What future agriculture can learn from nature's cheaters

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In a recent publication, researchers from Wageningen UR investigated what agriculture might be able to learn from the anomaly of 'cheating' plants. Natural selection ensures that cheating plants dominate in the ecological system of plants and organisms with which they interact. These cheaters selfishly use the largest amount of nutrients and other beneficial materials in their environment. There are plants that use their

larger flowers to lure pollinating insects away from other plants and plants that grow extra roots to steal nutrients and water from their neighbours.

However, it is notable that plant communities with these types of cheaters often do not have maximum seed generation. This peculiarity is referred to as 'the tragedy of the commons'. The benefits for a specific cheating plant or cheating plant species are gained at the expense of all other plants and plant species in the habitat. This gives the cheating plant or cheating plant species a selective advantage. This is not a desirable effect for agriculture, where a maximum yield of crops from the entire field is favoured. Cheating plants in agricultural fields would be a hazard to our food supply. In agriculture it would be best if plants did not compete for resources with each other at all, as this would result in maximum yields. However, it is never this simple. Some of these cheating traits might very well be beneficial. Plants with extra large fruits are more attractive to animals that help to spread seeds and the entire fruits themselves are also more attractive to consumers.

Selection of plant breeders

In their literature survey, the researchers state that plant breeders have both knowingly and unknowingly selected for the presence or absence of cheating traits. They suspect that, in the past, plant breeders unknowingly selected plants with smaller root systems, as they were focused on selecting for maximum yields and therefore lower competition. They also selected plants with large fruits, which implies a high level of competitiveness. However, breeders also overlooked a few things. Plants located in dense stands tend to switch off their resistance, perhaps in order to better compete with their neighbours.

Evolutionary game theory computer models

The researchers from Wageningen UR state that future agriculture might be able to benefit from linking knowledge about cheating traits to evolutionary game theory computer models. They ascertain that this type of approach has already helped the forestry industry to select different types of trees that together produce the best yield of wood. It is possible that plant breeders and growers of food crops will also benefit from such an approach. However, it is necessary to bridge the gap between agricultural practice and the still abstract evolutionary game theory computer models that have been developed for ecosystems. The researchers from Wageningen have made recommendations for this in their article in *Trends in Ecology & Evolution*.

Provided by Wageningen University

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