Cultivation of Bt poplars in China

in

- Genetically Engineered Trees [1]


Federal Ministry of Education and Research - Germany

"Seeing once is better than studying a thousand times"

...so goes a Chinese proverb and the summary by Dietrich Ewald, who visited the deliberate release sites of genetically modified trees in Northern China. The Chinese government is planning to reforest large areas over the coming years. Parts of the plantations are to be planted with genetically modified Bt poplars.

GMO Safety spoke to Dr. Dietrich Ewald of the Institute for Forest Genetics and Forest Tree Breeding in Waldsieversdorf, shown here with a Chinese colleague.

Since the early 90s the institute has been collaborating closely with the Chinese Forestry Academy in Beijing and Hebei University in Boading. Both establishments are playing a crucial role in the development of the Bt poplars. At the end of this year a joint publication by the German and Chinese researchers will appear, which for the first time will describe the state of the research and the commercialisation of transgenic trees in China.

Poplar seedlings that will later be planted out in the plantations.

Test planting with Bt poplars and conventional poplars in mixed cultivation

Damage caused by the Asian longhorn beetle:

Bt poplars are only resistant to leaf-eating pests. Researchers are trying to develop effective genetic engineering strategies against the wood-eating Asian longhorn beetle.

Biosafety measures for transgenic crops in China

Studies on the development of transgenic trees have been conducted in China since the 1980s.
1993: First legal regulations on the safety of genetically modified plants.
2002: Regulations on safety assessment, import and labelling of GMOs
2005: China ratifies the Cartagena Protocol on Biosafety

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Poplar seeds: Although the Bt poplars form seeds, these are either not germinable or the seedlings are generally not capable of surviving.

Testing the impacts on soil organisms and beneficial insects

The diversity of the insect community in the plantations and possible negative effects on soil organisms have been investigated. The findings will be presented by Dietrich Ewald and his Chinese colleagues in a publication at the end of the year.

Bt poplars for reaforestation

Poplars are one of the most commonly planted species of tree in China. They are an important raw material and are used for veneer wood, plywood and building timber. As a fast-growing tree, they...
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also have an important role to play in the reafforestation of deserts. Decades of intensive logging
have accelerated desertification, especially in the north of China. The aim is to reforest an area of
approximately 17 million hectares by the year 2012.

However, the cultivation areas, which are arranged as plantations, favour the rapid development of
pests, which cause severe damage to leaves and trunks. In future, to limit the reproduction and
spread of the pests, parts of the plantations are to be planted with genetically modified Bt poplars
which have proved resistant to leaf-eating pests.

The emergence of commercial cultivation

In 2002 the Chinese forest administration authorised the first Bt poplars for commercial cultivation.
In close collaboration with state institutions, tree nurseries are currently propagating and testing the
transgenic plant material.

According to official statistics from the Chinese Forestry Academy, Bt poplars are currently being
commercially grown on around 200-300 hectares. There are a further 300 hectares of small research
sites, distributed over several provinces.

Two transgenic poplar lines are currently authorised in China. Both lines, Poplar-12 and Poplar-741,
produce a Bt toxin in their leaves which kills leaf-eating insects.

Test plantings: The right proportions

In test plantations researchers are currently investigating the optimum plant densities and the right
mix between Bt and conventionally bred poplars. "Mixed planting serves several purposes", explains
Dietrich Ewald. "The Bt poplars should reduce the pressure of pests, particularly leaf-eating species,
in the plantations. Too high a proportion or the exclusive cultivation of Bt poplars, however, would
provoke an early development of resistance among the leaf-eating pests."

Joint cultivation with conventional poplars is therefore used partly for resistance management. But it
also offers a broader, and therefore more effective spectrum of plant resistance. This is because Bt
poplars are not protected against wood-eating species like the dreaded Asian longhorn beetle
(Anoplophora glabripennis). But there are conventionally bred poplar lines that have greater
resistance to this major wood pest.

"The reafforestation will largely involve commercial plantations with a ten-year rotation period",
says Dietrich Ewald. The plantations will be managed intensively for ten years and then harvested,
primarily for plywood and veneer wood. During the ten-year period, the plantations will be fertilised,
irrigated in some places and, depending on the region, also used for farming, especially the
cultivation of groundnuts between the rows of trees.

No uncontrolled spread

Poplars are dioecious, i.e. there are separate male and female trees. Female clones were selected for
the transformations.

Dietrich Ewald is convinced that "in the case of the two authorised poplar lines many of the security
concerns can be eliminated. Neither of the lines forms pollen, so they cannot pass on their genetic
material via pollen." In addition, seed propagation is only possible to a limited extent. Although the
Bt poplars do produce seeds if pollinated, the seeds of Poplar-741 are not germinable under natural
conditions. The Poplar-12 line does produce fertile seeds, but "observations conducted over several
years show that the seeds are not viable in the regions where commercial cultivation takes place
because of the prevailing drought conditions" says Dietrich Ewald. "If, despite this, seedlings do
form, they are destroyed by sheep and cattle grazing and by soil cultivation on the plantations."
The new traits must be stable

Regarding the commercial utilisation of the transgenic poplars, a primary aim is the stable
expression of the new traits. Particularly with long-lived crops like plantation trees, this aspect is
very important in the tests before commercial application.

As part of the German-Chinese cooperation, various lines from the 741 clone were studied, including
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in Waldsieversdorf laboratories. "Feeding studies with key pests confirm that the transferred genes are expressed stably and specifically in the transgenic lines, providing effective protection", says Dietrich Ewald. The tested plant material comes from regenerated plants from tissue cultures that were transformed about eight years ago.

It remains to be seen whether the Bt poplars will live up to the hopes of the Chinese. After ten years the plantations are to be used for timber. Then, if not earlier, they will know whether the concept of large-scale plantation agriculture using Bt poplars works in practice.

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