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BIOFORTIFICATION OF DURUM WHEAT GRAINS IN PROVITAMIN A

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Micronutrients, vitamins and minerals are form of nutrients, needed in small amounts, but essential for the proper functioning of the body. Their lack can cause serious and dangerous health conditions for humans. In this context, vitamin A deficiency represents one of the major causes of malnutrition in the world and mainly affects young children and pregnant women in poor countries. Vitamin A cannot be synthesized by humans and must be introduced through the diet. The two main forms of vitamin A are preformed vitamin A (retinol, retinyl esters present in animal products), and provitamin A carotenoids (present in plant products) that are converted to retinol. However, the main staple foods contain a modest amount of vitamin A precursors and are not sufficient to meet the daily nutritional needs. Since it is difficult to provide a balanced diet accessible to low-income populations, the genetic biofortification of staple crops can be an efficient and sustainable strategy.

Durum wheat (*Triticum turgidum* L.) accumulates mainly lutein, a non-provitamin A carotenoid, in the caryopsis, while provitamin A β-carotene is present only in traces. In this work, through a reverse genetics approach, known as Targeting Induced Local Lesions IN Genomes (TILLING), loss of function mutants have been identified for genes encoding the enzymes lycopene ε-cyclase (LCYε) and β-carotene hydroxylase (HYD1) which are involved in the synthesis pathway towards lutein and catalyzing the turnover of β-carotene in xanthophylls, respectively. Mutant genotypes lcyε-A-lcyε-B-and hyd-A1-hyd-B1- showed a significant increase of more than 70% of β-carotene compared to wild-type lines. To produce a “Golden Wheat”

genotype, a crossing program to pyramid these identified mutations on *lcyε* and *hyd1* genes has been started.

In conclusion, this study provides more insights into the molecular mechanism governing the biosynthesis of carotenoids in durum wheat and paves the way for the obtainment, through a non-transgenic approach, pre-breeding materials useful in future breeding programs focused on the production of durum wheat biofortified in provitamin A.