

# traceable and chemical-free Storage and Transportation Systems

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### Statement of problem:

Worldwide special grains trade is increasingly demanding quality, innocuousness, segregation and traceability. Such products are currently transported in non-airtight big bags or containers fitted with plastic liners without any actual functionality (not airtight), which lack a traceability system. This export modality entails assuming risks regarding the preservation of product quality and innocuousness, chiefly due to pesticide residue and mycotoxins.

International grain trade has zero tolerance for insects. Consequently, the use of chemical pesticides has become widespread, with the entailed risk of jeopardizing product innocuousness, as well as phosphine, which is highly questioned as a health risk for workers.

Additionally, humidity condensation on grains inside containers during maritime shipping may generate favorable conditions for proliferation of fungi, and eventually, mycotoxins.

In turn, in the specific case of trade in organic grains, chemical control is banned, but the alternative technologies available do not guarantee 100% pest control (for example, diatomaceous earth) or are implemented in an almost traditional manner (modified atmosphere packaging), with no guaranteed effectiveness.



### Technology Readiness Level:

Initial phase. Presently, we are fine-tuning a pilot plant to install the prototypes, including silos, watermill, grain drier, big-bag storage space, among others.

Experimental determinations of the barrier level were performed with different plastic linings that could potentially be used at a larger scale.

Laboratory assessments are being conducted on the effect of different atmospheres regarding the quality of different products. Additionally, pest control experiences were performed in the laboratory and in the field with different types of modified atmospheres.

In connection with the monitoring of variables and traceability, we identified the basic temperature, humidity and gas detection system, and the data storage system.

### Technology proposal:

This development constitutes a technology package that enables to store grains in big bags or containers under controlled atmospheres and an integral monitoring and traceability system that allows chemical-free grain storage and transportation.

Generating a carbon dioxide (CO<sub>2</sub>) and nitrogen (N<sub>2</sub>) controlled atmosphere prevents insect proliferation, while air-tightness controls condensation on grains, which prevents fungi development.

The technology package includes a prototype that bags, seals and injects gases, and a monitoring system for sensitive variables (temperature, humidity and gas concentration) for the storage and transportation of grains enabling the traceability of these conditions. This system ensures customers that grains were stored and shipped under optimal conditions, which adds value to the product. Additionally, the traceability system allows adding information on the crop conditions of the material in storage.

### Development requirements (testing, scale-up production, investment, etc.):

We rely on financing from the Technology Advancement Fund (FVT, as per the Spanish acronym) and we are looking for sponsors to complete the pilot plant installation.

Pending tasks include integration of all the parts of the technology package (thermosealing, gas injection, traceability system) into a harmonized system and testing functionalities in the pilot system.