

LAMMAS SHOOTS IN SPRUCE – OCCURRENCE, GENETICS AND CLIMATE EFFETCS

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In the northern hemisphere proper timing of onset and cessation of growth is crucial to avoid injury from late spring frosts and early autumn frosts. Normally Norway spruce (*Picea abies* (L.) Karst.) has one growth flush during the growth season. However, in some cases a second flush is observed in young trees. The shoots resulting from the second flush are called Lammas shoots. Any delay of growth cessation may postpone the onset of hardiness development, and thus make the trees susceptible to frost injury during autumn. It is also possible that the late bud formation will affect the timing of bud burst the following spring, and thus increase the risk of spring frost injury. Frost injuries to the terminal bud can result in two or more lateral branches competing for the lead. It has also been recognized that this second, but short, elongation of the leader cause a higher number of nodal branch buds to form. These later develop into the main branch whorl that in many cases appears as "double".

Increasing occurrence of Lammas shoots has been reported over the last years in Norway. This is possibly an effect of changing climatic conditions. On this background we recently carried out a survey on forest land in lowland of South East Norway¹. This pilot study showed that Lammas shoots are present with relatively high frequency on the most productive sites (Fig. 1), and that their occurrence increases the probability of development of multiple tops (forking) the following year (Fig. 2). This may influence structural wood quality in a negative way and cause spike knots and double whorls. Thus, the possible increased occurrence of Lammas shoots may be a negative factor in the production of quality timber in the Norwegian forest. Reduced structural strength might also influence on resistance towards wind felling.

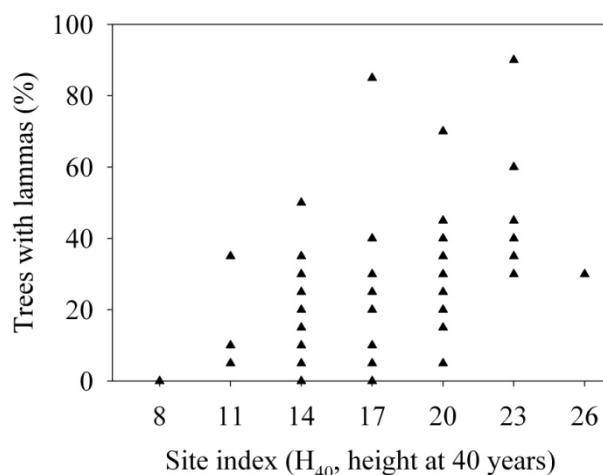


Figure 1. Relationship between site index (H₄₀-system, based on height at 40 years age) and occurrence of Lammas shoots.

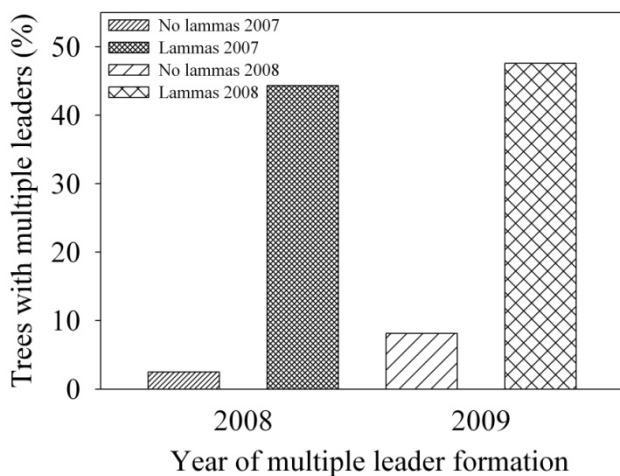


Figure 2. Relationship between Lammas shoots and forking.

Lammas shoots have been observed in genetic experiments with Norway spruce, with substantial differences in occurrence both among and within natural populations (provenances), and among families in breeding populations. In an experimental series with families and clones planted in short term trials and in field trials in Norway, Åland, Finland and Denmark, a considerable variation is present among families in the frequency of Lammas shoots. A strong relationship between formation of Lammas shoots at age five in the short term trial at Ås, Norway, and at age 21 years in the field trial at Paimio, Finland were observed. There is also strong correlation between Lammas occurrence at Paimio at age 21 and timing of bud flush at Ås at age five. Similar results were found in Denmark and Åland.

Further knowledge on Lammas shoot formation and its implications is necessary in order to provide sound recommendations for breeding and silviculture and thereby secure sustainable high quality wood production of Norway spruce under changing climate conditions.

References

- 1 Kvaalen, H., Søggaard, G., Granhus, A., Sundheim Fløistad, I., Holt Hansen, K., Steffenrem, A., Skrøppa T. 2010. Høstskudd og toppskader - et omfattende problem på god mark i lavlandet. *Skogeieren* 10/10.