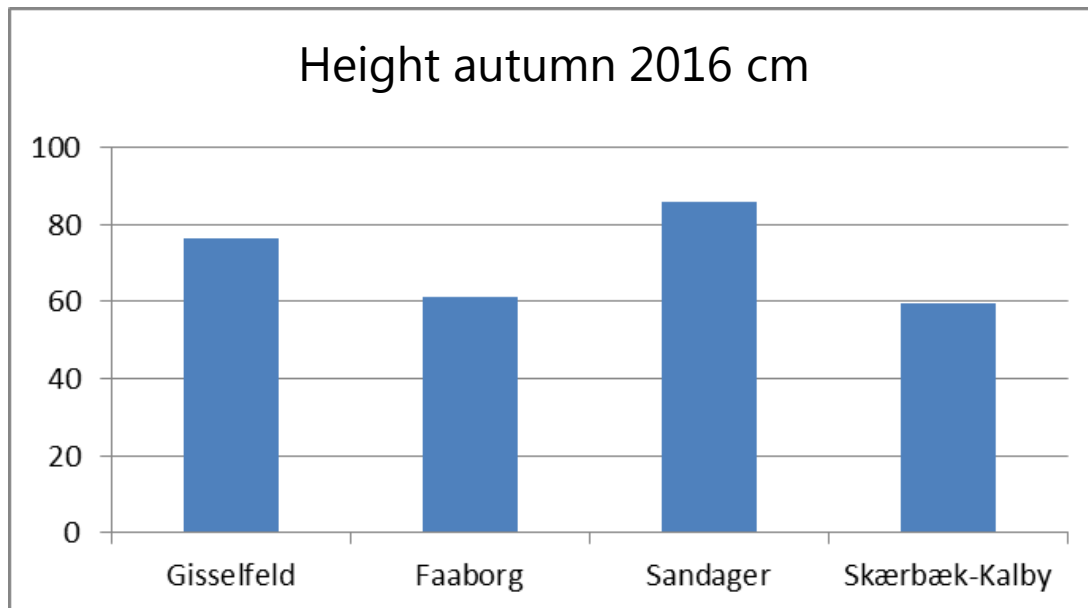
Mainly Borshomi



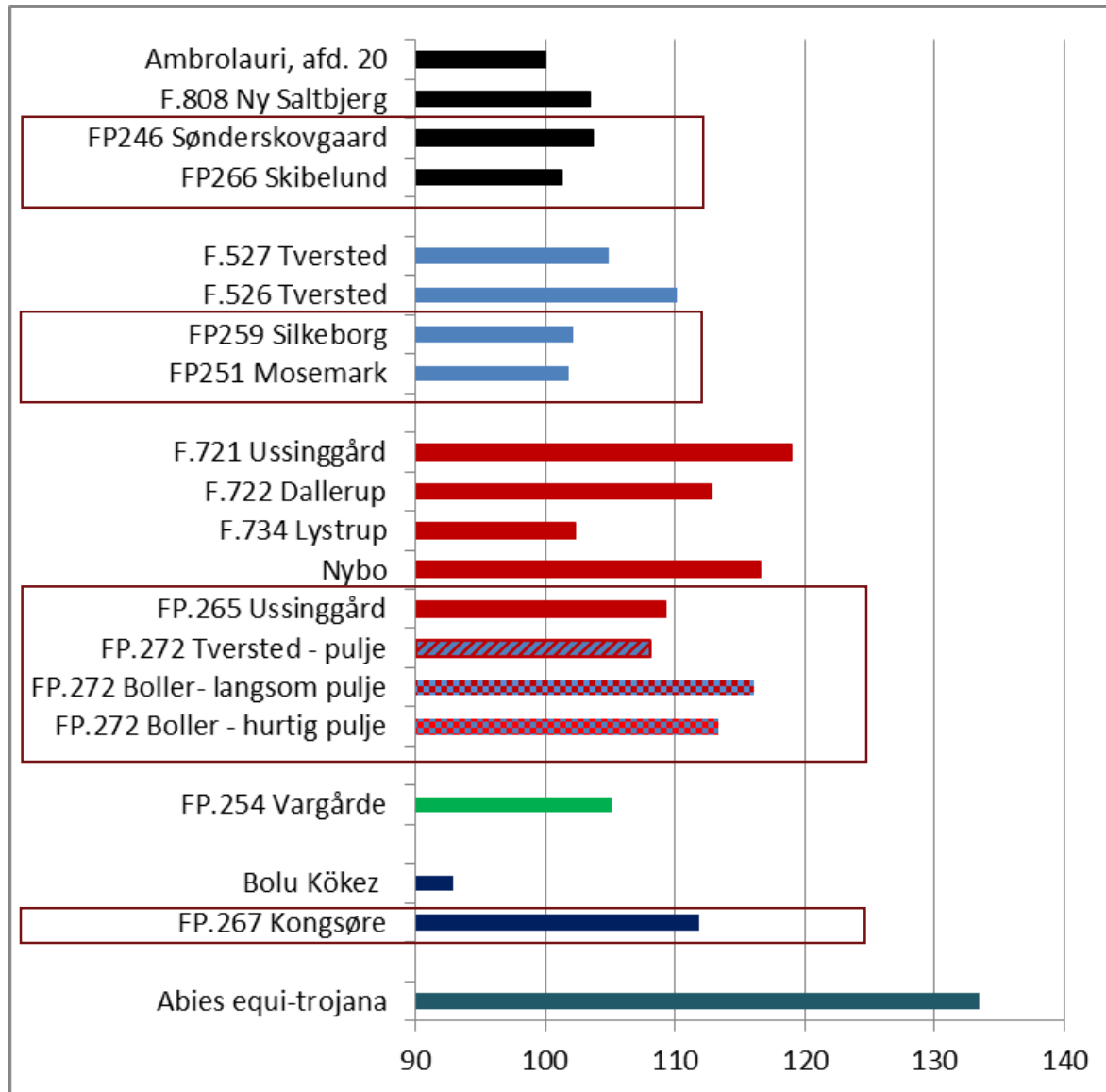
Trial – based on 2009 seed harvest

Spring 2013

