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Research that regenerates

From food to drug production, plant scientists are harnessing flower power

by Murray Tong
(Guelph, June 21, 2003)

A University of Guelph researcher isn't just turning over a new leaf — he's trying to grow a whole new plant, and that could revolutionize agriculture, forestry and even the fine chemical manufacturing industry.

Prof. Manish Raizada, Plant Agriculture, is studying the genetic basis for plant regeneration, an ability unique to plants.



The mysterious process of plant regeneration could have applications in a number of industries, says Prof. Manish Raizada.

Photo: Grant Martin

"Essentially, each plant can make a clone of itself," he says. "It's the equivalent of me cutting off my finger and using it to regenerate me."

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Plant regeneration is as simple as taking a plant cutting and putting it in water to grow a new plant. But how this process works is mostly a mystery.

For example, for regeneration to occur, specialized cells in the plant must somehow "forget" their identities, revert back to what are called stem cells (cells in an embryonic state that are capable of becoming any type of cell) and redifferentiate into new specialized cells, such as root cells and leaf cells.

Using mustard plants of the *Arabidopsis* genus, Raizada and his research team are looking for the genes responsible for this transformation back to stem cells. They hope to find ways of triggering the genes to turn the regeneration process on and off.

Raizada says putting the natural process of regeneration to work could help farmers — particularly those in developing countries — get higher crop yields from their land in shorter growing times while cutting down on natural resources. If plants could regenerate certain parts more easily, farmers could harvest only the desired part of the plant and simply wait for a new part to grow again.

"Growing plants from seed every season is inefficient," he says. "You need carbon, fertilizer and water to grow the entire plant, even though you want only a small part of what you harvest."

Planting from seed is an especially thorny issue for the developing world because many farmers there can't afford to buy hybrid seed every season, says Raizada. Regenerating plants would allow producers to reuse the previously formed root system and squeeze out extra growing seasons in the same year for higher output. Shoot regeneration could also reduce soil erosion caused by tilling at the time of seed planting.

He sees other applications for this research, including environmental and manufacturing programs such as reforestation, which could save energy, fertilizer and carbon if trees were grown from cuttings instead of seeds.

And because more than one-third of all medicines are derived directly from plants, regeneration is also applicable to the manufacture of pharmaceuticals and fine chemicals, he says.

Other researchers involved in this work include post-doctoral fellow Steve Chatfield, research associate Igor Kyrchenko, technicians Rosalinda Oro and Steve Dinka, and a number of undergraduate students.

This research is sponsored by the Canada Foundation for Innovation, Food Systems Biotechnology Centre, Natural Sciences and Engineering Research Council, OAC dean's office, Ontario Innovation Trust and Ontario Ministry of Agriculture and Food.

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