Scientists unveil robot that makes plant grafting a snap

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Clemson University state vegetable expert Richard Hassell has become one of the world's leading researchers on plant grafting. Credit: Clemson University

A machine with hands of steel has revolutionized the speed and efficiency of the once-tedious process of plant grafting.

Led by vegetable expert Richard Hassell, a team of scientists at Clemson University's Coastal Research and Education Center has recently unveiled a robotic system that grafts disease-resistant roots to robust plant tops as quickly as you can say chop-chop.

"Grafting has been done all over the world for about 60 years, but when done by hand, it's very slow and labor-intensive," said Hassell, whose team includes Brian Ward, Mark Schaffer, Manning Rushton and Ginny DuBose. "The robot does it much faster than a human can do it. This reduces labor costs while at the same time enhancing healthy and robust growth because the same clean cut is made every time."

This complex mechanical breakthrough, which is already being emulated worldwide, is a new addition to Hassell's impressive resume of grafting accomplishments. In 2014, his team patented a chemical method to eliminate regrowth, grafting's most costly side effect.

"The reason we graft crops such as watermelons, cantaloupes, tomatoes and peppers is because they have poor root systems that are very susceptible to soil-born disease. And so anything in the soil that stresses their roots collapses the plants," said Hassell, Clemson Cooperative Extension's South Carolina state vegetable specialist. "But if we graft hardier resistant rootstocks from plants such as gourds and squash onto the shoots of the desired crop, then the fruit-producing part of the plant is able to thrive."

However, regrowth often occurs in grafting because the rootstock is genetically driven to produce its own shoots and leaves. When this happens, the grafted upper portion of the desired plant dies. To overcome this quandary, Hassell's team turned to a chemical that for years has been used to control sucker growth in tobacco plants.

"We worked out the dilution and application methods and now we are

able to destroy the growing point of the rootstock, which eliminates regrowth," Hassell said. "We treat the root stock chemically as soon as it comes up and its first leaf appears. We call it blinding. The plant is actually blinded and has no growing point anymore."

Enter the robot. In just a few seconds, it grasps and slices the upper shoot of a watermelon and the rootstock of a gourd and then clamps the two together. The grafted plant is now ready-made for its next stages of life.

"After the graft is completed, the plant is put into a high-humidity healing chamber that encourages the graft to heal and the rootstock to store carbohydrates while also sending out new roots," Hassell said. "After about a week, we take the plant out of the healing chamber and put it into the greenhouse for another week, where it grows even larger and stronger. Finally, it's ready to go to the field."

Growers in South Carolina, the United States and around the world are adopting Hassell's techniques, the latter of which is ironic considering that research on grafting is relatively new in the U.S.

"Grafting was laughed at when I first came here," said Patrick Wechter, a research plant pathologist for the U.S. Vegetable Laboratory, which shares facilities and works in conjunction with Coastal REC in Charleston. "People said no one will ever do it in the U.S. because it's too expensive. But Richard has persisted and become of one of the leading experts in the world on grafting."

Provided by Clemson University