Provenances and Seed orchard progenies



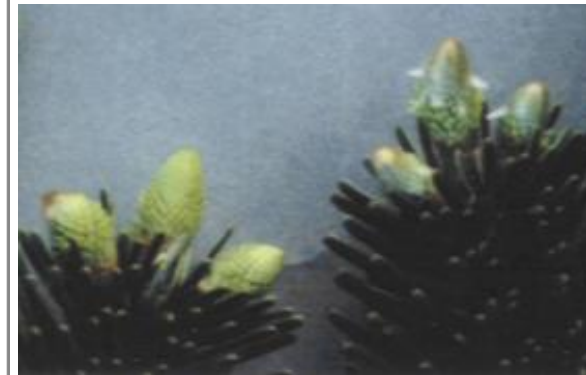
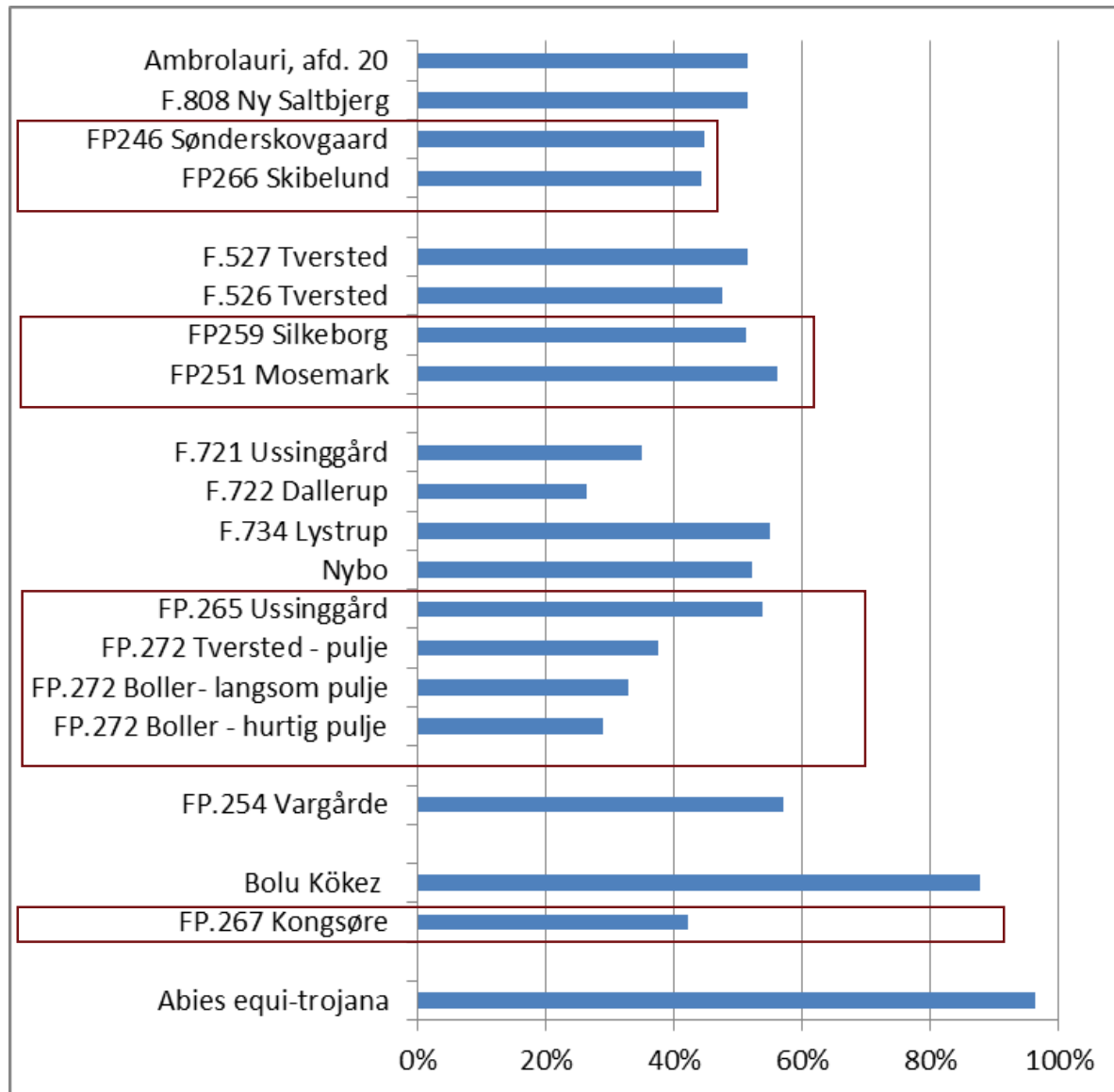
Relative height Ambrolauri = 100 (66 cm)



