# Researchers discover method to decrease harmful cyanogens and increase protein levels in key crop

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This is a cassava hydroxynitrile lyase root. Credit: Donald Danforth Plant Science Center

Researchers working at The Donald Danforth Plant Science Center have made an another advancement in their efforts to improve the root crop cassava which is a major source of calories to 700 million people worldwide, primarily living in the developing world. A study conducted by Dr. Narayanan N. Narayanan and Dr. Uzoma Ihemere, research scientists working in the lab of Dr. Richard T. Sayre, have developed an

approach that not only accelerates the reduction of cyanogen during food processing, resulting in a safer food product, but also lead to increased root protein levels and enhanced nutritional value.

The results of this research are published in the recent article, "Overexpression of Hydroxynitrile Lyase in Cassava Roots Elevates Protein and Free Amino Acids while Reducing Residual Cyanogen Levels," in the PloS One journal.

Cassava has many properties that make it an important food source across much of Africa and Asia. It grows well in poor soils with little rainfall, but it also has many limitations; both leaves and roots contain potentially toxic levels of cyanogenic glucosides and although calorie dense, the starchy, tuberous roots provide the lowest sources of dietary protein among the major staple food crops; less than 30% of the minimum daily requirement.

Insufficient protein intake often leads to protein energy malnutrition (PEM), which can lead to permanent physical and mental disabilities. Cassava has the lowest protein to energy ratio (P:E) of any staple food, making resource-poor populations that rely on cassava as their major source of calories at high risk of PEM. According to the World Health Organization, PEM is by far the most lethal form of malnutrition, affecting one in four children in Africa.

Hydroxynitrile Lyase (HNL) is a natural cassava protein that contains 50% essential amino acids and is found in the leaves of the plant. It can be eaten by humans with no allergic side effects. Narayanan and his colleagues showed that transgenic roots expressing HNL had a 53-74% reduction in root cyanogen levels, and resulted in a nutritionally enhanced cassava that contained three times as much protein and twice as much total amino acids when compared with wild type. They also proved that over-expression of HNL reduced the time required to

process and remove life threatening cyanogens in the tuberous roots from days to minutes. Significantly, HNL is heat stable and will tolerate cooking for 15 minutes which is helpful in variety of food preparation methods.

"This breakthrough demonstrates that it is possible to use genetic modification to deliver enhanced cassava with decreased cyanogenic content as well as increased protein and essential amino acids that will directly benefit children and at-risk populations," said Narayanan.

Provided by Donald Danforth Plant Science Center

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