

Spruces for the future

Andrew Leslie, Imam Sayed and Lorenza Pozzi give an update on spruce trials

Sitka spruce represents about 50% of the conifer forest resource in the UK and commercially is our most important species. The main limitation to planting Sitka spruce in the uplands is its high demand for soil moisture and it is generally not planted on sites receiving less than 1000mm of rainfall. Furthermore, some parts of the UK currently suitable are predicted to become too dry for Sitka spruce. Developing a tree with the attractive properties of Sitka spruce but more tolerant of dry conditions could therefore have significant potential. There is also a need to diversify the range of tree species and that could include a larger component of spruces other than Sitka spruce. Norway spruce covers about 5% of our commercial conifer forests and has a long history as an exotic in the UK and is a major species in northern continental Europe but there is little information on which improved material grows best in the UK.

This article described two research projects undertaken by Forestry England, Maelor Forest Nurseries Ltd, Scottish Woodlands, Tilhill and the University of Cumbria. The first project tests Lutz spruce (a hybrid of Sitka spruce and white spruce) against Sitka spruce, but also other spruce species in a series of trials across north eastern England and southern Scotland, established in 2019. The trials sites have been selected as those normally considered to be too dry for Sitka spruce and vary in their Ecological Site Classification suitability from Very Suitable to Marginal for Sitka spruce. The second project is directed at identifying the best seed



orchard material of Norway Spruce for use in the UK and compares material from seed orchards in France (but of Ukrainian origin), Sweden and Denmark against the stock material planted from Germany in four trials from northern Scotland, Wales to south west England established in 2018. We do not currently have seed orchards of Norway Spruce in the UK and so must import our improved seed. Members of the Conifer Breeding Coop are currently identifying plus trees of Norway spruce with the intention of establishing UK seed orchards.

Lutz spruce - a hybrid for drier site conditions?

Lutz spruce occurs as a natural hybrid between Sitka spruce and White spruce and is found in the transition zone between the wetter and more maritime coastal areas of Pacific North America (where Sitka spruce is found) and the drier inland and continental areas (where white spruce is found). It is hoped therefore that some of the hybrids will combine the desirable characteristics of Sitka spruce with the tolerance of drier conditions found in white spruce. In general, hybrids offer the potential of creating a tree with the best characteristics of both parents and sometimes also exhibit hybrid vigour (heterosis), a characteristic making them better than their parents. An example we are familiar with is hybrid larch, a

tree that is better as a commercial conifer than either of its parents and was widely planted until the arrival of *Phytophthora ramorum*.

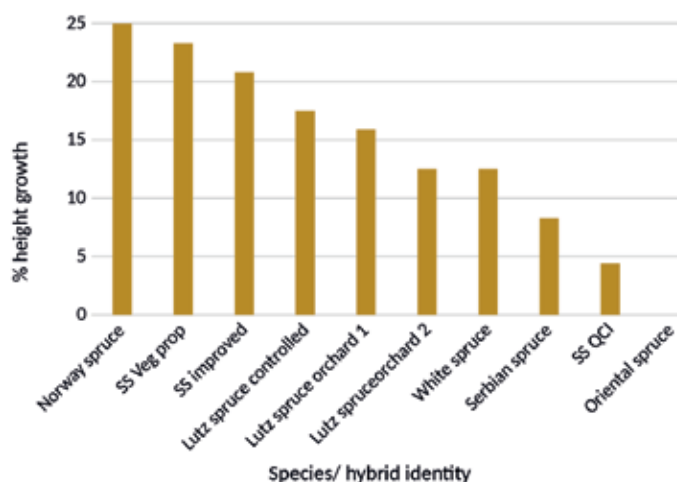
Existing trials assessed by Victoria Stokes and her colleagues at Forest Research have indicated that Lutz spruce has potential for commercial upland forestry in the UK. The new trials test a variety of material of Lutz spruce, natural hybrids from Canada, seed orchard material from Canada and also full-sib crosses some of which were propagated using somatic embryogenesis at Maelor Forest Nurseries. As benchmarks for growth and survival, QCI, improved and VP Sitka spruce have been included in the trials as well as Norway spruce, white spruce, Serbian spruce and oriental spruce. There is only one year data on growth and survival but so far, all the species and the Lutz spruce hybrid have shown excellent survival and its initial growth is more rapid than QCI Sitka spruce. Surprisingly, Norway spruce has shown the most rapid one-year growth across the trials.

Norway spruce provenance testing

Provenance testing of Norway spruce in the UK has shown that southeast European (eg Romania and southern Poland) origins grow most rapidly with Scandinavian ones being slowest and German and alpine ones being intermedi-

“Hybrids offer the potential of creating a tree better than its parents”

ate. The new trials, established in 2018 were planted to test the growth and quality of material of Norway spruce from seed orchards in France (but of Ukrainian origin), Sweden and Denmark against unimproved German material normally used for Christmas trees. Four trials were planted across a gradient of sites, identified in the Ecological Site Classification (ESC) as being very suitable to unsuitable for Norway spruce. Unfortunately, the trial in northern Wales had to be abandoned due to repeated damage from livestock but the sites that remain still provide a good range of conditions. After two growing seasons survival of all origins has been reasonable from 60 to 78% although these differences were not statistically significant. Material from the French seed orchard, one of the Swedish seed orchards and the unimproved German material have grown most rapidly over the first two years. However, the material is being tested not just for superior



Average percentage height growth of spruce species and hybrids after one growing season across four trials.

growth but also for quality and currently the trees are much too young to assess attributes such as stem form, branching, spiral grain and insufficient time has passed to rate them for adaptive attributes such as resistance to frost damage.

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E: alec@kwrplanthire.co.uk | **T:** 07903 463743 or
E: kate@kwrplanthire.co.uk | **T:** 07775 770454
www.kwrplanthire.co.uk

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