Genetic modifications to increase biomass yield in poplars

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Proceeding global climate change as well as a general skepticism about nuclear energy in German society demand new strategies for energy production. Due to an aspired reduction of both fossil and nuclear energy sources, renewable sources are in the center of attention of politics and science in Germany. In short rotation coppices planted poplar wood serves as solid fuel and possibly in case of technical advances as bio-based fluid fuel. To increase biomass yield in poplar trees seven candidate genes expressed in poplar cambium were chosen for genetic modifications. In several cases phenotypical changes were observed.
SOC1 and *FUL* are well known in flower formation and fruit development in *Arabidopsis*. Subsequently, it was shown that both genes have an influence onto biomass formation by observation of wood formation and secondary growth in the usually herbal plant *Arabidopsis*. By genetic modification of both genes in poplar hybrids, the influence of *SOC1* and *FUL* onto biomass formation was verified also in poplar in a first proof of concept. Here, the biomass formation was extremely disturbed. In a complement approach, to increase biomass is in focus through knockout of five paralog genes of *SOC1* and *FUL*.
Further phenotypic modified poplars were achieved by genetic modification of *PCBER1*. The oxidoreductase *PCBER1* catalyzes a certain step of lignan biosynthesis. While overexpression of *PCBER1* led to significantly modified wood composition, the knockdown led to significantly increased height growth in one transgenic poplar line and slightly modified wood composition. Since lignans are relevant for pharmaceutical traits and poplars could get multiple applications, the direct influence of *PCBER1* onto poplars' lignan content is currently analyzed.
As a fourth gene transcription factor *SCL7* was overexpressed in poplar, that is probably responsible for both salt and drought stress tolerance in *P. euphratica*. Here, no biomass variations were observed. However, a possible tolerance against harmful environmental conditions is interesting for poplar plantations on salt contaminated areas or regarding proceeding shift of arid climate zones towards temperate zone. The tolerance of transgenic poplars and their molecular background is currently under investigation.