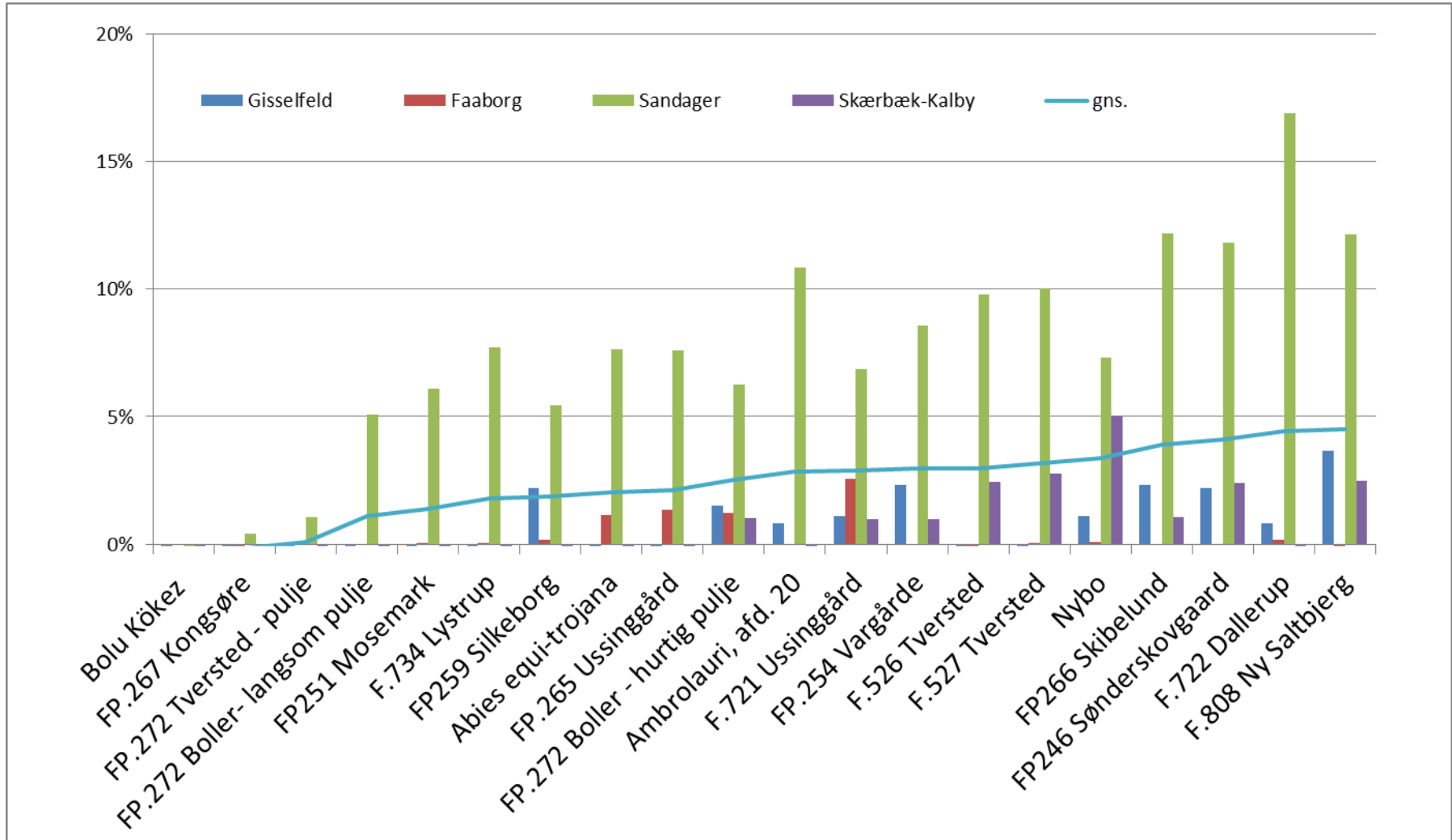


Abies equi-trojani, *A. bornmülleriana* and *A. nordmanniana*
(20 tree row plantings from left and bottom – May 25, 2017)

