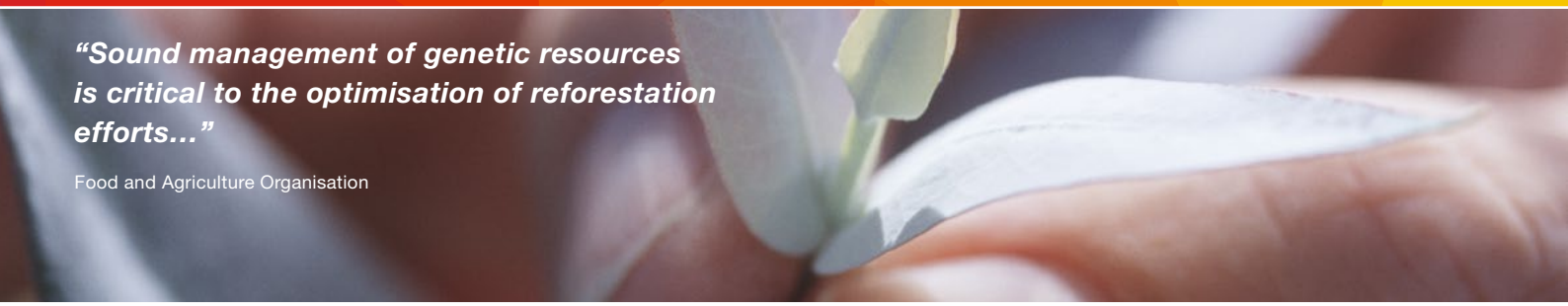
sappi | southern africa

Sustainability FAQs

# Tree genetics — tree improvement

Our **commercial forestry operations** are free from **GM trees**.

However, we have taken the decision to understand the **challenges** and **risks** of **genetically modified tree crops**. While we envisage possible environmental, social and reputational risks they may be a method to **adapt** our plantations to a potentially **changing climate**.



***"Sound management of genetic resources is critical to the optimisation of reforestation efforts..."***

Food and Agriculture Organisation

## What are genetically modified (GM) trees?

Genetically modified (or engineered) organisms have had the DNA changed by other than natural means. Typically, this involves inserting a specific gene or altering the sequence of an existing gene by ways that do not occur in nature.

## Does Sappi use or create GM trees?

Our commercial forestry operations are free from GM trees.

We breed or select trees to give us the best specimens (just like flower and fruit growers). We have a number of tree improvement programmes in place to achieve this.

## Why are Sappi's tree improvement programmes necessary?

Together with energy, wood is our most expensive input. It therefore makes sense to optimise the pine and eucalyptus wood supply we grow and use in South Africa.

To that end, our tree improvement programmes aim to increase the accuracy and efficiency of conventional tree breeding techniques, thereby enhancing our fibre base.

## Does tree improvement contribute to sustainability?

Used correctly, genetic improvement, through selective breeding, is a key component of sustainable plantation management as it: allows us to increase production per hectare; mitigates risk from drought, frost, pests and disease; and supplies wood with properties more suited to end-use. As the negative impacts of climate change become more apparent, with potential negative impacts on global fibre supply, so the need to speed up the rate of tree improvement is greater than ever.

Fast-growing plantations allow large volumes of woodfibre to be produced sustainably from relatively small areas of land and can contribute to the conservation of natural forests by providing an alternative wood source.

## How does Sappi propagate trees?

In conventional tree breeding, which we practise, new genetic combinations are produced through pollination which is a natural process. Seeds from this pollination process are germinated and the trees showing the best growth are selected for further breeding or deployment.

Very good specimens are sometimes cloned by means of vegetative reproduction (the planting of cuttings) which are then planted.

Used correctly, **genetic improvement**, through **selective breeding**, is a key component of **sustainable plantation management**, it: allows us to **increase production** per hectare; **mitigates risk** from drought, frost, pests and disease; and **supplies wood** with properties **more suited** to end-use.

Our trees are **propagated** by planting **seeds** and **cuttings**.

## What do Sappi's tree breeding programmes involve?

Our tree breeding programmes mainly focus on:

- Genetic resource management
- Primary growth traits, such as height/volume growth
- Wood quality traits including chemical properties such as cellulose and lignin content
- Physical properties like wood density — wood basic density (oven dry mass per green volume) is an important trait for kraft pulp production as it affects specific wood consumption
- Testing and selecting genotypes best suited to the range of sites where we plant trees, including harsh sites susceptible to drought
- Understanding host defence mechanisms for important tree pests and diseases.

