They’re top branch managers!

By John Hudswell

Queensland University is branching out and that’s good news for the forestry industry! A joint research initiative between UQ’s School of Integrative Biology and ARC Centre for Integrative Legume Research as well as researchers in France (INRA-Versailles and the University of Toulouse/CNRS-Toulouse) have discovered a new plant hormone that controls shoot branching. The hormone strigolactone, a molecule with a specific four-ring structure, has been shown to inhibit shoot branching in plants.

Chief investigator and UQ Associate Professor Christine Beveridge said the research could have massive financial gains for the forestry and other plant industries. She said that by adding the compound directly to the buds or by supplying it in a solution into the stem of the plant, the number of branches was altered.

But, what prompted researchers to take this tack?

“For many years we have known that a mysterious signal specifically controls shoot branching in plants as diverse as moss through to grasses and flowering plants,” said Professor Beveridge.

“Genetic work indicated the compound may be derived from carotenoids which are secondary metabolites in plants. Carotenoids are also the precursors of strigolactones which are exuded from roots. Strigolactones are found broadly in plants and were therefore suspected to have an important function in plant growth or development.

“So, we put two and two together and investigated whether they affect shoot branching,” said the Professor.

She said too many branches on a tree could take away the energy from the trunk and cause poor growth, and the manual removal of branches was labour-intensive so it was hoped the finding would lead to a natural chemical approach to prevent branches from forming in the first place.

How does this tie in with carbon collecting?

“It is hard to say at this point. Strigolactones inhibit young branch development. Other branches and the main trunk or stem will grow more to compensate. We see this very clearly in herbaceous species such as garden pea,” said Dr Beveridge.

Would this mean less opportunity for biofuel (collecting and bundling from the forest floor)?

“If we can remove unwanted branches before they develop or reduced the size of branch biomass, then the need to remove these from trees would be reduced leaving less on the forest floor. We are yet to explore whether it could mean enhanced biomass into the trunk which would enhance timber yield which, if used for building for example, would be an excellent long-term carbon storage outcome.

“This discovery is too new to answer these questions effectively. What we can say is that strigolactones provide a new tool which may lead to paradigm shifts in our ability to modulate shoot architecture. Further research is needed,” Professor Beveridge said.

She said the new hormone could also be used to increase yield in horticultural industries and again manual pruning may be circumvented through the use of the natural strigolactones or related products.

“Because strigolactones are natural compounds which directly control shoot branching, they can be applied without the use of gene transfer technologies and have minimal side effects on the plant,” said the professor.

Would such a system be applicable for all trees or would it be more type-specific?

“We need to test a case by case basis. A good analogy is the discovery of gibberellins, the plant hormone that controls dwarfing. Different plants respond to different gibberellins. But practically all species respond. Gibberellin analogues that are more active or more stable have been developed for application in the horticultural industry in particular. We now have that opportunity in relation to shoot branching,” the doctor said.

How long before your work will be available for commercial forests?

“Hard to say. It depends on current research outcomes.”

Dr Beveridge said strigolactones were also responsible for the germination of parasitic weeds that cause huge losses in yields of staple food crops in Africa and Asia.

“Our discovery provides the first biosynthetic mutants to study these important interactions with plants and to develop ways of plant improvement and weed management. We are very excited about this discovery because hormones in plants and animals are an amazingly powerful and natural way to modify and investigate growth and development,” she said.

Dr Beveridge along with Drs Elizabeth Dun and Philip Brewer from the ARC Centre of Excellence for Integrative Legume Research at UQ were among a group of authors whose research formed part of the article “Strigolactone inhibition of shoot branching” which was recently published in the journal Nature.
Associate Professor Christine Beveridge... “the research could have massive financial gains for the forestry”.