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Seed trees III - Genotype, age and environment interaction

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The trees as we see them

Trees as we see them are formed by the inheritance from their mother (genotype) but also by their age and the environment, where they grow. It is sometimes expressed as P= G x E x D, where P stands for phenotype (the tree as we see it), G stands for genotype (the inheritance), E stands for environment (climate, soil, competition etc) and D stands for development or age of the tree. A small poor looking tree does not necessarily have poor genes. It could just be young or be growing in a poor place.

Looking for the best genetic material in seed sources, we look for the relative role of the development and the environment. If trees have approximately the same age and grow under similar conditions, we expect that the variation, we see, is primarily due to genetic variation.

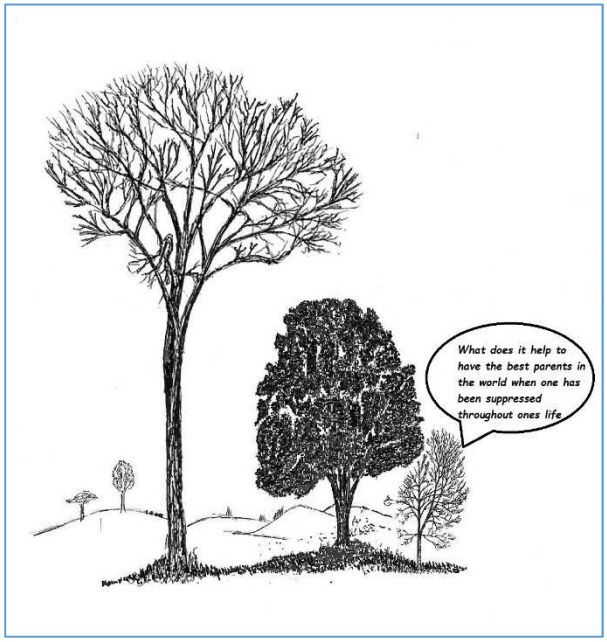

Figure 1. A suppressed tree does not necessarily have poor genes

In natural forest with different age of trees, a variable environment and competition between trees, it is not possible to select individual trees based on how they look. We should though, avoid very poor looking trees, since it 'could' be inherited. Only such characters that are unlikely to be influenced by the environment, for example taste of fruits, may be selected in natural forests. A tree that grows straight and tall shows that under the right conditions, it has the ability to grow straight and tall. Maybe the crooked trees around would also have that ability, they just happened to be suppressed or stressed.

Trees planted at the same time and at reasonable uniform growth sites and with even spacing show differences that are more likely to be because of their genes. Therefore, it is easier to select seed trees in plantations. Occasionally, we also find even-aged stands in natural forests e.g. trees that have regenerated and colonized an area after a major disturbance for example a fire or a land-slide.

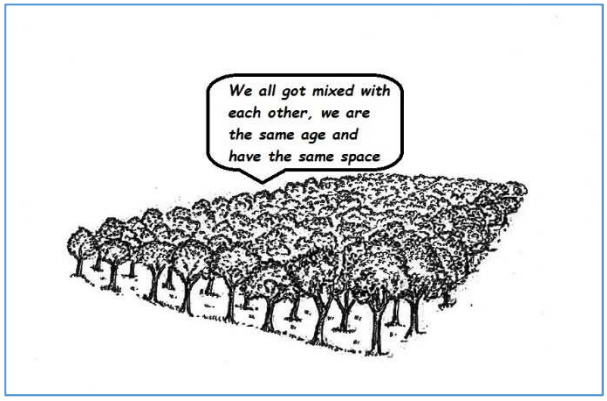

Figure 2. Plantations are usually even-aged and grow with the same spacing between trees. The variation we see between them is thus mostly genetic variation.

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Figure 3. Variation within a population of trees can have many causes

Summary, do's and don'ts

Do:

- Select only for characters that are little influenced by the environment if selected in natural forests.
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Don'ts:

- Don't select trees for good growth or tree form in stands with different aged trees, competition between trees and strong environmental impact

Selected readings

Zobel B and Talbert J. Applied forest tree improvement. The Blackburn Press.

Willan R, Olesen K, Barner H. 1989. Natural variation as a basis for tree improvement. University of Copenhagen /DFSC-LN-A3

Natural variation as a basis for tree improvement.

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This Development Brief was written as an extension note for PATSPO project, Ethiopia