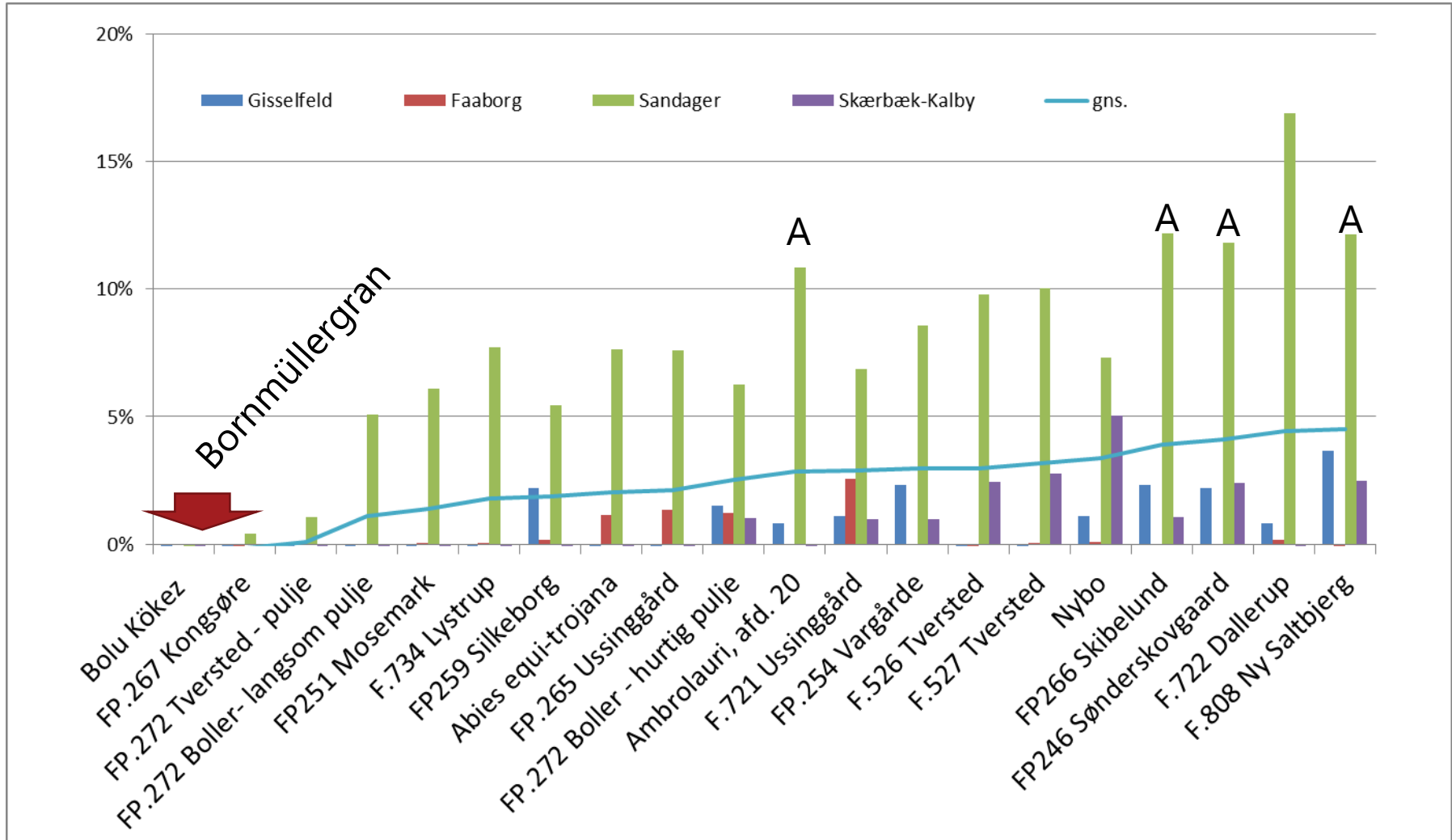
Budbreak % trees May 25-29 in 2016



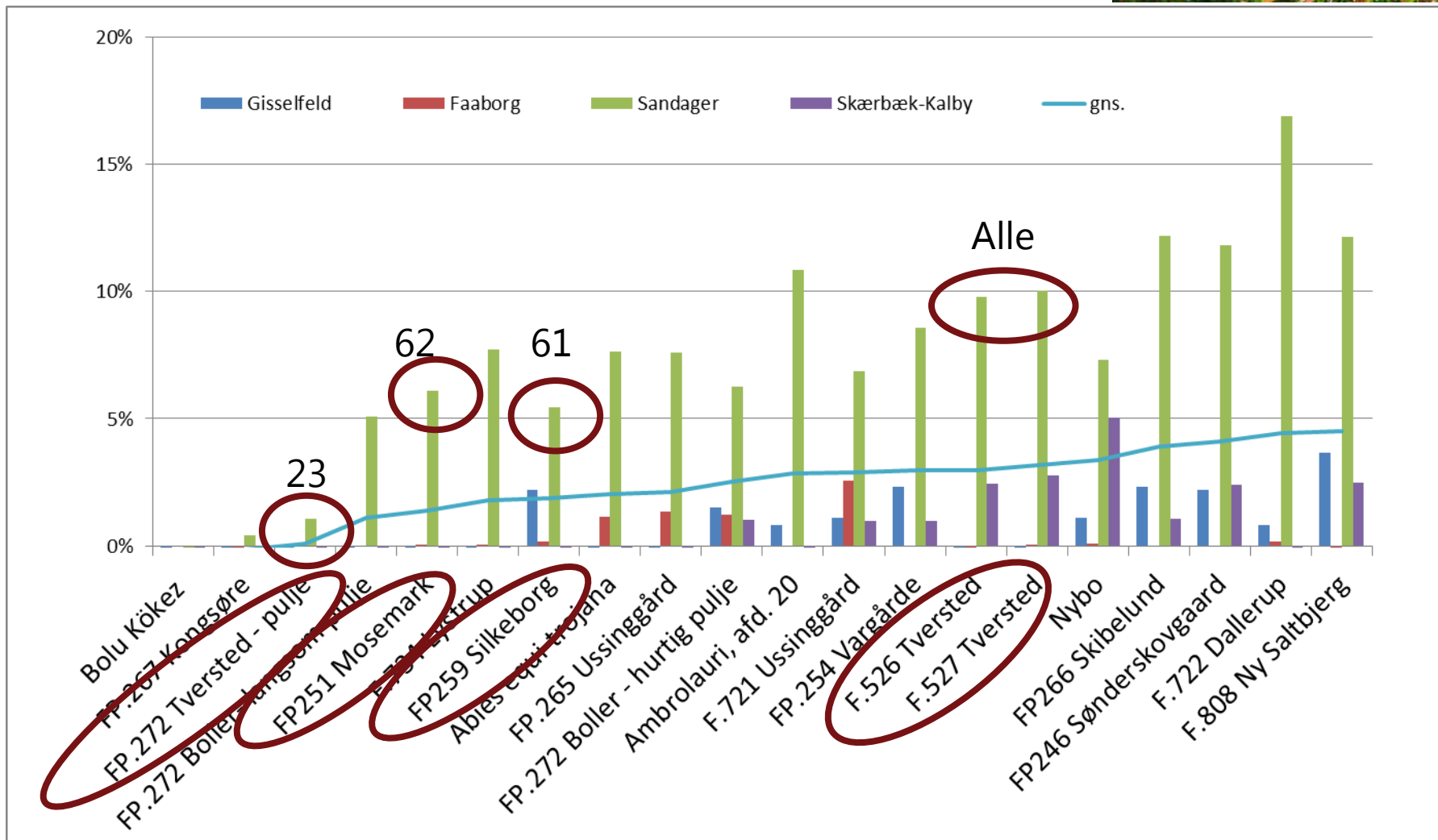
'CSNN' current season needle necrosis



