# Modified Enzymes to Improve Crop Yield

Tech ID: 30104 / UC Case 2018-281-0

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**OTHER INFORMATION**

**KEYWORDS**

Phosphoenolpyruvate carboxylase, photosynthesis, carbon dioxide sequestration, crop yield, PPC

**CATEGORIZED AS**

- Agriculture & Animal Science
  - Other
  - Plant Traits

**RELATED CASES**

2018-281-0

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| United States Of America | Issued Patent | 12,168,773 | 12/17/2024 | 2018-281 |

Additional Patent Pending

## BACKGROUND

It is expected that by 2050 there will be a need to feed an additional 2 billion people worldwide. Technologies that enhance crop yields to improve food security and lessen the environmental impact of increased agricultural activity are greatly needed to meet the demands for future food production.

## BRIEF DESCRIPTION

Researchers at the University of California have identified new modified versions of the carbon fixing enzyme, Phosphoenolpyruvate carboxylase (PPC). in planta results show that the modified PPC enzymes confer upwards of a five fold increase in carbon fixation when compared to wild type plants.

PPC dependent carbon fixation is key to photosynthesis, production of nutrients, and plants conditioning their growth environment. Plants with modified PPCs that increase carbon fixation and photosynthetic output will have increased plant productivity, which is critical for feeding a growing population. Additionally, by identifying surgical changes that can unleash the full productivity of plant PPC's, it will be possible to increase the rate of depletion of atmospheric $CO_2$. The combination of these outcomes represents the opportunity to boost agricultural productivity, increase the amount of agriculturally available land by upwards of 100%, and improve the nutritional quality of plants all of which are dependent on removal of $CO_2$ from our atmosphere.

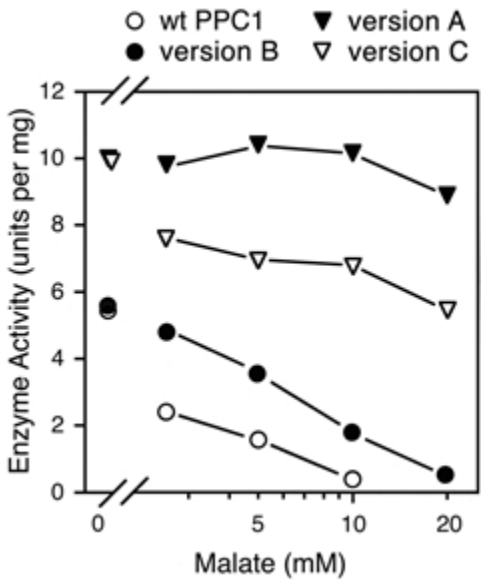


**Fig. 2** *in vitro* comparison of wild type (wt) and modified versions of maize PPC1, which is key to C4 photosynthesis, in the absence or presence of increasing amounts of the allosteric inhibitor, malate. Whereas version A is less affected by malate than wt, both versions B and C are largely unaffected by malate and have a 2-fold increase in activity compared to the wt version.

## APPLICATIONS

- Crops with modified PPC will have increased growth in marginal soils, improved nutritional quality and increased rates of C4 photosynthesis. C4 photosynthesis is a light-driven process that is dependent on fixation of carbon by PPC into the critical metabolic intermediate oxaloacetate, which is a precursor to malate and subsequently glucose.
- Enhanced crops will remove atmospheric CO2 at an increased rate due to increased carbon fixation rates.

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