Transgenic Tomatoes Destined for International Space Station

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When the Space Shuttle Endeavor rises from its Florida launch pad Tuesday (Aug. 7), it will carry passengers from North Carolina State University.

"We're sending up tomato plants," says Dr. Chris Brown, professor of plant biology in the College of Agriculture and Life Sciences at N.C. State.

Actually, tomato seeds will be traveling into space on the shuttle, destined for the International Space Station.

"These are transgenic tomato plants that are modified such that the signaling pathway related to how they respond to gravity was altered," Brown explains. Brown is director of space programs for the Kenan Institute for Engineering, Technology and Science at N.C. State. He also directs the N.C. Space Grant program.

Once on the space station, the seeds will be "planted," inserted into growth chambers designed for space, then they'll grow. Similar seeds will be planted back on earth, and scientists will compare the growth of the space plants with that of the earth plants.

Brown said pictures of the space tomatoes will be beamed back to earth, where they'll be available on a Web site (www.ncsu.edu/project/agronauts/) designed at N.C. State to teach elementary school students about space and foster interest in science.

The tomato seeds that will ride the shuttle were developed by Dr. Mariya Khodakovskaya, a post-doctoral researcher in the laboratory of Dr. Heike Winter Sederoff, assistant professor of plant biology.

Winter Sederoff studies how plants respond to gravity. The tomatoes that will go into space have been altered genetically so that they produce less of a substance called inositol triphosphate, or IP3. Brown describes IP3 as "an important signaling molecule in the gravity response" of plants.

In effect, IP3 helps tell the plant which way is up so that its roots can grow down. The transgenic tomatoes should produce less IP3, so their gravity response should be less robust than normal tomatoes. Couple that with free fall, or microgravity conditions in space, and there could be some interesting results. IP3 may also affect drought tolerance, Brown adds. The transgenic tomatoes are unusually drought tolerant, and their leaves are thicker than normal.

Brown said the plants will grow in special chambers designed by BioServe Space Technologies, a non-profit NASA-sponsored Research Partnership Center at the University of Colorado at Boulder. The seeds will be put in the chambers 40 to 50 days after arriving at the space station. The growth chambers contain a nutrient solution, and the plants will grow for as long as the solution provides moisture.

Brown does not anticipate they'll grow long enough to produce tomatoes. But he adds, "We'll see. I would be surprised if they produced tomatoes, but who knows. It's space."

The experiment is, in Brown's words, "observational," and designed to a certain extent to test the BioServe plant-growing system.

"We would like to see, number one, that the plants and the plant-growing

system are successful, that the plant-growing system and our transgenic plants work together," Brown says. "Second, we'd like to see if there are any differences in the growth in space that we can discern from growth here on the ground."

Being able to grow plants in space would likely be a vitally important piece of manned long-term space travel or colonization. As Brown points out, plants are "the ultimate life support machine for long-term human application" in space.

Plants, he explains, produce oxygen and take up CO2. They can clean water by taking up dirty water through their roots and transpiring clean water vapor through their leaves. Plants also produce food and may be used as building materials.

And, says Brown, "Plants are nature's best chemists," producing secondary chemicals such as pharmaceuticals or neutraceuticals.

But on earth, plants respond to gravity; the roots automatically grow downward. In space, there is no gravity, so, in effect, there is no down. If astronauts are to take plants into space with them, it is imperative that scientists understand how plants respond to gravity.

And if scientists understand how plants respond to gravity, it may be possible to alter them genetically so they are better adapted for life in space. That is what N.C. State University scientists are working to do. The university has had a strong space biology program since 1996, when a NASA Specialized Center of Research and Training in Gravitational Biology in Plant Gravitational Biology and Genomics was located in the university's College of Agriculture and Life Sciences.

Source: by Dave Caldwell, NC State University