'CSNN' current season needle necrosis

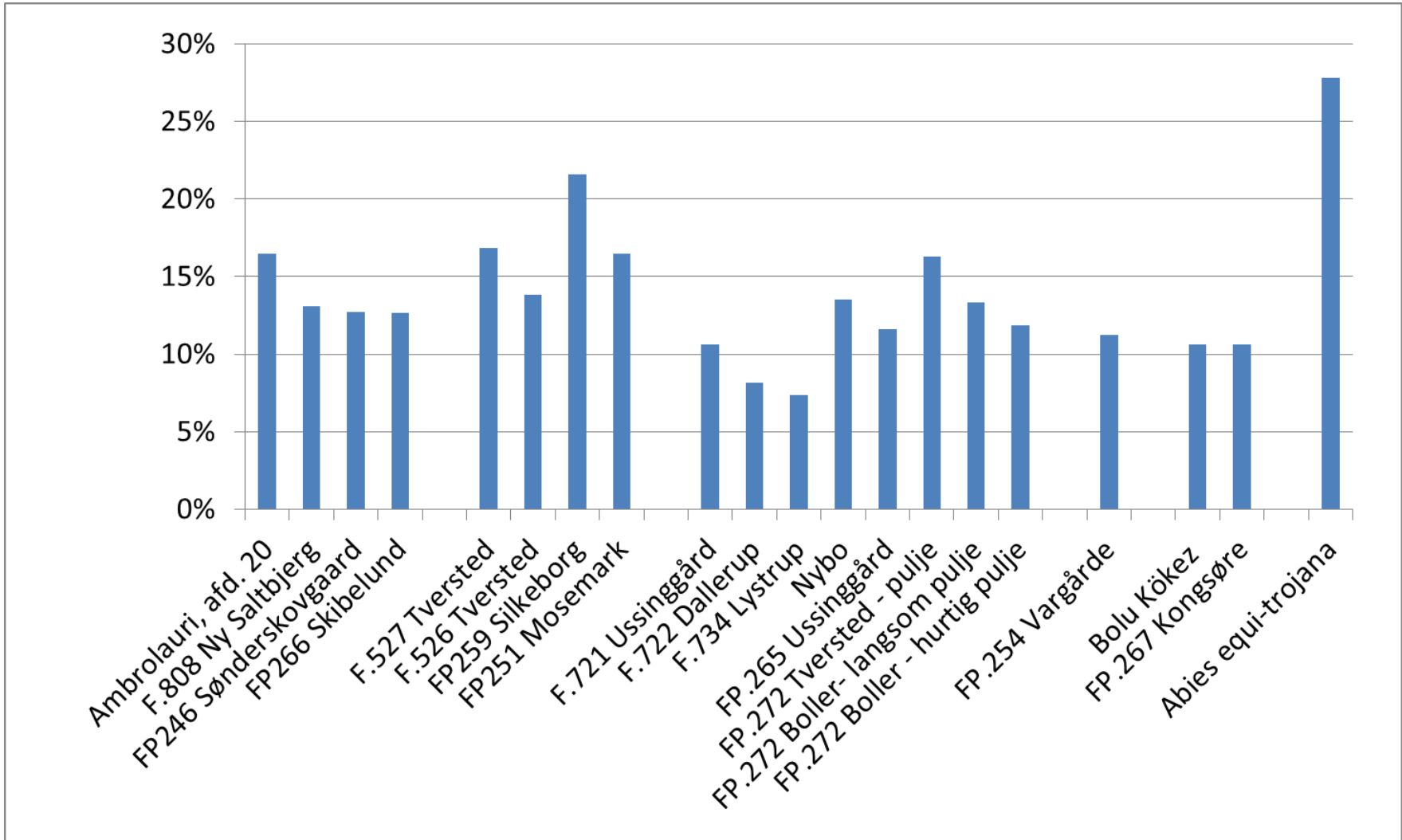


'CSNN' current season needle necrosis



'Bare shoulders'

