Where Crop Science and Human Nutrition Meet

by Susan Fisk

Are you eating your five servings of fruits and vegetables every day? Do you supplement your diet with vitamins? Are there any differences in the nutritional quality of various fruits and vegetables?

All good questions, and ones that Michael Grusak answers almost daily. Grusak is a professor of pediatrics at Baylor College of Medicine and a researcher with USDA-ARS, but his training is in plant physiology. He’s been a member of ASA and CSSA for more than 20 years and is “enamored with what our Societies can do.”

“I have been very fortunate to get involved with the human nutrition community and do what we can to push the nutritional quality of the food supply,” says Grusak, “and to help make nutrients more available from our foods.”

Part of his research is to find the best ways to get stable isotopes of various elements into vegetable and grain crops. The harvested foods are then used in clinical studies to see how the body absorbs and metabolizes vitamins and minerals from different food crops. His lab works with stable isotopes of minerals like iron or calcium or uses nitrogen to label amino acids.

Working at the Children’s Nutrition Research Center, Grusak contributes to studies assessing the nutrient requirements of children, from preemies through adolescents, and pregnant and lactating moms. “We developed methods to label or tag plants with stable isotopes so that we could follow the nutrients into the human body. We generally use hydroponic systems to get the right labeling in plants and to do it as economically as possible. If we use soil to grow the vegetables that complicates things because soil can hold on to the very expensive mineral isotopes.”

Recent work in Grusak’s lab involves the use of heavy water (containing deuterium, the heavier stable isotope of hydrogen) to label hydrocarbons. This allows for the labelling of compounds like vitamin K or beta-carotene, a pro-vitamin A carotenoid. “The whole point is to use heavy water, which is a source of deuterium, the heavy stable isotope of hydrogen. The heavy water provides isotopically labeled foods to study nutrient absorption in humans. Photo courtesy of Michael Grusak, USDA-ARS.

Collard greens are grown in nutrient solution enriched with heavy water, which is a source of deuterium, the heavy stable isotope of hydrogen. Raising crops in heavy water provides isotopically labeled foods to study nutrient absorption in humans. Photo courtesy of Michael Grusak, USDA-ARS.

A major project that Grusak has been his work with transgenic rice that makes beta-carotene to combat vitamin A deficiency in parts of the developing world. When we grow it in heavy water, we can label the beta-carotene in the rice. The labeled rice is then used in studies to tell us how much beta-carotene is actually picked up from the normal digestion process and how much is converted to vitamin A. Recent work in Grusak’s lab involves the use of heavy water to label beta-carotene, which is then used in feeding studies to test how much is converted to vitamin A.

Grusak’s work with golden rice—a transgenic rice that makes beta-carotene in its grains—has been a major project. “Golden rice makes beta-carotene in its grains, and when we grow it in heavy water, we can label the beta-carotene. The labeled rice is then used in feeding studies to tell us how much is actually picked up from the normal digestion process and how much is converted to vitamin A.”

Most cereal grains, and especially rice, don’t have beta-carotene, and there were no studies done on beta-carotene absorption from that type of food. Grusak’s research with golden rice found that the conversion of beta-carotene to vitamin A was much better than was expected—three to four times more effective than expected.