## How does pollination work?

In nature, pollination occurs through random pollen distribution by the wind as is the case with pines, or insects in the case of eucalypts.

Pollination can also be controlled by manually placing pollen from one tree onto the flower of another tree and isolating the flower to prevent unwanted pollination. This produces a specific cross. Hybrid crosses can be very useful as they combine properties of both parent species, sometimes offering significant advantages.

Eucalypt flowers are pollinated by insects; pines are polinated by the wind.

Recombining genes through successive generations of cross-pollination, with selection for specific traits — growth rate, wood density or tolerance to drought or frost — is how all domesticated plants, including maize, wheat and beans have been developed.

Pollination cannot always occur naturally, as species have to be compatible, eg one would not be able to cross pollen from a bamboo plant onto the flower of a eucalypt tree as they are not compatible.

## What is cloning?

Cloning is the process of producing many identical individuals from a single parent through vegetative reproduction — a type of asexual reproduction found in plants where new independent individuals are formed without the production of seeds or spores.

Cloning is both a natural process in many plant species and one utilised by horticulturists to obtain quantities of economically viable plants. The methods horticulturists use for vegetative reproduction range from simple cloning such as rooting of cuttings to grafting, to the complex artificial propagation of tissue material in laboratories. Many plants, including roses, tulips, grapes and apple trees are reproduced in this way and have been for centuries. Vegetative propagation is very important in capturing the genetic improvement from specific crosses, especially with hybrids.

## How are Sappi's trees propagated?

At Sappi, 90% of our plant species are propagated by seedling material, the remaining 10%, comprising our eucalyptus plantations in KwaZulu-Natal, are propagated by cuttings.

## Sappi's view on GM trees?

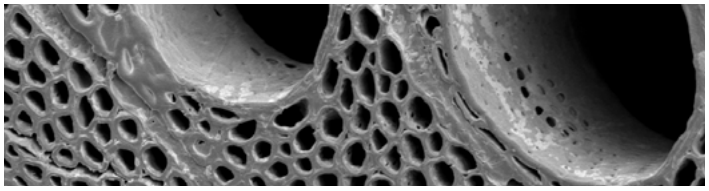
It is our duty as a responsible global corporate citizen to secure the future of our business and the welfare of our stakeholders, in particular the communities where we operate. As such we are exploring the potential solutions that genetically modified (GM) trees, which have been developed and deployed elsewhere in the world, could offer in Southern Africa as regards combating climate change and the threat of pests and diseases.

We are a consortium member of the Forest Molecular Genetics Programme at the University of Pretoria, which is busy with evaluations in a highly controlled research environment. Through this process we aim to obtain a better understanding of this technology, its impact, benefits and associated costs. However, our commercial forestry operations are free from GM trees.

## What do tree breeding programmes achieve?

Changing the composition of the fibre supply can have significant impacts on mill productivity and reduced environmental impact per unit of production.

Positive outcomes of our programmes include increased mill throughput as a result of shorter processing times, and reduced chemical and energy usage.



Electron microscope image of *Eucalyptus nitens*; showing wood structure.

In addition to superior growth, the eucalypt hybrid species we have developed are more disease resistant and better adapted to the sub-tropical climate of KwaZulu-Natal.

## Reducing planting of *Pinus patula*

*Pinus patula*, a widely planted commercial tree species, is susceptible to a fungal pathogen, *Fusarium circinatum*, which causes Pitch Canker Fungus — a threat to the long term sustainability and commercial viability of the species.

During the last 20 years, our research centre has been working on a programme to develop and commercialise *Pinus patula* x *Pinus tecunumanii* hybrids, as a replacement for *Pinus patula*. Our field tests of this hybrid over the last 10 years indicated:

- Substantial increases in tolerance to *Fusarium circinatum*
- Large volume-growth improvements over *Pinus patula*, as well as intermediate levels of frost tolerance. Frost damage on some sites is a challenge that is being tackled both through breeding and more accurate mapping of frost risk.

We are now planting the hybrid commercially and this has meant a gradual reduction in planting *Pinus patula*.

## Using biotechnology

Biotechnology tools such as DNA fingerprinting — help improve our tree breeding, seed production and propagation efficiencies by allowing us to keep track of our elite pine and eucalypt breeding stock. We also use biotechnology to develop trait-linked molecular markers for breeding and for understanding host defence mechanisms to important tree pests and diseases.