



# CROP CLEANING

Professional crop cleaning as an essential contribution to grain hygiene management

Dr. Heike Knoerzer, PETKUS Academy, Wutha-Farnroda (Germany)

**L**osses begin after the harvest. According to official estimates, about one third of the grain produced for food purposes is lost during post-harvest processes such as storing, drying, cleaning or milling.

This corresponds to approximately 1.3 billion tons with a value of one trillion US dollars per year, as Deepak Kumar and Prasanta Kalita summarised in their report in the “Foods” magazine 6 (1) 2017. Process engineering with regard to optimising post-harvest processes receives little attention from a scientific perspective. Less than five percent of research funding has been allocated to this critical issue in recent years.

Mechanical, aerodynamic and optical sorting technologies

within grain processing are an essential contribution to hygiene management. However, they are hardly considered as such and thus, far too rarely included. Between grain storage and food processing, there is great potential for minimising losses, ensuring product quality and generating added value.

Many grain lots have to be discarded because they have been attacked in part by insects, contaminated with mycotoxins or because they contain an unacceptable level of critical impurities (e.g. invasive alien species) or closely related species. Already popped popcorn maize, red coloured bran in white rice, sclerotinia in sunflowers or ergot in rye can destroy an entire field production if no adequate processing technology is available. Bean weevils, ambrosia, cuscuta, deoxynivalenol or aflatoxin lead to post-harvest death if processing is inadequate. By contrast, investments in modern technologies are paying off.





Hamid Alavi (World Bank) reports that small to medium scale village mills in South-East Asia achieve only 57 percent instead of the theoretical head rice recovery of 70-73 percent. As decisive reasons, he claims inadequate cleaning and calibration as well as insufficient maintenance of the machines. Traditional winnowing causes losses of around four percent of total field production, which according to FAO data (Ø 2012 - 2016) amounts to around 0.2 million tonnes of grain per year in Africa, Central America and South-East Asia alone. In Europe, an estimated one to two percent loss of good grain results in an annual loss of approximately 9500 tonnes within the pre-cleaning process alone. This corresponds to 17 million one kg loaves of bread.

### **Hygiene begins with professional crop cleaning**

It already starts with pre-cleaning as an essential step. A large proportion of dust, soil, stalks, chaff, impurities, and parts of heads, cobs or panicles are removed here. From a grain trader's perspective, the primary task of pre-cleaning is to waste as little sellable product as possible and



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Caraway seeds raw material



Caraway seeds after mechanical cleaning



Caraway seeds after optical sorting



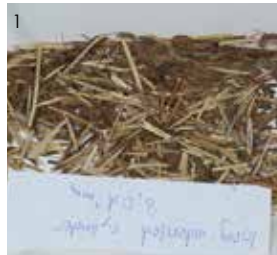
to sort out as many impurities as necessary in order to sufficiently dry and store the grain afterwards. Pre-cleaning significantly reduces storage losses. Inhomogeneous material means inhomogeneous drying and moist spots in storage. If you clean improperly, you will be faced with waste later on.

In addition to capacity, it is important that cleaning is efficient and the loss of good grain is minimised.

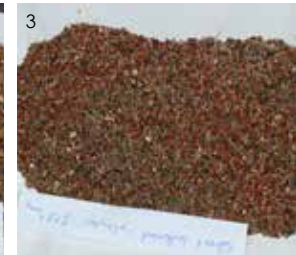
Drum cleaners, screening machines or air screen cleaners are used for pre-cleaning. Petkus Technologie GmbH in Wutha-Farnroda, Thuringia, relies primarily on the linear oscillation principle for its screen cleaners because this achieves a very precise cleaning performance.



Corn before HySeed treatment



<sup>1</sup>Caraway seeds reject from long grain separation (indented cylinder) <sup>2</sup>Caraway seeds reject of sifting <sup>3</sup>Caraway seeds reject from short grain separation (indented cylinder)



In the linear oscillating system, the screens vibrate horizontally, meaning they carry out a linear oscillating movement driven by an eccentric shaft and unbalance motors. Operation is according to the ejection principle. As a result, the kernels are arranged parallel to the perforated sieve slots, improving flow and sorting accuracy.



Corn after HySeed treatment



Wheat before HySeed treatment



Wheat after HySeed treatment

### Hygiene is achieved mechanically, aerodynamically and optically

Indented cylinders, air screen cleaners and gravity tables are all classical mechanical and mechanical-aerodynamic cleaners. They play a decisive role in grain processing. However, the juxtaposition of machines does not yet constitute a technology. Foremost the proper machine selection, its configuration, feeding and bypass functions as well as the state of the art of the individual machines determine functionality, sorting quality and cost-effectiveness. "That's why at Petkus engineering, technology and innovation go hand in hand," emphasises Mark Scholze, CEO of Petkus Technologie GmbH.

Practical examples have proven these points. A comparative analysis of the annual return on investment, where a conventional gravity table was compared with a Petkus G 40mid-ex, showed that after the use of the Gmid-ex technology, sales per ton of sorted seeds were around €80 higher than with the previously installed technology.

Using the same input lot with Petkus Gmid-ex, the proportion of sellable seeds increased by 18 percent compared to the conventional table due to its increased sorting efficiency and precision. It separated considerably more reliably into heavy and light material fractions. This represents a 12 percent increase in revenue per year.

In the Petkus test centre, an optimised sorting process for wheat contaminated with *Fusarium* was evaluated. Analysis of the raw material showed a DON content of 1.65 ppm. The maximum legal content of unprocessed cereals is 1.25 ppm.

"We were able to reduce the DON content to 0.82 ppm by means of optimised mechanical cleaning," says Dr. Doreen

Thoren, Manager Research Department at ROEBER Institut GmbH. "Further processing by the ROEBER OS900, our optical sorter, resulted in a final DON content of less than 0.25 ppm."

### Hygiene without chemistry but active steam technology: HySeed bio

The latest development in the area of crop hygiene comes from the Petkus R&D department, the Roeber Institut. The "HySeed bio" process consists of a technically sophisticated steam treatment of grains, which kills pathogens such as fungi or bacteria. Chemistry is not used, only water and purely biological additives to enhance the effects. "The technology is in the final testing phase," says Thoren. "Comprehensive laboratory scale tests with seed samples infected artificially, naturally and artificially in-field were more than promising."

Laboratory infected wheat with *Fusarium culmorum* resulted in a reduction from 5900 initial colony-forming units (cfu) per grain to 0.2 cfu/grain. In maize, also infected with *Fusarium culmorum*, 8500 cfu/grain were reduced to 0.6 cfu/grain; in barley, only 0.4 cfu/grain of initially 25000 cfu/grain was detected after treatment. A sample of soybeans showed a natural infestation with *Diaporthe phaseolorum* of 27.5 percent. The infestation was reduced to 7.5 percent. Field infected wheat with *Pseudomonas syringae* pv. *atofaciens* had 924 cfu/grain and after treatment 2.2 cfu/grain. "With the opportunities of the HySeed bio process, we may well be at the beginning of a truly novel technology for comprehensive hygiene management," says Scholze.

So that after the harvest there are no losses, only profits.