Breeding for Nutritional Traits in Tomato Using Naturally Occurring Variation in the Fruit Specific Beta-Cyclase Promoter

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Recent interest in in selecting tomato varieties with diverse colors has been stimulated by interest in market diversification, bioavailability, bioaccessibility, and nutritional properties of carotenoids. Beta-carotene in tomato is an important carotenoid for human health due to its pro-Vitamin A activity. The ***B*** gene encodes lycopene-beta-cyclase, the enzyme responsible for converting trans-lycopene to beta-carotene in the carotenoid biosynthesis pathway. Prior research suggests that variation in the promoter of the ***B*** gene may modulate beta-carotene levels in tomato fruit. In this study, we compared the promoter region of the ***B*** gene in multiple accessions and discovered 6 unique haplotypes, at least 3 of which occurred in high beta-carotene varieties. Further screening and sequencing is in progress. Single nucleotide polymorphisms (SNPs) and insertion/deletion variation diagnostic for high beta-carotene was used to develop primers for marker-assisted backcrossing. In addition, variation from the SolCAP 7,720 SNP array was assessed for polymorphism and genome coverage. A set of 96 SNPs spaced along all 12 chromosomes was developed for background genome selection to introgress distinct Beta alleles into elite processing tomato varieties in order to assess functional differences. Variation that exists in tomato with respect to beta-carotene may allow for the modulation of carotenoid production and further enhancement of tomato as a bio-fortified crop.