

VARIATION OF DROUGHT TOLERANCE OF HYBRID LARCH IN GREENHOUSE EXPERIMENTS

Dr. María del Carmen Dacasa Rüdinger¹, Dr. Heino Wolf¹

¹Staatsbetrieb Sachsenforst, Department of Forest Genetics and Forest Plant Breeding
Bonnewitzer Straße 34, 01796 Pirna, Germany
Maria.Dacasa@smul.sachsen.de

Background

Hybrid larch resulting from crosses between European and Japanese larch (*Larix decidua* x *Larix kaempferi*) has been shown to display heterosis for several relevant commercial traits like growth and stem form and to thrive well on a broader range of ecological conditions than its parents (Pâques, Ann. sci. for. 1989, 46). This makes hybrid larch especially interesting for its use in reforestation and afforestation programs as well as in short rotation management systems.

Testing in the greenhouse

Three important questions arise in the attempt to breed Larch varieties with enhanced tolerance to drought:

- Are there differences in drought stress tolerance among hybrid progenies of Larch?
- Which physiological aspects are the most suitable to evaluate the response of Larch to drought?
- Are there trade-offs between relevant features like growth of the breed varieties and their tolerance to drought?

To address these issues, five hybrid larch full sib families, all derived from tested seed, have been assessed for their drought stress tolerance. Seedlings of the parental species of the hybrids, European (ELA) and Japanese (JLA) larch, were included as a reference. A total of 50 one year-old seedlings per variety and parental line were used and divided into a control and a treatment group, the first being regularly watered during nine weeks until the end of the experiment. The treatment group was left without watering during the whole period. In addition, the stress tolerance of 21 hybrid larch clones derived from somatic embryogenesis was determined using ten ramets per clone, half of which used as controls as above. The clones represent five full sib families, descending from basic material of the category "tested". Plants were evaluated by determining:

- plant vitality evolution,
- height growth under drought stress,
- photosynthetic efficiency using a portable chlorophyll fluorometer.



Figure 1: Vitality scores
 ● 1 No damage or just slight damage
 ● 2 Intermediate damage
 ● 3 Severe damage or dead

The challenge

There exists a large variation among hybrid families regarding the extent of the heterosis effect. This fact has to be considered in breeding programs in order to maximize the genetic gain for the desired traits. The public enterprise Sachsenforst is working on larch improvement since about 70 years and in view of the predicted rise of temperatures has now included the resilience against drought stress in its breeding program as a feature to look for along with the classical targets growth, stem straightness and branching.

Variation in response to drought

- There are differences among families and among clones from the same family. After 9 weeks of drought it was possible to find all three vitality scores among individuals of the same family (Fig. 1). Only one of the five hybrid families resulted less tolerant than the parental lines (Fig. 2)
- Assessment of plant vitality seems to be a stable indicator of tolerance as it render similar ranking results as obtained in previous experiments.
- The three most vital families after nine weeks of drought present the largest growth under control conditions (Fig. 3). No correlations between growth under drought stress and vitality scores has been found (Fig. 4).

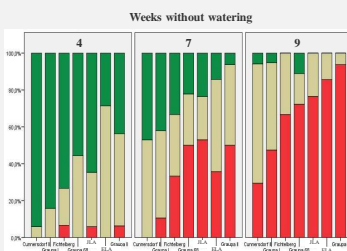


Figure 2: Percentage of vitality scores

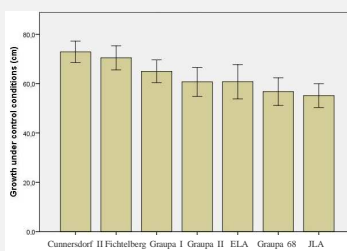


Figure 3: Growth of the control groups

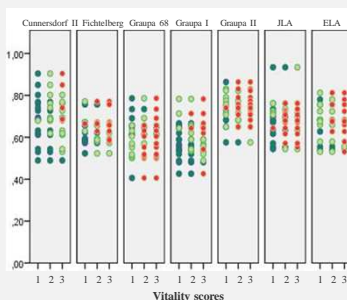


Figure 4: Percentage of growth under drought conditions relative to the respective control group

