CASE STUDY 6

Tackling food loss and waste

Tackling food loss through mycotoxin reduction in grains

One-third of food produced is never consumed: this represents 8% of global greenhouse gas (GHG) and a quarter of the water used in agriculture, as well as crop-land the size of China. Strong business, social and environmental drivers to tackle post-harvest loss and food waste include reducing contamination loss across the key value chain stages from production to consumption, financial savings, resource use efficiency, higher performance and contribution to climate targets, food availability and better returns on investments for actors involved.

WBCSD is collating this series of case studies to scale private sector action that tackles post-harvest loss and food waste through fostering more knowledge-sharing and peer-learning.

Case studies will be made available at www.wbcsd.org.

The context

Every day, Bühler process technologies and production equipment support billions of people's basic needs for food and mobility. As a global industrial solution provider, the family-owned company contributes to a better and more sustainable world with collaborative innovation, new technologies, training and services.

In August 2019, Bühler increased its targets to respond to the unprecedented challenge of climate change. The company committed to reducing waste, energy and water consumption in its customer's value chains by 50%, which will have a significant impact on CO_2 and GHG emissions. Contamination and spoilage are major causes of food loss, for example due to mycotoxins which are secondary metabolites produced by fungal molds that can contaminate food and feed. Within the Horizon 2020 project MycoKey, Bühler conducted industrial-scale grain cleaning studies with the National Research Council of Italy, Institute of Sciences of Food Production (CNR-ISPA), to verify the mycotoxin reduction efficiency of grain cleaning based on mechanical and optical technologies.

The mycotoxin challenge

Mycotoxins are a global threat, not only economically due to the high yield losses they cause, but mainly because they jeopardize human and animal health. Global warming and extreme weather conditions, such as drought and flooding, stand to increase the mycotoxin risk even further. Compared to microbial contamination, mycotoxins cannot simply be inactivated by heat. However, through Bühler's research, grain cleaning was found to be an effective post-harvest mitigation strategy to reduce high levels of mycotoxins.

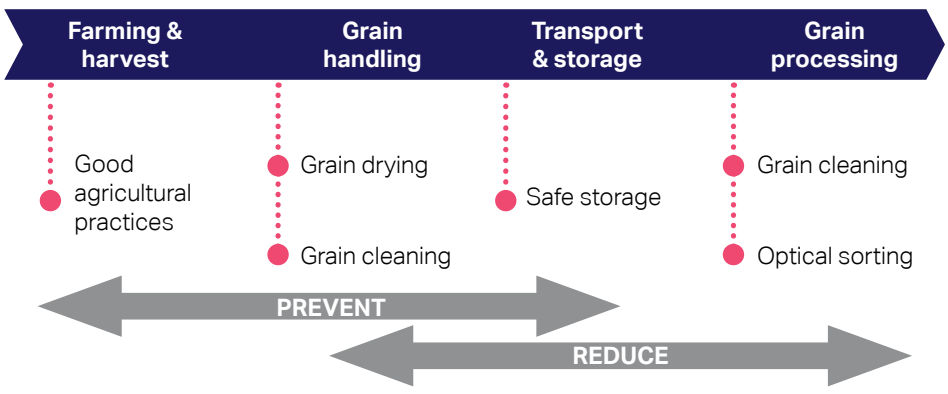
Mycotoxins may occur already in the field, depending greatly on weather conditions and agricultural practices, or during storage, as a result of poor post-harvest handling. Depending on the classification system used, some 300 to 400 known mycotoxins exist of which, based on their toxicity and occurrence, approximately a dozen have a major economic impact.

Grain cleaning across the supply chain

To reduce mycotoxin levels, strategies need to be applied along the whole process chain, as visualized in Figure 1. This starts in the field, where fungal growth and mycotoxin formation must be prevented in the grains by applying good agricultural practices, including proper variety selection and crop rotation beside other control measures. After harvest, grains should be dried to prevent further mold growth and mycotoxin formation.

During further processing, grain cleaning — or the elimination of contaminated grain fractions — is important to reduce the mycotoxin levels at the earliest possible stage to prevent cross-contamination. This must be done before the grains are milled, after which it is difficult to remove the contamination. Another important point is to ensure safe handling and storage of the grains under dry and cool conditions to prevent condensation.

Figure 1: Mycotoxin mitigation along the process chain.



Typically, a small fraction of a total grain lot will contain most of the contamination. By removing these fractions by grain cleaning, the mycotoxin level of the lot as a whole can be reduced. Dust; small or broken fractions; and low-density and shriveled kernels typically contain high mycotoxin levels. Contaminated grains will often show visual signs of mold infection, such as color defects, surface modifications, or shape deformations. As in Figure 2, dust and broken kernels can be removed by size separation and aspiration, and low-density kernels by density separation. Finally, kernels with visual signs of contamination can be removed by optical sorting.

One of Bühler's MycoKey studies focused on corn with levels of aflatoxin contamination of 10 µg/kg and 20 µg/kg. Bühler performed trials on batches of three tons each, which were cleaned by size separation in conjunction with aspiration and optical sorting. After cleaning, total aflatoxin contamination was found to have been reduced to below 4 µg/kg, resulting in an overall reduction rate of 70-95% with a total reject rate around 10%. This means the product quality was improved from 'biomass and feed grade' to 'food grade'.

Figure 1: Depiction of grain fractions that typically contain high mycotoxin levels and how they can be removed. This example shows fractions of corn (maize), however the strategy can be applied also to other grains.

Original infographics source: Bühler

Training and collaboration for success

Although the efficiency of the grain cleaning process depends on the type of grain and its contamination level, this study shows that grain cleaning is an efficient solution to reduce mycotoxin levels in grains. To implement these mitigation strategies, companies must train food processors and producers. Success also requires collaboration between farmers, producers, researchers, and legislators to improve on existing strategies and prepare for unforeseen challenges. Ultimately a single mitigation strategy to remove mycotoxins is not sufficient, but instead the challenge requires an optimized combination of context-appropriate strategies.

ABOUT WBCSD

WBCSD is a global, CEO-led organization of over 200 leading businesses working together to accelerate the transition to a sustainable world. We help make our member companies more successful and sustainable by focusing on the maximum positive impact for shareholders, the environment and societies.

Our member companies come from all business sectors and all major economies, representing a combined revenue of more than USD $8.5 trillion and 19 million employees. Our global network of almost 70 national business councils gives our members unparalleled reach across the globe. Since 1995, WBCSD has been uniquely positioned to work with member companies along and across value chains to deliver impactful business solutions to the most challenging sustainability issues.

Together, we are the leading voice of business for sustainability: united by our vision of a world where more than 9 billion people are all living well and within the boundaries of our planet, by 2050.

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