Company
Solynta

Case Title
Potato CRISP(R)s

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Problem description
Potato is the fourth most important food crop in the world in terms of production with 388 million tons produced in 2017, following rice (770 million tons), wheat (771 million tons) and maize (1.1 billion tons). Potato is also one of the most productive food crops. Potato cultivation is more sustainable as it uses less freshwater per food content (FAO website). Taken together, the potato stands out as a crop which can fulfill Solynta’s mission to significantly contribute to food security in a sustainable manner.

The discovery of the genome editing technique CRISPR/Cas9 in 2013 has opened a new era of genetic modification. The technique allows for easy and precise modification of the genome of any living organism. An increasing amount of genetically modified crops are being cultivated globally. Compared to traditional breeding strategies, genetic modification has led to a much faster generation of new desirable cultivars. Moreover, CRISPR/Cas9 will allow for the creation of new traits, e.g., by the incorporation of transgenes.

The commercialization of these genetically modified crops has recently been restricted in many developed countries. In the European Union (EU), the legislation on genetically modified organisms (GMOs) has banned GMOs for use as a commercialized product. In addition, it has been decided that the mere use of CRISPR in an organism will mark that organism as a GMO. Therefore, there may be
no market for GMO products in the EU in the near future. Nonetheless, the debate is evolving and there is an opening to more nuanced views on genetic techniques.

Therefore, Solynta would like to have an overview of the technical possibilities of CRISPR/Cas9 which will have an additive value on their potato hybrid breeding program as well as the potential application and commercialization of such new cultivars with respect to the current and future GMO legislations on a global scale.

**Approach**

Solynta has created a new breeding program with which they can produce new potato cultivars from stable parental potato plants in a matter of a few years. With this new technique, Solynta are not only able to generate new cultivars with the most desired traits but they are able to produce higher yields and a cleaner product. These innovations can contribute to help combat famine and improve the world’s population health. Nevertheless, there are needs for specific traits that can be hard to generate by breeding alone. A new genome editing technique, called CRISPR/Cas9, allows change to specific genes in the potato to improve them in any way desired, with precision. CRISPR/Cas9 genome modification tools can be used to complement traditional breeding strategies to create potatoes that would fulfill those needs.

An extensive literature review and the collected data were analysed to 1. identify the traits to target for incorporation/deletion in the existing cultivars, 2. define and anticipate changes in GMO legislation in the EU and around the world, and 3. formulate various strategies for the new cultivars to be released on the market.

**Conclusion**

There is a growing need for new traits in potatoes in less developed countries as well as developed countries all over the world. The need for a specific trait depends on the user, being a farmer or a consumer. CRISPR/Cas9 can solve certain issues by introducing novel traits into crops, while others may be solved by breeding strategies alone. Additionally, CRISPR/Cas9 genome modification tools can be complementary to both classic and novel breeding strategies to create potatoes that would fulfill those needs.

One main restriction is the commercialization of GMO products. For example, new potato cultivars generated with the use of CRISPR/Cas9 cannot be sold in the EU. However, scientists and companies together are lobbying to get the legislation changed as they believe their products to be safe and could be an outcome for existing global issues like famine, world’s population health, the use of pesticides, and global warming. The efficiency of hybrid breeding programmes and anticipated updating of the GMO legislations around the world makes the re-evaluation the additive value of CRISPR/Cas9 for the improvement of Solynta’s potato cultivars very timely.

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