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Title: Breakthroughs in plant based PHB production: Harnessing Nature to Heal Nature

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Crops have the potential to not only be a source of food and fuel but also a source of renewable materials. One of the most interesting classes of material targets are the polyhydroxyalkanoate (PHA) family of microbial carbon and energy storage polymers, which have a wide range of potential applications. Although PHAs are targeted as replacements for petroleum derived plastics, and over time these markets will dominate, water treatment is a simpler market entry strategy and directly linked to improving the sustainability of food production and consumption. PHAs are well known growth-substrates for denitrifying bacteria in water systems enabling them to convert nitrate to nitrogen gas and reduce nitrate levels produced from food production and human waste. Developing PHA producing oilseed cover crops such as *Camelina sativa* to reduce nitrogen runoff in agricultural fields would also enable low cost production of PHA pellets for water treatment applications. Oilseeds are an ideal production platform since seed metabolism is well suited to the polymer pathways and multiple co-products can be harvested (polymer, seed oil, protein rich seed meal) increasing the value of the seed.

Yield10 has made significant progress in addressing the technical challenges of producing polyhydroxybutyrate (PHB), the simplest member of the PHA family, in plants. We previously demonstrated the production of high levels of PHB in the seeds of Camelina by targeting enzymes for PHB synthesis to the seed plastids, however the seedlings were severely impaired in emergence and survival. Yield10 has recently demonstrated a cytosolic PHB production pathway with an ER targeted polymerizing enzyme PHA synthase that produced PHB levels up to 10.2% of the seed weight in T4 seeds with good seedling emergence and survival. These results are a significant step forward towards commercial production of PHB in plants.