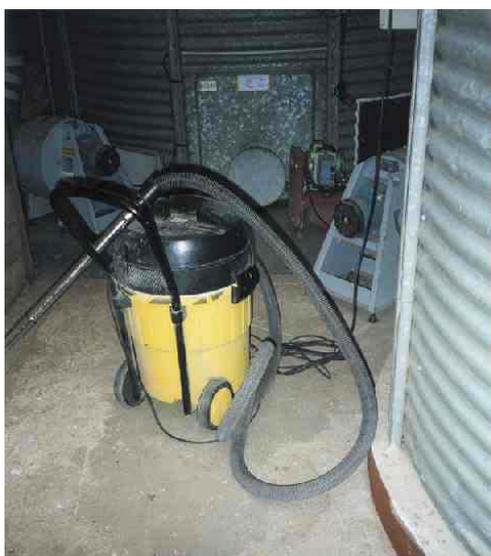


Storage in grain store facilities

Insects: a problem which is increasingly difficult to manage

With the withdrawal of some of the insecticides used in storage, preventive measures must be reinforced, both on the farm and in grain store facilities, in order to ensure optimum grain quality.



Cleaning of facilities before grain storage is a the minimum required to control insects

Increasingly often, grain storage on the farm is the first step in controlling quality, and especially in preventing insect development. It determines the kind of strategy which should be followed thereafter.

Insects coming from the field are biologically incapable of surviving during storage. Storage insects are specific to the foodstuff being stored and can only survive if they are in contact with grain, fragments or dust, thanks to which they then colonise new stocks.

Grain sale contracts stipulate that batches must satisfy "health, purity and merchantability" criteria, i.e. that they must, for example, be free from live insects, adhering to a very low tolerance limit of insecticide residue, called Maximum Residue Limit (MRL).

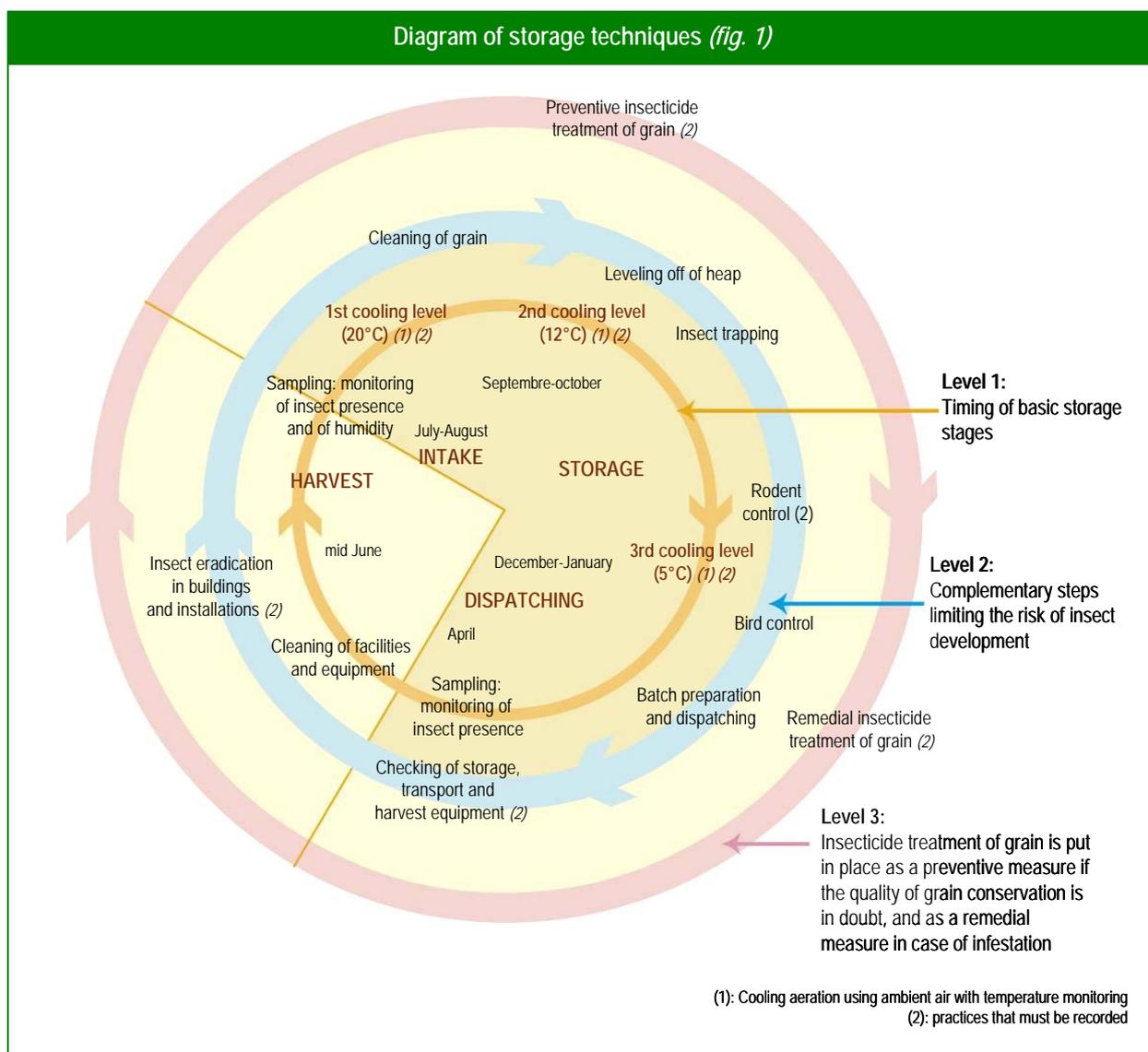
To be able to sell the grain, a complex equation must be solved between preventing the presence of live insects and staying within the insecticide maximum residue limits.