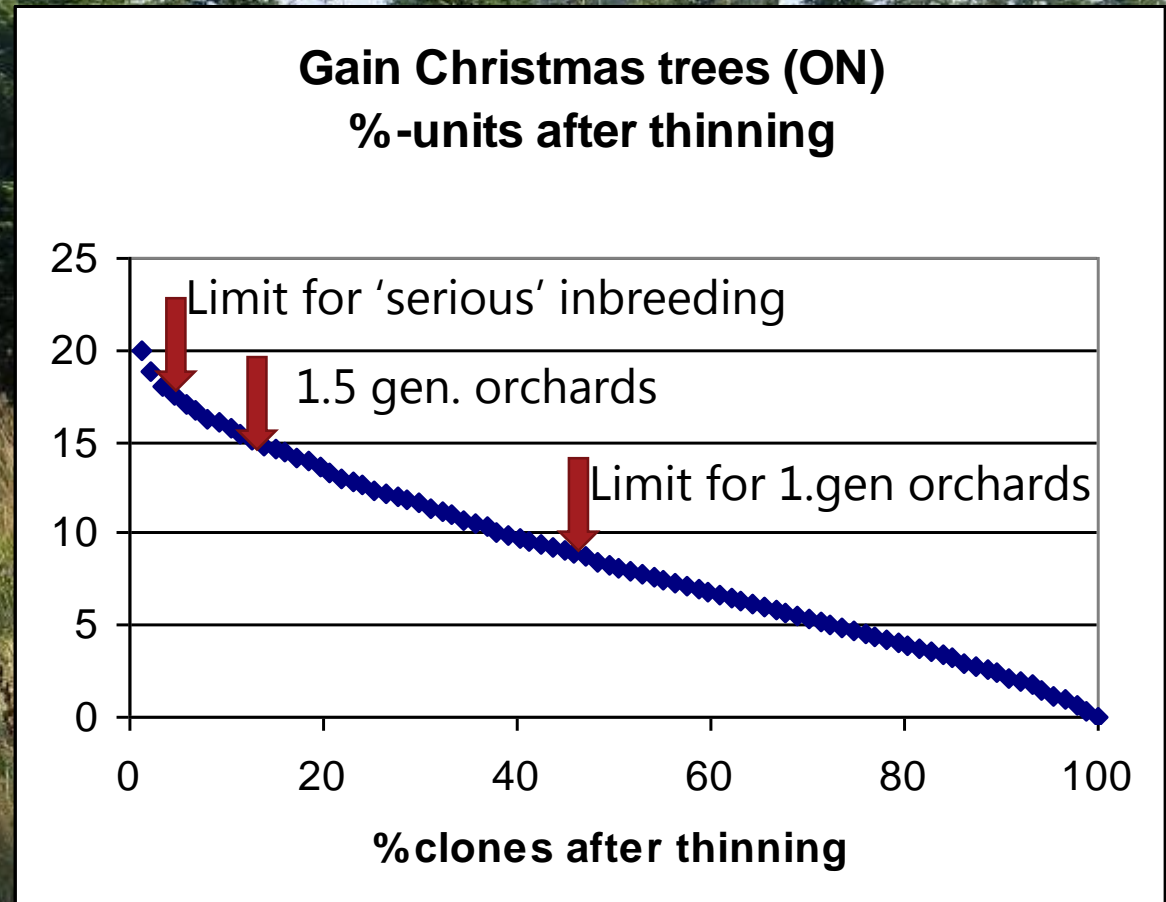
All 4 sites



Genetic gains - salable trees

Percent – units gain in good saleable trees

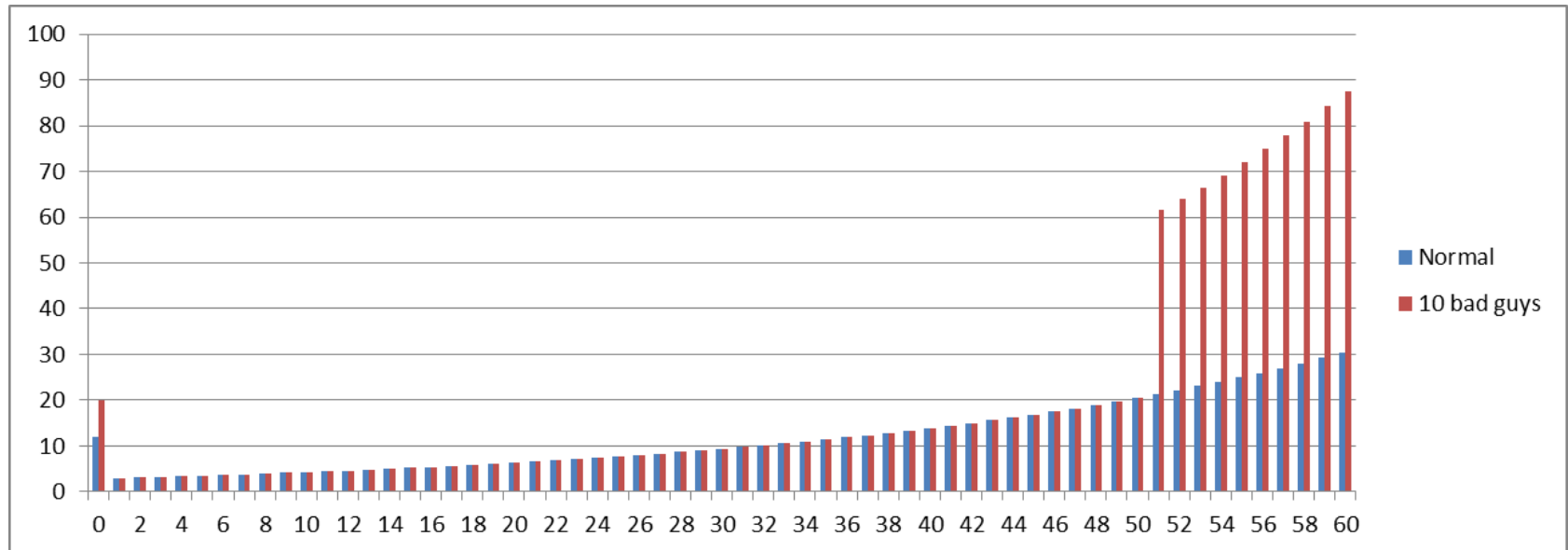
- Tversted provenance



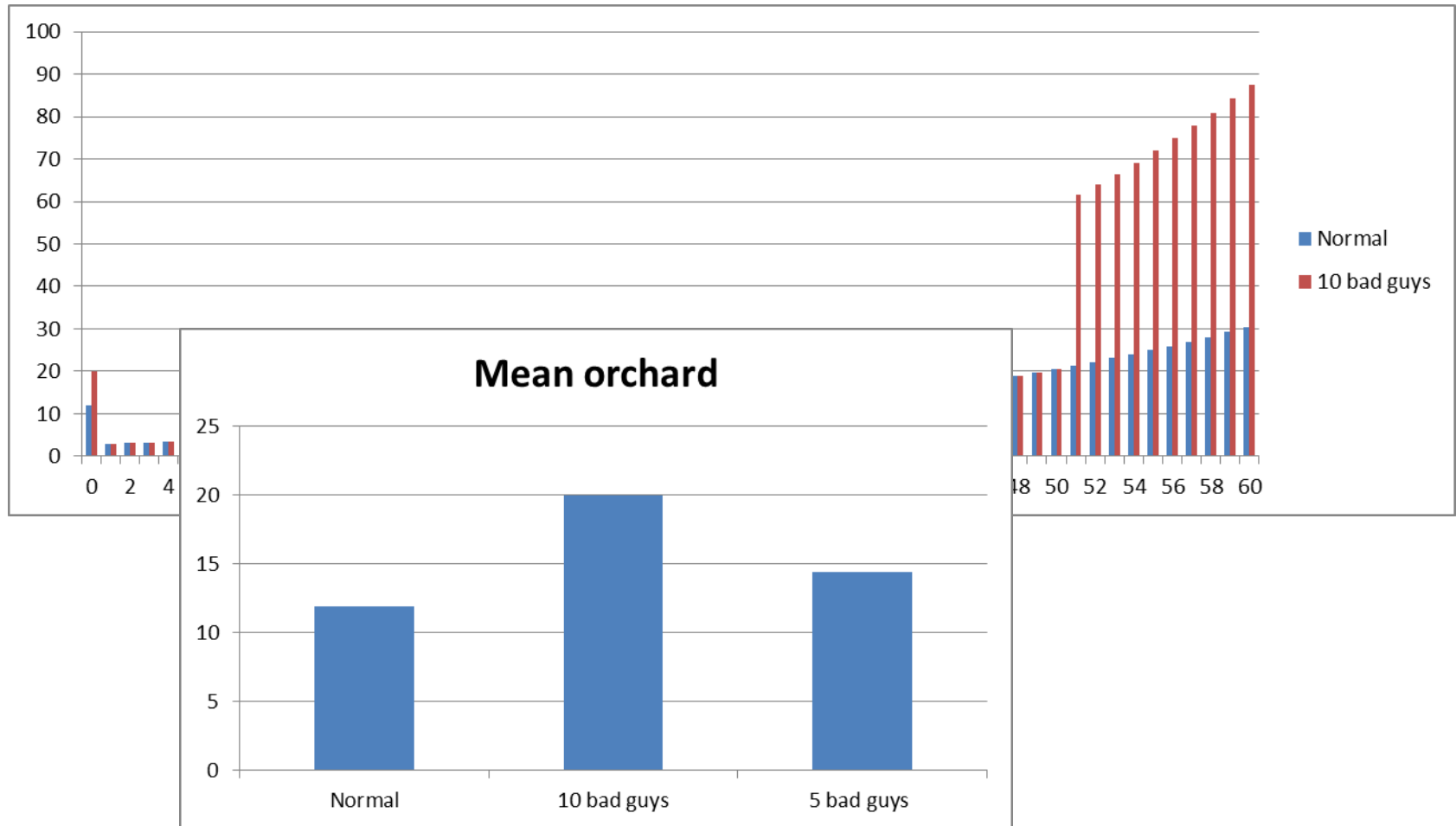
Risk = non tested traits

- Neonectria
- Adelgids – sprayed (few tested)
- CSNN – ‘to little’ damage in progeny trials
- ‘Bare sholders’
- Nutrient demand
- The new disaster…….

Unwanted trees



Unwanted trees



Combine known traits – react to new threats

Utilise our genepool

