

Summary

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S U M M A R Y

The aim of the present investigations was to characterize factors limiting the distribution of Fagus silvatica (beech) on podsol soils in the northern Swiss Prealps. As a study site, Guberswald (Schwarzenberg) near Lucerne was chosen because under the same general climate three different Types of soils viz. podsol (normally drained), brown-earth (normalley drained but with some indication to imperfect drainage) and A₁-pseudogley (imperfectly drained) were found with different stand conditions. Three site factors were studied, which might have a limiting influence on beech and fir regeneration, establishment and growth: water, nutrients and competition. Investigations were started in 1972 and terminated in 1974.

1. To characterize the habitat, a vegetation survey was made. A vegetation table shows the precence of Bazzanio-Abietetum typicum, Leucobryum-variant with fir as a dominant on podsol and pseudogley and Abieti-Fagetum typicum with beech as dominant tree on slope brown-earth.
2. Soil profile studies reveal that there are five sub-types of soils viz. podsol, pseudogley podsol, acidic brown-earth, A₁-pseudogley and brown-earth. Particle size analysis shows that of all the soil, podsol has the most sandy texture, A₁-pseudogley the most clayey and brown-earth in between.
3. Water desorption curves were made from undisturbed soil samples. They demonstrate that podsol has a maximum amount of large pores while A₁-pseudogley has a maximum amount of fine pores in the depths of 10 - 20 and 40 - 50 cm. Tensiometer installations were made at six places. Two years results show that water is not the limiting factor for the growth of beech seedlings. Even in podsol, water remains in the range of availability on account of periodical rainfall.
4. The amount of total exchangeable metallic cations is very small (13 meq/100g) in 1 - 60 cm depth of podsol while it is large (125 meq/100g) in the same depth of brown-earth.
5. Germination experiments: 4000 beech nuts were put in the field at different places. Inspection in May revealed that all nutsexcept a few were eaten away by birds and rodents. This indicates that with the normal small quantities of beech nuts on the ground, damage caused by these animals is nearly complete. Therefore, wire mesh cages were installed to protect the nuts. Experiments revealed a higher germination percentage on brown-earth. Germination experiments in the greenhouse showed that beech nuts do not germinate on the durface of the soils while fir seeds do. The failure of beech nut germination is due to lack of good contact with soil. In the field, beech nuts germinate on the surface of brown-earth because rainfall, surface run-off, earthworms and frosts bring them in good contact with soil. On podsol, beech nuts come to lie on fir litter where neither they are in good contact with soil nor can imbibe enough water for germination. Therefore, beech nuts rarely germinate on podsol. Fir seeds germinate even on litter layer because of their fine seed coat they imbibe water quickly.

6. Countings of seedlings on $4m^2$ plots revealed that beech regenerates profusely on brown-earth while rarely on podsol.
7. Root/shoot ratio for beech seedlings is greater on podsol than on brown-earth. On podsol the tap root system of beech is suppressed and lateral roots grow profusely in the humus layer. On the contrary, on brown-earth the tap root grows deep into the soil while lateral roots are suppressed. The tap root of fir seedlings sustain the growth and grows deep into the soil.
8. In the humus layer of podsol, beech nuts encounter strong root competition from Vaccinium myrtillus. Fir escapes root competition by sending the tap root into deeper horizons of podsol.
9. Increment studies of saplings showed a trend that beech grows slowly on podsol, whereas fir saplings grow well. Therefore, fir dominates over beech already in an early age under otherwise comparable conditions.
10. It is concluded that fir is able to germinate and establish itself successfully even under the conditions of a podsol, thereby dominating over beech which fails to germinate and establish itself. However beech dominates on base rich brown-earth in the Guberwald because of favourable conditions for germination and establishment.