

“Golden Rice” especially attractive for pest insects?

Higher concentration of carotene benefits plant-feeding insects

24 September 2021 / Recent publications show that genetically engineered (GE) plants fortified with vitamins pose a specific challenge in risk research. A higher content of carotene can be an advantage for insects feeding on the plants. This could be amongst the problems with so-called ‘Golden Rice’, which is to be grown in the Philippines. It will be the first GE plant grown in the fields that will produce additional carotene to improve vitamin A intake via consumption.

Carotenes are involved in the metabolism of insects on several levels and can benefit their fitness, e.g. growth and reproduction. Several studies investigated the survival of pest insects fed with carotene (Vitamin A) and at the same time exposed to (Bt) insecticides. These insects had an increased tolerance to the toxin dependent on species, age and diet. Consequently, there is a danger that the cultivation of GE plants fortified with higher levels of carotene could promote the spread of pest insects.

Existing evidence of this has been found in GE maize, but no data have yet been published for the GE rice. Trials with Bt maize carried out in 2018 found a significantly reduced effectiveness in corn borer larvae that ingested additional carotene. More recent research shows that the effects are dependent on the age of the larvae and that carotene can influence their growth. Further studies found that additional carotene in the form of vitamin A and vitamin C also had a positive impact on the vitality of other plant-feeding insects (corn earworm and armyworm) under specific conditions.

The Spanish scientists carrying out the studies emphasised that these effects need further investigation. According to their data, the insects may profit from antioxidant effects, and thus have enhanced stress resistance and vitality. The carotene also seems to interact with the growth hormones of insects.

Unlike the GE maize used in the experiments, ‘Golden Rice’ could soon be grown in the fields. The scientists who developed the GE Rice at the International Rice Research Institute (IRRI) are nevertheless also well aware of the potential problem with pest insects, as they mention this in their questions & answers. At the same time, they are trying to dissipate the concerns of farmers. Even though no data have been published, they describe the risks as low.

In addition, there are other risks which the developers of ‘Golden Rice’ at IRRI are approaching in a questionable manner: for example, they emphasise that direct gene flow from GE rice to other fields is rare, even though the evidence so far appears to show an increased risk of contamination in other rice fields.

The IRRI appears to be ignoring the risk of conventional rice fields being contaminated due to gene flow from wild rice. These plants are typically found growing as weeds around the edges of the fields and act as a transmission factor in gene flow between the fields. Indeed, several cases of contamination with GE rice are already known from US and China, where conventionally bred rice has been contaminated over several years with GE rice, despite the GE rice only being grown for experimental purposes and for a short period of time.

Therefore, large scale cultivation of ‘Golden Rice’ undoubtedly carries a substantial risk of gene flow to other rice varieties. The gene flow might, in addition, also transmit unwanted biological characteristics such as enhanced susceptibility to pest insects. This would have serious consequences for the center of biological diversity of rice in the Philippines.

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Further information: [Paper on carotene maize and Bt \(2021\)](#) [2]

[Paper on carotene and Bt crops \(2021\)](#) [3]

[Paper on carotene maize and Bt \(2018\)](#) [4]

[Q & A on ‘Golden Rice’ at IRRI](#) [5]

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