Factors influencing development of lamas growth of coniferous tress at the age of 4-6 years

Aris Jansons, Juris Rieksts-Riekstins, Janis Jansons
Latvian State Forest Research Institute "Silava"
aris.jansons@silava.lv

Introduction

Lamas growth – development of second height increment at the end of vegetation period (fig.1) – can be an important problem for productivity (higher probability to suffer in autumn frosts and decrease growth) and quality (increased number of branches per meter, increased probability of double leader, spike knots) of trees.
In forest plantation increased frequency of coniferous trees with lamas growth have been observed in recent years, probably reflecting the fact, that vegetation period has increased in last decade. The trend is predicted to continue and by the end of century vegetation period is predicted to be by 1-1.5 month longer. Aim of the study was to understand the severity of already existing problems with lamas growth and obtain data about its causes, that could be used to prevent or minimize this effect.

Test site

Data have been collected in 6 open pollinated progeny trials (3 pine and 3 spruce) at the age 4-6 years, located in central and eastern part of Latvia. Presented results are form one of the Norway spruce experiments and reflects the trends observed also in other test sites.
Experiment consists of 60 open pollinated families in 4 replications, planted in *Hilocomiosa* forest type, initial spacing 2x3m. On average 20 trees per family, no shorter than 80 cm and without animal damages, have been assessed during 6th growing season.

Results and conclusions

Proportion of trees with lama growth in family varied widely: from 0 to 42%. At individual tree level lamas growth was not related to tree height at the beginning of vegetation period, length of height increment or proportion of total height growth, that is formed in period with highest growth intensity ($r<0.1$). Some families had significantly ($p=0.05$) higher proportion of trees with lamas growth (36% on average) and some - significantly lower proportion (<4%).
Spatial distribution of families with high proportion of lamas growth does not reveal any trends, that could suggest influence of specific environmental conditions (fig. 2).
Analysis at family mean level reveal, that proportion of trees with lamas growth was weakly correlated to height increment ($r=0.2$-0.3), tree height ($r=-0.1$) or length of used vegetation period ($r=0.1$), but strongly – to proportion of total height growth, that is formed in period with highest growth intensity ($r=-0.5$). This trait, in turn, had a negative correlation with height increment ($r=-0.6$-0.7).
Results suggest, that families with higher proportion of trees with lamas growth tend to have more intensive and shorter period of formation of height increment, that, in turn, might lead to more time between end of height increment and beginning of winter conditions, if the autumn is warm .
Despite the general trends, described above, it is possible to select families, that have low proportion of trees with lamas growth, high height increment and relative large proportion of it formed during the period with most intensive growth (fig. 3).

Figure 1. Tree with lamas growth in open-pollinated progeny trial in end of August

	5339	5214	5067				
5205		5021	5058				
5204	5068	5280	5221				
5182	5065	5265	5201	5348	5205		
5180	5163	5260	5014	5326	5153		
5164	5037	5239	5010	5301	5128		
5157	5033	5214	5008	5290	5085		
5200	5067	5278	5028	5371	5139		
5181	5063	5264	5017	5339	5130		
5178	5048	5242	5012	5302	5263		
5160	5036	5218	5009	5294	5095		
5029	5068	5153	5204	5280	5371		
5028	5058	5139	5200	5278	5348		
5021	5065	5134	5182	5265	5058		
5017	5063	5130	5181	5264	5326		
5014	5059	5128	5180	5260	5302		
5012	5048	5113	5178	5242	5301		
5010	5037	5099	5164	5239			
5009	5036	5095	5160	5218	5294		
5008	5033	5085	5157	5214	5290	5205	
5371	5301	5326	5348	5280	5294	5302	5339
5181	5200	5204	5218	5180	5182	5201	5058
5068	5095	5113	5130	5067	5085	5099	5128
5009	5012	5017	5028	5008	5010	5014	5205
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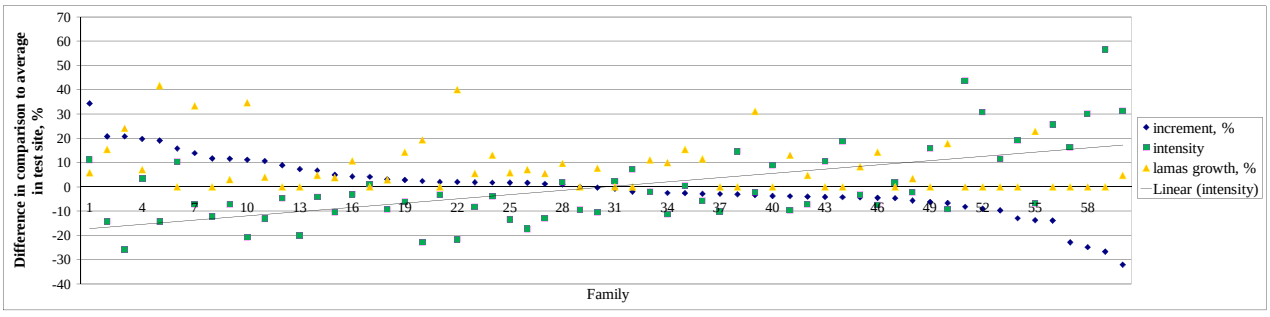
5067	5068	5085	5095	5099	5113	5128	5130
5029	5033	5036	5037	5048	5059	5063	5065
5008	5009	5010	5012	5014	5017	5021	5028

Figure 2. Locations of open-pollinated spruce families with higher than average (red) and lover than average (blue) proportion of trees with lamas growth



Increment, % height increment in comparison to total tree height at the beginning of vegetation period
Intensity – proportion of increment, formed during the period of most intensive height growth
Lamas growth, % - proportion of trees per family with lamas growth

Figure 3. Avearage values of traits for particular open-pollinated spruce families