CACO-2 CELL AND ANIMAL MODEL STUDIES ARE EFFECTIVE AT SCREENING AND DEVELOPING STAPLE CROPS WITH IMPROVED FE BIOAVAILABILITY

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Iron biofortification is a strategy that alleviates Fe deficiency by improving Fe bioavailability and/ or concentration in staple crops. To do so, breeders need a high throughput screening approach that accurately ranks bioavailability relative to standard reference controls. Molar ratios of known food factors such as phytic acid, polyphenols, and ascorbic acid are often highly linked to environmental and processing effects and thus not reflective of the genetics of Fe bioavailability. A bioassay such as the in vitro digestion/Caco-2 cell model is therefore necessary for measurement of Fe bioavailability during the crop development stage. In vitro observations should then be confirmed by an inexpensive animal study before select lines should be advanced for human absorption or efficacy studies. Our research team has now conducted several studies on beans, lentils and maize where samples were first screened for Fe bioavailability with the in vitro model, then tested in vivo using a poultry model. In these studies, we implement physiological, cellular and molecular parameters in order to assess Fe status and the dietary Fe bioavailability in crops. Coupling this approach with QTL (quantitative trait loci) mapping has been effective at developing high bioavailable Fe maize and shows promise for identifying QTL associated with high Fe concentration in bean cotyledons. In the absence of QTL mapping, screening of Fe bioavailability and concentration has not been effective at consistently producing an consistently enhanced crop due to the strong environmental effects and genotype x environment interactions. Thus, QTL mapping may be necessary to produce sustainable enhancement of Fe bioavailability and concentration in staple food crops.