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Dr. C. S. Prakash is the Director of Center for Plant Biotechnology Research at Tuskegee University. He oversees the research on food crops of importance to developing countries and the training of many postdoctoral scientists, graduate students, and undergraduate students. He has a bachelor's degree in Agriculture and a Masters in Genetics and obtained his Ph.D. in genetics from the Australian National University, Canberra. He has considerable research expertise in transgenic plants, gene expression, tissue culture, and plant genomics.

Dr. Prakash is a regular writer on biotechnology issues in the ISB News Report (http://www.isb.vt.edu), a newsletter on agricultural biotechnology. Dr. Prakash serves on the executive committee of the American Society of Plant Physiologists and on the Commission on Biotechnology, and the International Society for Horticultural Science. He is also the Panel Manager for the Biotechnology Risk Assessment Grant Program of the United States Department of Agriculture, and an Advising Editor to AgBioForum, a web journal devoted to agbiotech issues (http://www.agbioforum.missouri.edu/), since 1999. Interviews with Dr. Prakash and stories about his research have appeared in various media including National Public Radio, Science, *Wall Street Journal*, *The Scientist*, *Technology Review*, *Focus* (Germany), *Atlanta Journal Constitution*, MSNBC.com, *The Village Voice*, and several overseas newspapers.

Increasing the Nutritional Protein Content of Food Crops of Importance to Developing Countries

Protein malnutrition is a serious problem in some developing countries, especially those in sub-Saharan Africa and South Asia. While the industrialized countries have a reliable and affordable source of dietary protein supply, primarily through animal products, the developing country's population depends mostly on plants as a source of protein. Although plants are an efficient, inexpensive, and environmentally friendly producer of proteins, many crops such as sweetpotato cassava, potato, and plantain that are staples in the sub-Saharan Africa have a low protein content. Further, when compared to animal protein sources such as beef, milk, or egg, the plant proteins are seriously deficient in essential amino acids that are critical to the growth and development of the body especially in growing children. Greater food and nutrition security in the developing world can be achieved by enhancing the quality and sustainable productivity of local food crops that are important to this region. Sweetpotato [*Ipomoea batatas L. (Lam.)*] is one such crop grown by poor farmers and is a major source of calories, protein, and micronutrients. The seventh most important crop in the world, sweetpotato is especially popular among low-resource farmers because of its high yield, adaptability, and drought tolerance, and requires minimal or no chemical inputs. The goal of our research is to improve the nutritional protein content and quality in food crops, using sweetpotato as a model system.

To improve the nutritive quality of plant proteins, a novel storage protein (asp-1) with many essential amino acids and with enhanced stability features was synthesized. The *asp-1* gene under the transcriptional control of the constitutive CaMV 35S promoter was introduced into sweetpotato using the *Agrobacterium* vector. Genetically modified sweetpotato plants with the *asp-1* gene were normal in growth and phenotypic appearance under laboratory, greenhouse, hydroponic and field conditions of testing. Interestingly, the storage roots ('tuber') of *asp-1* plants exhibited a three to five-fold increase in their total protein content. A proportional increase in the levels of many essential amino acids such as methionine, threonine, isoleucine, and lysine was also observed, while tryptophan increased by several orders of magnitude.

In a controlled animal feeding study, golden Syrian hamsters fed with high-protein sweetpotato showed 56% more live body weight over the control-fed animals. Animals fed with the engineered sweetpotato also had lower levels of total cholesterol, triglycerides, and LDL-cholesterol in their plasma and liver. Our animal feeding test also demonstrated the superiority of *asp-1* sweetpotatoes in terms of the true protein digestibility, net protein utilization and biological value of the protein. The corrected 'protein efficiency ratio' of transgenic sweetpotato (3.71) was comparable to that of soy protein (3.72) and higher than control sweetpotato (2.57) or casein (2.49). Histopathological studies with brain, liver, kidney, intestine, and bone showed that transgenic sweetpotato lines had no detectable toxic effects. We are now introducing the *asp-1* gene into other food crops of importance to developing countries such as cassava, rice, and potato in collaboration with other research groups.