Poplar Seminar Germany

Report

(to be presented by Hans-J. Muhs, Rome 13-15 November, 2003)

1 Policies

1.1 Studies or the cultivation or poplars and willows in short rotation

Experimental cultivation of poplars and willows for biomass production in short rotations at various locations have been going on since 1976. On approximately 100 ha of plantations questions of practical cultivation and suitable species and varieties are being studied. Economic studies have shown that the relatively high costs of investment possibly yield a return if promotional funds within the framework of set-aside can be used.

1.2 Cultivation or poplars and willows 00 set-aside agricultural areas

The Act on Equal Status for Set-aside and Agricultural Used Areas *(Gestz zur Gleichste//ung sti//gelegter und landwirtschafilich genutzter Fliichen* - Federal Law Gazette I, p. 910), preserves the arable status of set-aside areas plated with fast growing tree species. However nearly no farmer opted for this alternative form of cultivation.

1.3 Genetic conservation concerning the European black poplar and the white poplar

Due to the cultivation of hybrid poplars and the destruction of alluvial forests, there has been a sharp decline in the occurrence of the indigenous pure black poplar. Germany takes part in the international network of the EUFORGEN programme and takes active measures to conserve the remaining poplars through in situ and ex-situ measures.

2 Production, Imports and Exports

The significance of poplar and willow cultivation for raw materials is low in Germany. There are no exact data on the current levels of felling. It is estimated to be about 150,000 m3. The foreign trade of the Federal Republic of Germany in poplar wood is insignificant all in all. Exports clearly exceed imports.

3 Utilisation

A newly developed method to produce mechanical pulp (alkaline peroxide mechanical pulp, APTMP) could open markets far poplar wood. A paper manufacturer plans to establish an industrial plant for production of poplar based pulp in the area of Pima near Dresden. The Federal Government has been promoting a pilot project since 1997 to plant poplars with a 10-year production period on set-aside agricultural areas. All in all 50 ha of model plantations were established at various locations. Final results are not available yet.

4 Research

During the period from 1950 to 1980 research was conducted in breeding, vegetative propagation and field testing of poplars, especially hybrid aspen. Then the aims of forestry policy changed drastically and breeding became less and less important, because the production function of forests lost its priority in favour of multifunctional forestry. Research focussed since 1993 on safety research of genetically modified forest trees. (Note: safety research is not exactly the same as risk research). Three projects were initiated. The first one aimed at analysing the stability of the insertion of a foreign gene in a host genome and its expression. In laboratory, green house, and field tests most of the transformed clones showed

good stability. However, some clones inactivated the foreign genes and reverted to the "wild type" characteristic, which happened in some leaves or twigs while the Test of the plant maintained its transgenic status (see chapter on expression and stability). This experiment was very important for future regulations for the production oftransgenic clones (OECD-Scheme on forest reproductive material moving in intemational trade and EU-Directive on the marketing of forest reproductive material).

Gene transfers in aspen

The studies of genetically modified aspen clones have been continued. 1996 a release test was started on the premises of the Institute far Forest Genetics and Forest Tree Breeding at Grosshansdorf. Eight transgenic lines with a total of 256 plants were laid out in a randomised block with four replications and 96 additional control plants. The hybrid clone Esch5 *(Populus tremula x P. tremuloides)* and the clones Brauna 1l and W52 *(Populus tremula)* were used as parent clones.

The construct *rolC,* used for transformation, has been derived from the *Agrobacterium rhizogenes* and was used either under the control of the constitutive cauliflower mosaic virus 35S promoter *(35S-rolC)* or the light-inducible promoter of the small sub-unit of ribolose biphosphate carboxylase *(rbcs-rolC).*

The experiments focus on:
-expression and stability of the construct
-interactions between mycorrhizal fungi and transgenic aspen clones
-hormone and carbohydrate metabolisrns in *rolC* transgenic aspen clones and their possible effects on phytopathological features

These studies have not been concluded yet, preliminary results can be summarised as follows:

Expression and stability

To characterise the phenotype of the transgenic plants under outdoor conditions, characteristics like foliation, plant height, stem diameter, branching characteristics and leaf size have been measured. The *35S-ro1C* transgenic plants sprouted approximately one week earlier and the *rbcs-rolC* transgenic plants only a few days before the control plants. Hormone analysis in buds demonstrated that transgenic plants contained lower concentrations of abscisic acid, a phytohormone responsible for bud and seed dormancy. Measurements of plant height and stem diameter indicated that the *35S-ro1C* transgenic plants showed much less growth, whilst the *rbcs-rolC* plants developed like the non-transformed plants. The determination of the branches clearly demonstrated a difference between the various clones: while in the *35S-ro1C* transgenic plants of the parent clone Esch5 there was a decrease in the number of branches, the parent clones Braunall and W52 showed an increase. It was possible to observe morphologically and phenotypically visible reversions (visible deviations from the expected *35S-ro1C* phenotype) in two transgenic lines. While only six plants expressed the *35S-ro1C* phenotype in the *35S-ro1C* transgenic lines of the parent clone Braunall, the leaves of26 plants were larger. These leaves, however, did not completely correspond to the leaf size of the control clone Braunall. In one 3 *5S-ro1C* transgenic line of the parent clone Esch5 two plants (out of a total of 32 plants) were found with visible reversions. However, in contrast with the *35S-ro1C* transgenic plants of the parent clone Braunall they included only parts of the plants (twigs and leaves). In addition, in the *35S-ro1C* line of the parent clone Esch5 four other plants showed reversions in 1998. In all other transgenic lines no more reversions were observed until the end of 1998.

Interactions between mycorrhizal fungi and transgenic aspen clones

Genetic modification of forest plants can only be advantageous to the utilisation of the plants if neither the formation nor the functionality of mycorrhiza are adversely affected. This is why the following questions should be explored before using transgenic trees to a great extent in forestry: Is the transgenic trees' ability to form mycorrhiza qualitatively or quantitatively restricted? Might genes be horizontally transferred from transgenic plants to mycorrhiza fungi as a result of the close contact between the symbiosis partners? Which are possible consequences of such a horizontal gene transfer?

Hormone and carbohydrate metabolisms and effects on physiological features

For *rolC* transgenic aspens the project focuses on the question how the *rolC* gene influences the formation of low-molecular carbohydrates and how this causes changes in the spectrum and infestation with fungus pathogens. A field experiment is available to these studies, located on the premises of the Institute for Forest Genetics and Forest Tree Breeding of the Federal Research Centre for Forestry and Forest Products. The Institute cooperates in this project with the Max-Planck-Institute for Breeding Research in Cologne.

5. Access to the German National Report

The Report on activities related to poplar, aspen, and willow cultivation and utilisation in the Federal Republic of Germany Period: 1996-1999 can be found as pdf file in the World Wide Web under http://www.bfafh.de/bibl/pdf/ii_00_01.pdf

6 Priorities to be discussed at the International Conference

6.1 Related to the Common Agricultural Policy (CAP) of the **EU**

The CAP aims at the regulation of the agricultural market rather than on at the production of raw material, which can be utilised for innovative industrial products. The CAP has been developed during the past decades and was successful up to now. But the extension of the EU needs different approaches to solve the problems on the agricultural market favouring the production of non food products in order

- to reduce the costs for set-aside of agricultural land
- to provide an industry with raw material, which is renewable and environmentally friendly
- produced
- to give returns to the farmers (increase of income)
- and to turn intensively managed crop land into more sustainable utilisation of the agricultural land (not only in ecological terms).

One alternative could be the cultivation of poplars and willows. The CAP should stop discriminating the poplar culture, if the alternative shall be successful. The most powerful obstacle should be removed, which is the restriction 10 recultivate the set aside land after lO years. Meanwhile a further l0 years period can be allowed. However, questions need to be answered like: Is a poplar plantation up to l0 years or older than l0 years defined as forest land or agricultural farm land (this has implication on taxes, valuation, and some legal aspects)? Is there a tendency in the CAP to classify the poplar plantations neither as agricultural land nor as forest land but as a special type of land use, and if so, how can this type be described?

6.2 Other matters related to poplar/willow culture

Four topics are suggested far discussion.

.Rules far the certification of poplar/willows cultures to meet the criteria far sustainability.
.Linking the wood/pulp industry with the farmers far setting up a co-operation to induce and enhance the poplar culture. What is needed on the political level and what on the side of the industry and farmer?
.If in poplar/willow cultures genetically modified cultivars will be used, what prerequisites must be fulfilled to achieve acceptance by farmers, environmentalists, and the public?
.Poplar/willow cultures will contribute to CO2 -sequestration and to the regeneration of the soil of intensively managed agricultural land. Are there incentives planned to enhance a European- wide programme?

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