

## What is Golden Rice?

Golden rice is a genetically modified variety of rice that contains Beta-carotene (vitamin A precursor). Golden rice produces almost 20 times the beta-carotene of previous varieties. It provides a cheaper option to supply vitamin A requirement than other vit A supplements. This rice was created by adding two genes, one from the Daffodil (*Narcissus pseudonarcissus*) that produces Phytoene synthase and Lycopene beta cyclase enzymes. The other gene comes from the bacterium *Erwinia uredovora* which produces an enzyme called Phytoene desaturase. The activity of these enzymes together enable beta-carotene to be accumulated in the rice endosperm. Golden rice was mainly intended for Asia.

## History of Golden Rice

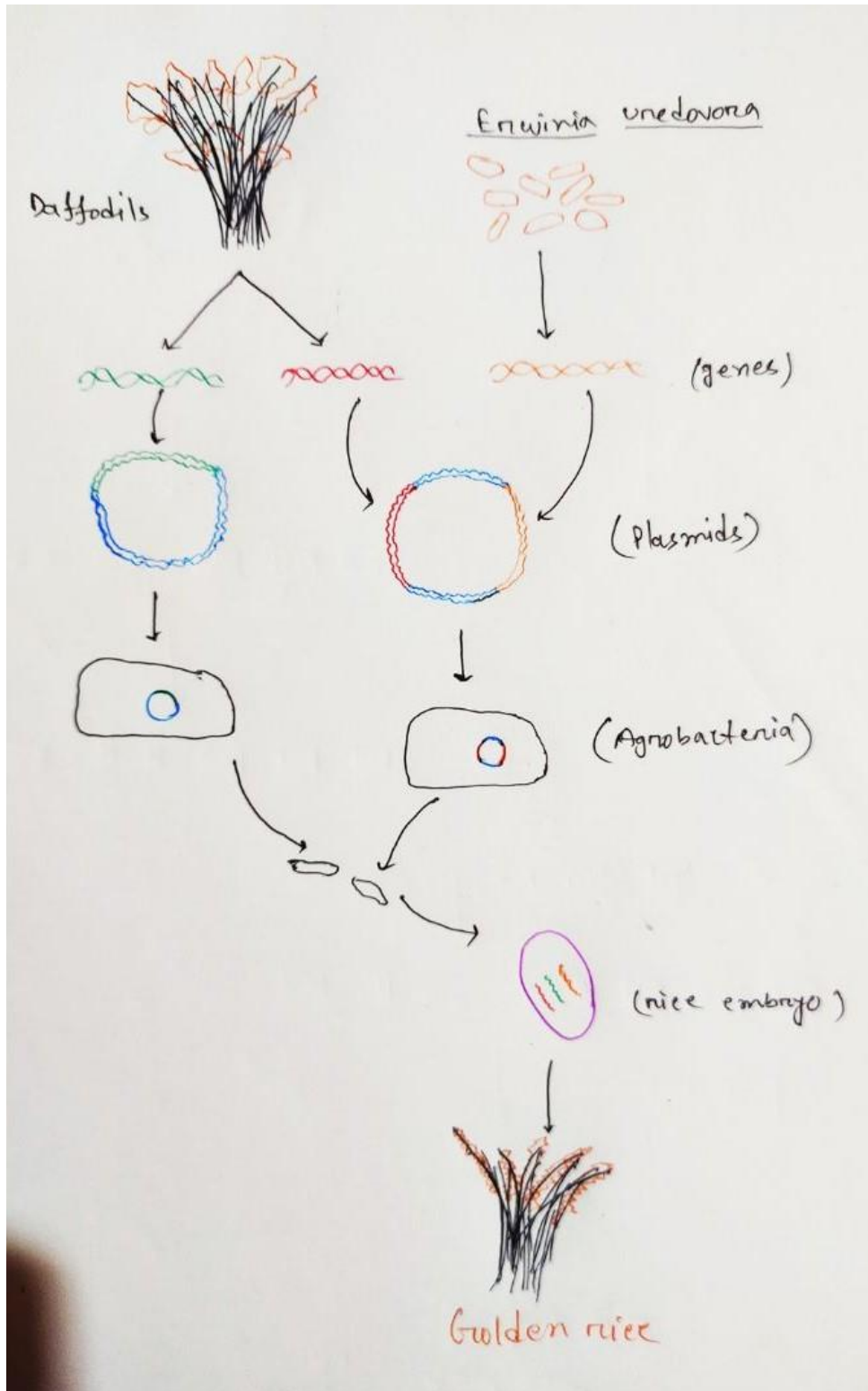
The details about golden rice were first published in 2000 by [Ingo Potrykus](#) of the [Swiss Federal Institute of Technology](#) and [Peter Beyer](#) – Professor of Centre for Applied Biosciences, [University of Freiburg](#), Germany. The funds came from the [Rockefeller Foundation](#), the Swiss Federal Institute of Technology and Syngenta (a crop production company).

