

Seed set for Scots pine grafts is difficult to predict

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Extended abstract

Having predictions for breeding values of clones for both seed set and the genetic quality of the seeds, these two desirabilities may be balanced when choosing clones for a seed orchard (Lindgren et al 2004), but to do that we must know more about the genetics and predictability of seed set.

The study is based on predicted seed production for Scots pine grafted clones in Sweden with origin north of about latitude 62 (the four northernmost counties). Half a century ago plus trees were selected in mature autochthonous forests. At selection comments on the cone-set of the plus-trees were noted. The plus-trees were grafted. An archive with grafted clones of almost all selections (748 plus tree clones) was established at Sävar (present SkogForsk Umeå station close to the coast at latitude 63°54' and altitude 10m) in 1969-70. For each clone a row with four grafts was planted. Many of these clones have also been used in seed orchards and trials. The cone set of each ramet in the clone archive was screened 1984, the information collected was mainly intended to guide when selecting clones for seed orchards. Few clones had few cones, about 7% had less than 25 cones, just a few percent had more than 1000 cones, the average was 120 cones/ramet. The coefficient of variation among clones for cone-set was 94% and for ramets within clones 68%, thus cone-set was rather variable. The northern-most clones originating about 300 kms north of the archive had about half as many cones and they had also a lower diameter growth, but this is not sufficient explanation for the lower cone-production.

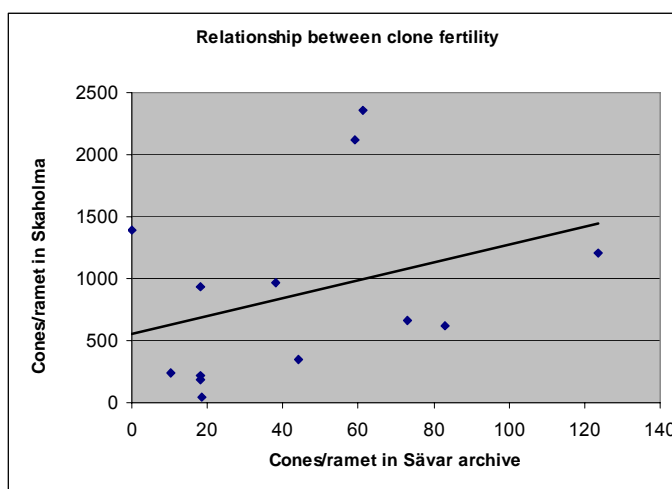
The female fertility for some of these clones has also been observed in four seed orchards and a clone trial. These observations of female fertility were compared with the earlier observations of cone set. The observations are compiled. The observations often do not include all clones in a seed orchard and comments were not made for all plus trees, thus it is only for some clones pair of observations exists.

Object	Lat	Alt	Age	Number of observation pairs (clones)		Correlation	Weight ^B
Seed orchard		M	Years	Archive	Plus trees	Archive - object	
Skaholma	63°50'	5m	43	13	11	0.35	2
Robertsfors	64°	40m	20	30	20	0.22	3
Klocke	62°54'	75m	21	12	12	0.06	2
Sävar SO 99	63°54'	10	30	20	18	-0.21	3
Clone trial ^A				10	8		
Sävar 82	63°54'	10	12			-0.44	0.5
Sävar 93			23			0.10	1
Sävar 04			34			-0.05	1
Röskär	59°25'	25m	21			0.00	1
Degeberga	55°47'	120m	22			0.29	1

^A The clone trial was planted at three localities in northern, middle and south Sweden. The northern site was measured at three occasions

^B Subjective weight for weighted average

The relation between observations prior to selection and in a mature seed orchard is illustrated by the figure (Skaholma was the object with the highest correlation).



For each object a correlation was calculated. To visualize what potential gains in female fertility which may be possible also a predicted percentage potential gain was estimated. It was assumed that the selections raised the cone set in the archive or plus-trees by one standard deviation (selection intensity = 1, which is an unrealistic high weight given to cone-set for seed orchard applications). Averages are compiled in the table below. The female fertility observations in the objects differ, it may be cones, seeds or female strobili, and the quality of the information differs (number of ramets observed, accuracy of method, age of grafts at observation). Therefore for gain predictions also a weighted average where the objects are given subjective weights (see table above) was calculated.

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	Archive	Plus trees
Correlation – mean	0.081	0.055
Gain potential – mean	-2.6 %	-4.2 %
Gain potential –weighted mean	8.9 %	-5.1 %

The comparisons suggested correlation close to zero between evaluations of cone set in plus-trees or clone archive versus cone set or seed set of clones in seed orchards. In no single case out of 18 comparisons there was a significant relationship between cone-set predictions based on observations in the archive or plus trees and female fertility observed in seed orchards or trials for the same clones. The predicted gain in seed production by choosing clones with a good cone set as plus-trees or a good cone set in the graft archive was low and uncertain. It is noted that the two lowest correlations are between objects at Sävar, which grow only a few hundred meters from each other. In the clonal trial the same clones have been observed at different locations and different years, but the observations did not seem to correlate well.

This study may be an argument against locating seed orchards many latitudes south of origin of the clones. Skaholma is such a seed orchard (it is around 20 kms from Sävar but the clones origin from around 300 kms from the north), and the figure shows that only one of the clones is above average in the clone archive and half of them are among the poorest at the clone archive. But still a very high seed production was registered in this seed orchard 2004 (based in the same object data as this study, Prescher et al 2005)!

This is a limited study. It is for Scots pine grafts in northern Sweden. A single archive which was not meant to function as an experiment was inventoried a single year when the grafts had not got old enough for full cone production. Thus generalizations of this study would require observations under more circumstances.

This study suggests that no efforts should be done to predict female fertility for orchard candidates. This simplifies selecting efforts and low-input breeding.

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Keywords: Cone production, female fertility, seed orchard, *Pinus sylvestris*

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