OPTIMUM NEIGHBOURHOOD SEED ORCHARD DESIGN - SOFTWARE PACKAGE

Seed orchards (SO) represent the link between operational forestry and tree improvement. Globally, SO are the most common deployment scenario in forest tree breeding programmes. A variety of available designs have been used for new SO establishment and most of them are primarily focused on minimizing inbreeding. In our opinion, a good quality design should promote random mating too. With this in mind, the Optimum Neighbourhood Algorithm (ONA) was developed by Chaloupková et. al (2016).

ONA promotes panmixia in seed orchards due to the original heuristic algorithm, which is based on the fact that the most frequent gametic exchange occurs among close neighbours.

The current version of the software was programmed in the R language and the code is connected to a simple interface in Microsoft Excel. The end-user works almost exclusively in an Excel file, which includes all necessary instructions.

Input Parameters:
• SO grid
• number of clones, their ID, and sizes,
• number of iterations and additional parameters controlling the heuristics.

These parameters are automatically forwarded to the R software and the resulting scheme with the matrix of direct neighbourhoods are sent back to MS Excel. All these steps are done using simple keyboard shortcuts, as described in the instructions.

In its current basic form, the ONA is specifically suited for the establishment of first generation SO. It allows the creation of layouts of any size and shape. It also works efficiently with variable clonal sizes (i.e., different numbers of ramets per clone). ONA can also be utilized to improve an existing SO if mortality occurs or in conjunction with an additional design. Software extensions are under continuous development and the software link is being updated. Extensions should include, in particular, the addition of assortative positive/negative mating, and relatedness. Therefore, ONA will become suitable for the establishment of advanced generation SO.

ONA design was utilized for establishing *Acacia mearnsii* SO in South Africa. During this activity, cooperation was established with the Institute for Commercial Forestry Research, specializing in the breeding of eucalyptus and acacia trees. The resulting orchard numbered several hundred trees. During the year, ONA was also used to improve several existing SO owned by Military Forests and Estates s.p.