The first field trials of golden rice was done in 2004, conducted by [Louisiana State University](#). Some additional trials were also conducted in the Bangladesh, Taiwan and Philippines in 2015. The results were satisfactory that showed 4-5 times more beta carotene in field than in greenhouse. It costs farmer the same as other varieties. After that, in 2019, Canada and USA also approved golden rice and [Food and Drug Administration](#) (FDA) declared it safe for consumption.

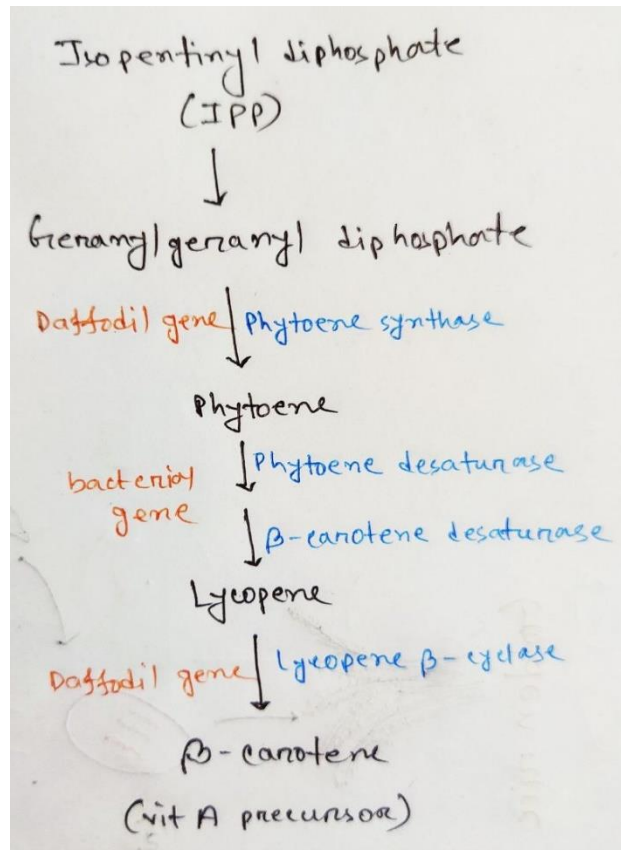
## How was Golden rice genetically modified?

- First the genes that are required to make beta-carotene in rice endosperm are isolated from Daffodils and bacterium *Erwinia uredovora*.
- These genes along with promoters are then inserted into plasmids. These plasmids are known as recombinant plasmids.
- These recombinant plasmids are transferred to a bacterium known as *Agrobacterium tumefaciens*.
- *Agrobacterium tumefaciens* are then added to a petri dish containing rice embryos.
- When agrobacteria infect the embryos, they also transfer genes for beta-carotene.

- Thus, the rice that will grow from these embryos will have properties to produce beta-carotene.



## Beta-carotene pathway



## Advantages of Golden Rice

- Golden rice gives more quantity vitamin A than other varieties
- Easy distribution to needy
- Cheaper and easier option to supply vitamin A than other supplements
- Costs same as other varieties
- Safe for consumption declared by FDA
- Can be cultivated every growing season and saved seeds, therefore no need for yearly budgetary investment for distribution

## Disadvantages of Golden Rice

- May cause allergies
- May fail to perform desired effect
- Supply of vitamin A does not meet the daily requirements
- Loss of biodiversity, may become a gregarious weed
- Endanger the existence of natural rice plants

- Genetic contamination of natural, global staple food
- Cultural disadvantage as some people prefer to cultivate and eat only white rice based on traditional values and spiritual beliefs

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