Influence of a planting year to the growth performance in Scots pine provenance trials – an Estonian example

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Introduction

The main aim of provenance research is to identify well growing and sufficiently adapted tree populations (Köning, 2005). In addition the provenance test data have been used for modeling climate change effects and assessing populations responses to climate (e.g Mátyás, 1993; Rehfeldt et al, 2003; Danusevicius, 2008). There is a number of papers published with results of seed transfer influence to the growth performance of trees but there is a lack of information of planting year influence. Provenance trials of Scots pine in Estonia were not established for this purpose but results can be drawn on several additional factors including effect of planting year.

Material and methods

The geographical trial plantations of Scots pine in Estonia were established in the spring of 1964 and 1965, using seeds from 22 different regions of the former Soviet Union. Seeds from 14 regions were used for sowing (from the same seed lot) in both year (Table 1,2). All the 4050 trees under study were measured for DBH and from each plot 15 model trees were selected randomly, which were measured using a laser altimeter Vertex for tree height. Data analysis was carried out with the SAS package, version 8.2.

Results

It was statistically proved that in pines growing under Estoinan conditions survival (Figure 1), height, DBH, mean tree stem volume, volume per hectare (Figure 2) depended on the latitude of seed collection site. The influence of the east longitude and of the combined longitude-latitude of provenance on growth properties is not statistically significant.
Influence of planting year was significant (p=0,0027) for survival and for volume per hectare.

Table 1

Seed origin	Latitude of seed origin	Longitude of seed origin	Height (m) ± standard error predicted by Model 1	Mean height (m) 1964	Mean height (m) 1965	Mean DBH (cm) 1964	Mean DBH (cm) 1965
Järvselja, Estonia	58,25	27,25	18.82±0.09	18.15	19.03	22.4	18.1
Jelgava, Latvia	56,50	24,00	19.49±0.11	19.98	18.94	18.7	18.5
Tukums, Latvia	57,00	23,00	19.58±0.09	19.43	19.63	20.7	18.1
Kedainiai, Lithuania	55,00	24,00	20.04±0.09	20.06	20.03	21.4	19.0
Arkhangelsk, Russia	63,00	43,00	16.46±0.10	16.60	16.13	15.0	16.4
Bryansk, Russia	53,50	34,00	19.35±0.10	19.68	18.73	21.3	17.3
Mari El Republic, Russia	56,75	48,00	19.97±0.08	19.95	20.00	21.7	20.3
Orenburg, Russia	52,00	55,00	19.42±0.09	19.11	19.79	18.7	19.7
Kharkiv, Ukraine	49,50	36,00	18.66±0.07	18.61	18.81	23.1	22.1
Kyiv, Ukraine	50,75	30,75	18.61±0.11	18.00	19.48	22.4	26.9
Lviv, Ukraine	50,00	24,00	19.49±0.10	19.16	20.37	20.4	22.3
Poltava, Ukraine	49,00	33,75	18.15±0.11	17.78	18.62	24.0	21.6
Zhytomyr, Ukraine	50,75	28,75	19.09±0.08	18.23	19.89	21.7	21.1
Ternopil, Ukraine	49,50	26,00	18.88±0.09	18.41	19.17	24.1	23.0

Table 2

Seed origin	Survival (%) 1964	Survival (%) 1965	Mean stem volume (m^3) 1964	Mean stem volume (m^3) 1965	Volume (m^3/ha) 1964	Volume (m^3/ha) 1965	Δ Survival (%)	Δ Volume (m^3/ha)
Järvselja, Estonia	15,0	29,7	0.347	0.236	278	375	+14,7	+97
Jelgava, Latvia	19,7	32,1	0.262	0.246	276	421	+12,4	+145
Tukums, Latvia	21,7	31,9	0.313	0.242	362	412	+10,2	+50
Kedainiai, Lithuania	19,9	27,6	0.343	0.271	364	399	+7,7	+35
Arkhangelsk, Russia	16,3	35,2	0.146	0.170	127	320	+18,9	+193
Bryansk, Russia	18,1	30,2	0.290	0.182	323	343	+12,1	+20
Mari El Republic, Russia	16,5	23,0	0.351	0.309	310	379	+6,5	+69
Orenburg, Russia	13,8	31,4	0.253	0.288	186	483	+17,6	+297
Kharkiv, Ukraine	19,0	15,4	0.325	0.294	345	285	-3,6	-60
Kyiv, Ukraine	15,0	3,6	0.345	0.527	276	102	-11,4	-172
Lviv, Ukraine	10,0	25,1	0.301	0.377	161	505	+15,1	+344
Poltava, Ukraine	11,7	6,6	0.391	0.329	243	117	-5,1	-126
Zhytomyr, Ukraine	18,4	16,6	0.327	0.332	320	293	-1,8	-27
Ternopil, Ukraine	20,8	14,2	0.406	0.382	450	289	-6,6	-161

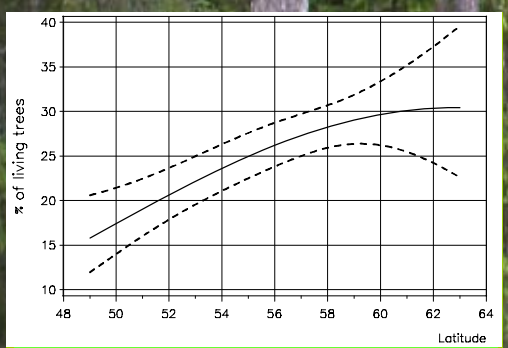

Figure 1 Dependene between survival and latitude of provenance

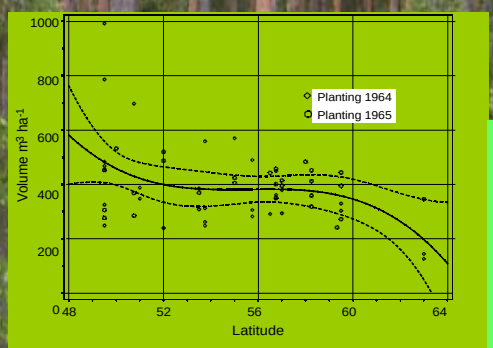

Figure 2 Dependence between latitude of provenance and volume per hectar

Discussion

It is complicated to determine which factor has the powerful impact to the growth performance each year. The meteorological factors of particular year may have crucial influence on the growth of this and subsequent years. It is known from the reports that after planting the trial in 1964 was a month long drought. In this case we may conclude that the drought affected the survival percentage and exceptional growth conditions for local trees had positive impact to trees from southern provenances

Conclusions

Whereas provenance trials are used as a source of data for modeling climate change effects there is a need to establish trials with replications in following years to get more information on the performance of different genotypes. Weather conditions must be considered in growth estimation.

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