

# Short Note: Juvenile Height Growth of *Abies grandis* from different Geographical Seed Sources

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## Summary

Four year tree height in the average of 63 provenances from the natural distribution of *Abies grandis* in Canada and the USA extended from 28 cm to 54 cm. When arranged the provenances into 8 different geographical regions, coastal regions showed superior growth to regions of the east side of the Cascades, with the Coast Range in Oregon as the best and the east slope of the Cascades in Washington as the poorest region. Because the variation between provenances is within western regions very large and within eastern regions relatively small, the crest line of the Cascades is considered to be a criterion for provenance selection in *Abies grandis*. Selection for growth vigour seems to be promising in western regions but without much prospects in eastern once.

*Key words:* *Abies grandis*, height growth, geographical differences

## Zusammenfassung

Die Höhenwuchsleistung 4jähriger Bäume von 63 Herkünften aus dem natürlichen Verbreitungsgebiet der *Abies grandis* in Kanada und den USA schwankte in den Herkunftsmittelwerten zwischen 28 und 54 cm. Durch Zuordnung der einzelnen Herkünfte zu 8 geographisch verschiedenen Regionen wird gezeigt, daß die wüchsigen Herkünfte aus den küstennahen Regionen, die geringst wüchsigen aus Regionen östlich der Kammlinie der Kaskaden in Washington und Oregon sowie aus Idaho stammen. Als im Mittel beste Region erwies sich das Küstengebirge in Oregon, als schlechteste die Osthänge der Kaskaden in Washington. Die küstennahen Regionen unterscheiden sich von den Regionen des Binnenlandes aber auch in der Variationsbreite der Herkunftsmittel deutlich voneinander. Für die Küstenregionen wurden große, für die Regionen östlich der Kammlinie der Kaskaden relativ geringe Herkunftsunterschiede gefunden. Es wird gefolgert, daß der Kammlinie der Kaskaden bei der Herkunftsfrage der *Abies grandis* eine wichtige Bedeutung zukommt: Westlich dieser Linie ist ein hoher, östlich davon nur ein geringer Erfolg durch Herkunftsauslese auf hohe Jugendwuchsleistung zu erwarten.

## Introduction

The outstanding performance of older stands with *Abies grandis* in Germany arouse increased interest in German forestry (KLEINSCHMIT 1978) which may direct to a remarkable extension of afforestation with this tree species. Since the origin of the existing German stands are rather unknown, the seed supply must be based mainly on results from provenance experiments. Consequently seed source studies according to BARNER (1978) are the main objective of the provenance experiment in the Institute of Forest Genetics and Forest Tree Breeding in Schmalenbeck. For the import of seed in quantities of practical significance early criteria are needed not only for the assessment of provenances in detail but also for extended seed areas. The purpose of investigations in this

Institute, which started in 1977 with one year seedlings (SCHOLZ 1978), is to fit these requirements by coordinating field trials with experiments under controlled conditions. This paper is based on transplants in the nursery prior to the establishment of field trials.

## Material and Methods

The material stems from 63 seed sources, of which 44 came from the IUFRO-collection in 1974 and 1976 (FLETCHER *et al.* 1978), 17 from Oregon representing some seed zones and elevation lines, and 2 extra seed sources sent by other collectors. In the total there are 8 seed sources from British Columbia (Vancouver Island), 15 from Washington, 33 from Oregon and 7 from Idaho.

After sawing in 1977 the plants were kept in the seed beds for 2 years. In spring 1979 the seedlings were separated according to different aims and the larger part of them were transplanted without replications in a relatively homogeneous nursery bed of Pein & Pein in Halstenbek near Hamburg and raised as 2 + 2 stock.

At the survey in autumn 1980, there was no loss of plants and no worth mentioning injuries. Therefore, only height growth was assessed in the 2 + 2 stage using 200 transplants of each of the 63 seed sources. In order to get relative values for larger seed areas the specified provenances were arranged according to 8 geographical regions and the ranks of regions were tested for significance with the H-Test by KRUSKAL and WALLIS (1952/1953). The compilation into regions in this case is based partly on MUELLER (1935/36), partly it follows merely geographical pattern.

## Results and Discussion

### Height growth of provenances

The range between maximum and minimum provenance means in 4 year tree height was  $54 - 28 = 26$  cm. By arranging the means of all 63 provenances in order of 3 classes not normal frequency distribution due mainly to major geographical differences becomes obvious. From the total number of provenances 50% belong to the lowest class with mean tree heights from 28 cm to 36 cm, 33% to the middle class with values between 38 and 45 cm, and 17% belong to the highest class with provenance means over 46 cm. The lowest class includes all provenances from Idaho and from the east side of the Cascades in Washington and Oregon. The highest class consists of 9 provenances from western region in Oregon and 2 provenances from Vancouver Island in British Columbia.

### Differences in height growth between and within geographical regions

In order to estimate geographical differences in juvenile height growth of *Abies grandis*, which already was dis-

Table 1. — Mean heights of provenances arranged into 8 geographical regions.

British Columbia Vancouver Island	Washington Coast Range		Oregon Coast Range		Washington Cascades West Slope		Oregon Cascades West Slope		Washington Cascades East Slope		Oregon Cascades East Slope		Idaho			
	Means cm	Rank	Means cm	Rank	Means cm	Rank	Means cm	Rank	Means cm	Rank	Means cm	Rank	Means cm	Rank		
40.0	34	38.0	33	33.1	22	35.0	30	30.9	10	28.8	4	28.0	1	29.1	5	
40.4	36	41.5	39	36.1	32	35.5	31	32.6	20	30.4	8	28.1	2	30.6	9	
41.1	38	42.3	40	41.0	37	44.2	46	33.5	23	31.6	12	28.6	3	31.9	15	
42.4	41	42.7	42	43.4	44.5			34.5	28	32.5	18	29.7	6	32.0	16	
43.1	43	44.9	47.5	45.4	50			40.1	35	33.8	25	30.1	7	32.5	18	
45.6	52	45.1	49	45.6	52			43.4	44.5	34.1	26	31.0	11	32.5	18	
48.5	59			46.3	54			44.9	47.5			31.7	13.5	34.8	29	
49.9	60			47.7	56			45.6	52			31.7	13.5			
				50.2	61			47.0	55			33.0	21			
				50.4	62			48.1	57			34.2	27			
				53.9	64			48.3	58							
								52.1	63							
Means of regions	43.9	45.4	42.4	41.7	44.8	48.6	38.2	35.7	41.8	41.1	31.9	15.5	30.6	10.5	31.9	15.7
No. of prov. in regions	8		6		11		3		12		6		10		7	

cernible from the array of the single provenance means, the 63 provenances were grouped according to 8 different geographical regions. In Table 1 mean values and ranks between and within the regions are listed in the form appropriate to carry out the H-Test (see previous chapter). The differences between means of ranks for the regions turned out to be highly significant with the probability P less than 0.001. According to the means the Coast Range in Oregon and Vancouver Island are the best regions, closely followed by the Coast Range in Washington and the west slopes of the Cascades in Oregon and Washington. With a larger distance from the former Idaho and the east slopes of the Cascades constitute the geographical regions with the least growing provenances.

But there are also differences between provenances within regions which vary remarkably from region to region. In the western regions, especially in Oregon, the provenances were very heterogeneous in this trait, in the eastern regions provenances were relatively homogeneous. According to these preliminary results the crest line of

the Cascades may be considered as a criterion for provenance selection in juvenile growth. Westerly of this line comprehensive selection being based on high means and large differences between provenances seems to be indispensable and promising whereas no much gain is to be expected from selection in the easterly regions.

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