- **Breeding values from testing is an efficient tool**
- **Quasi field trials – ‘test the threat’**
- **Graft and/or do thinning**

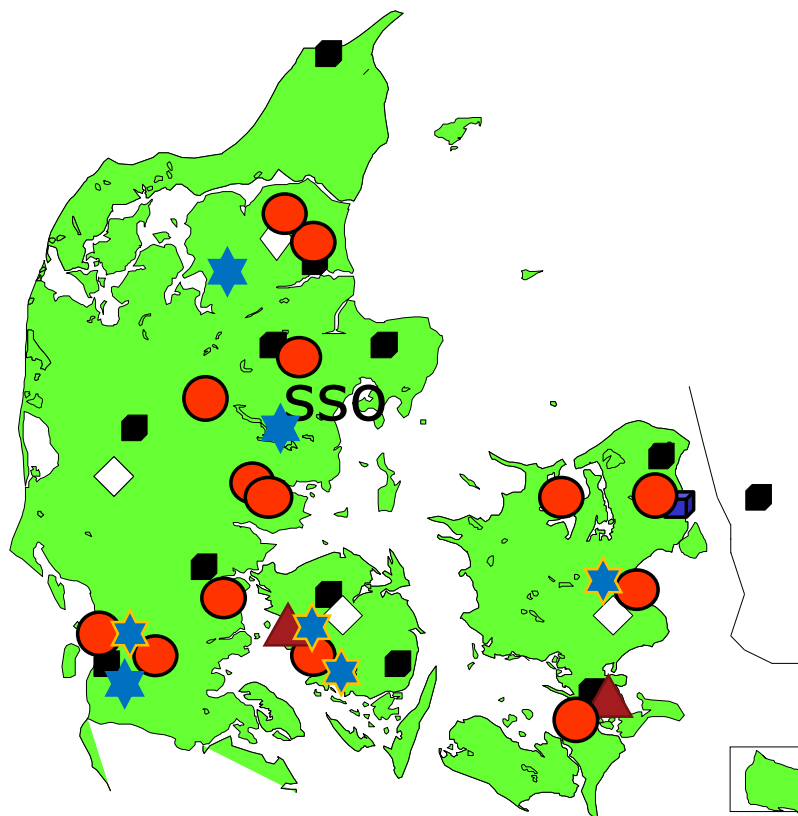


Post harvest needle retention



Fungus: *Neonectria neomacrospora*

Nordmanns fir seed orchards + progeny trials



- Seed orchards
- Progeny trial '97-07
- ◇ Progeny trial '91-00
- ▲ Progeny trial '03-12
- ★ Progeny trial '11-
- ★ Realised gain trial 13-

464 plus-trees
(80.000 seedlings in tests)

40 ha seed orchards – State tree improvement program
+ 30 ha new private orchards

Frøplantagerne virker teknisk set efter hensigten !!

Vurderet på blomstringsscorer
og DNA-analyser
af afkom



Thanks

- Field trials hosts
 - Mads Peter Larsen, Raahavegård v. Sandager
 - Bjarne Knutsen, Birkholm Christmas tree v. Faaborg
 - Jan Olsen, Gisselfeld
 - Torben Ravn, Plantningsselskabet Sønderjylland A/S
- Gerner Frederiksen
 - Measurements
- Kenneth Klausen, Danish Christmas tree ass.
 - Advice and calibrating grade score

Thanks for listening

Funding measurements:

- Nature Agency

