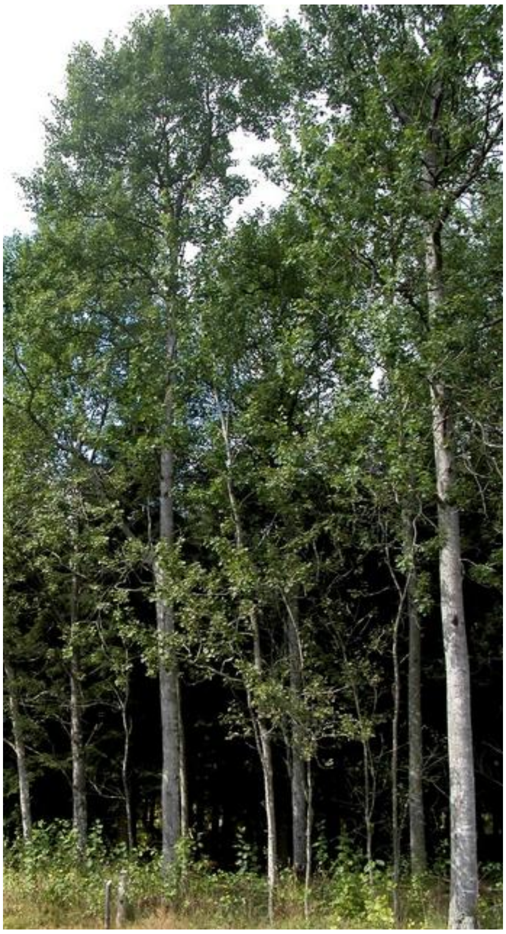
Trees can be manipulated to grow bigger and faster

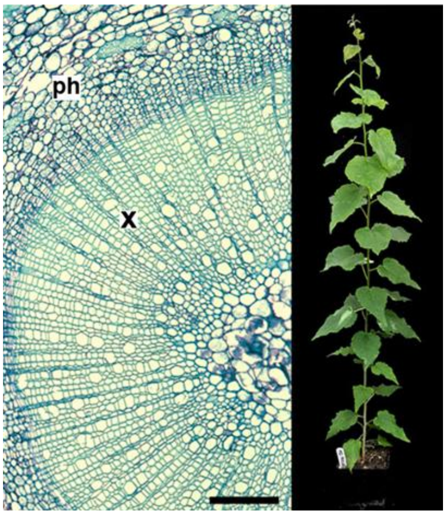
It would be very interesting to know that scientists have discovered a way to make trees grow bigger and faster. A team of researchers from University of Manchester have demonstrated this in Poplar trees by successfully manipulating the secondary growth pathway thereby drastically increasing tree growth and productivity. However, the results are yet to be confirmed in field conditions. If the results are tested positively in field, it will be a breakthrough in tree improvement for increased production of biomass in a fewer timeframe.

Trees form a unique source of biomass and wood contributes almost 90% of total biomass. Wood generally increases in diameter by adding new tissues between the existing wood and the inner bark, a process called as secondary growth. The majority of tree biomass is obtained from these radial growth characterized by growth rings. However, the size and increment of the growth rings are directly proportional to the environmental conditions in which the trees are growing. In other words, they are controlled by both genetic as well as environmental factors.

A team of researchers from Faculty of Life Sciences, University of Manchester headed by Professor S.P. Turner has been involved in manipulating this radial growth to achieve an increased biomass. For this purpose, accessions of Poplar trees were selected as model tree species to carry out the experiments. They conducted transformation studies in 'Hybrid aspen' mediated through an *Agrobacterium* strain. Poplar trees dominate the Northern Hemisphere and are popularly known as 'aspens'. The important aspens include *Populus tremula, P. alba, P. tremuloides,* etc., The most common Hybrid aspen occurring and well adapted in these regions is a cross between *P. tremula* and *P. tremuloides.*



A 'Hybrid aspen' stand



Phenotype of hybrid aspen with over-expression of PXY-CLE (picture in left is the transverse section of stem showing xylem (x) and phloem (ph) tissues, scale = 200 µM)

In trees, the woody tissue is composed of xylem cells, the resultant of cell divisions within the cambium meristem. Thus the rate at which trees grow is directly proportional to the rate of cell division in the stem. The team has identified two genes PXY and CLE that are responsible for cell division in the stem. Prof. S.P. Turner and team engineered the PXY-CLE expression and found that it can lead to increased wood formation. They also observed that by manipulating PXY-CLE, the tree height and leaf size also increased considerably. Further, the results indicate that this pattern of growth is likely to continue during the lifetime of the tree, thereby providing a means of dramatically increasing tree productivity that would help to meet the increasing demand for renewable resources.

Professor Turner says: "Our work offers the possibility we may be able to maintain a fast growth rate even in the face of adverse and changeable environmental conditions that all plants are likely to be faced with. Most plants, including crops, respond to adverse environmental conditions with lower growth rates that result in correspondingly lower yields. Understanding how the plants respond to environmental signals and to what extent we are able to manipulate them to override these signals is likely to be very important for continued improvements to crop performance. In future it may be possible that manipulating the expression of the PXY and CLE genes can override environmental signals that normally alter plant growth.

Prof. S.P. Turner concluded, "Although, this needs be tested in the field, this discovery paves the way for generating trees that grow more quickly and so will contribute to meeting the needs for increased plant biomass as a renewable source of bio-fuels, chemicals and materials while minimising further CO_2 release into the atmosphere". Apart from the potential to increase biomass supplies for the growing bio-fuel and industrial biotechnology sectors, the discovery could help plants deal with the environmental consequences of climate change.

The team now plans to work with a forest products company to test their findings in the field.

Source:

http://www.alphagalileo.org/ViewItem.aspx?ItemId=151744&CultureCode=en