Initial storage, whether it is on the farm or in grain store facilities, is therefore a determining phase, especially since the two insecticides most commonly used during storage, dichlorvos (ddvp) and malathion, have recently been withdrawn.

In Europe, four insecticides can still be used to treat stored foodstuffs, either in liquid or gas form. Three liquid insecticides can still be used: pyrimiphos-methyl (Pirigrain), chlorpyrifos-methyl (Nuvagrain) and deltamethrin (K Obiol or Deltagrain). They are usually sprayed on surfaces, or applied in the form of a very fine mist (very fine droplets) onto the grain. Those products must only be used if needed, in order to avoid multiple treatments. The only gaseous insecticide licensed in France is phosphine (PH₃). The staff accredited to use it put in place a fumigation procedure lasting from a few days to a few weeks, depending on temperature and type of insects present. This method is rarely used nowadays because it requires specific storage equipment, concentration measurement tools and optimum protection for users and surrounding area. An additional reason for its lack of popularity is that it needs to be planned well in advance if the treatment is to take place at loading.

Grain store facilities find themselves faced with a real technical turning point, and deprived of a quick insecticide solution.

Diagram of storage techniques (fig. 1)



Each circle represents a management level. Each level is more refined than the previous one.



The effectiveness of cooling aeration will then be monitored by regularly checking temperatures

Practices vary from one grain store facility to another

A recent survey showed that current practices are quite variable from one grain store facility to another. Practices differ, they are linked to the history of the silo and suited to its technical resources. They range from preparing the facilities by extensive cleaning and insect eradication in the premises before the grain is delivered, which constitutes the start of routine preventive management, to routine preventive insecticide treatment of each batch, which is easier to implement.

Preventive insecticide treatment of grain using a residual product, as the storage bins are being filled, is an easy solution which can be approached in different ways: treatment of the whole batch using the recommended rate, or using a half rate, or treatment of every alternate layer of grain... In those cases, maintaining the amount of residue under the MRL becomes a tricky exercise, especially if there is no record of previous treatments.

In view of the new regulations, treatment management will have to improve along the entire production chain, or treatment might even have to stop in cases where technical deterrents can be put in place. Then, only remedial treatments will be carried out, if those deterrents fail to be effective. Therefore the risk of insects developing in the grain can be pre-empted by putting in place, on the farm, a series of basic and complementary steps, which are then followed up by the grain store facility.



An insecticide treatment is sometimes necessary in addition to the cleaning to control insects.

Effective preventive measures

All preventive measures to control insects can be combined as part of a set of storage techniques. (figure 1).

Each of them helps to ensure the success of the following one. Each step contributes towards the ultimate control of insects.

The minimum required is to thoroughly clean the facilities, and then to make sure that the moisture content of the product that is going to be stored is low enough to maintain its quality during storage, with the help of cooling aeration using ambient air. However, as the grain is being delivered, it is important to check that batches have not been infested, in spite of all the measures taken. If they have, remedial treatment is then essential and must be discussed with the buyer.

The way to proceed afterwards is to completely clean the facilities prior to delivery, to treat the premises and the equipment with insecticide, and to get rid of insects from the previous year. The effectiveness of cooling aeration will then be monitored by regularly checking temperatures. The presence of insects will be detected early with traps, to prevent, if there are any, the whole silo from being contaminated.

Traps help to detect the presence of insects.

Finally, the procedure can be completed by routinely cleaning each batch of grain as it is being placed in the storage bin, which, like levelling the top of the bin, improves the effectiveness of cooling aeration.

When this level of technical standard has been reached, remedial treatments are almost never necessary.

Those storage techniques must also be implemented by the grain storage organisation, after they have checked that there are no insects in the delivered grain. If contaminated grain is delivered to the grain store, the latter will then be forced to apply a remedial treatment.

When the grain is being delivered, it is important that the farmer, if he/she has treated his/her batch, informs the grain store of the date of treatment, and of the product and rate used, in order to avoid another treatment being carried out, which could bring the level of residue above the MRL.

Very few chemical possibilities in the future

Research teams working on grain storage, in France and abroad, are focusing on finding alternative treatment methods to replace withdrawn products. New physical methods, such as thermal shocks, UV treatment of grain, etc., as well as new liquid or gaseous insecticides, are being examined as part of a dialogue with English and Australian teams. But none of those solutions will be able to totally replace dichlorvos. Furthermore, the use of pyrimiphos-methyl is currently being reviewed, and in the end, it is likely that the use of chemical products will be subject to increasingly stringent regulations.

The whole sector must take account, now, of those inevitable changes, and modify its current practices.

To provide practical and effective solutions to grain storage issues, ARVALIS - Institut du végétal is establishing an applied research platform in the Halle Technologique des Céréales (Technology Centre for Cereals) of its Boigneville experimental research station, near Paris. Research activity will involve testing equipment, new insect eradication -methods and insecticide products on experimental facilities, in order to provide the cereal sector with the means of satisfying each aspect of specifications, even when this looks like being an impossible task.

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Replacing dichlorvos will probably not be achieved through a single solution. It is unlikely that a new "super insecticide" will be licensed in Europe. However, the storage techniques outlined in this paper should help, through a methodical succession of complementary steps, to only treat grain with insecticides on a very occasional basis, until an effective treatment which does not rely on pesticides might be accepted, or at least tolerated, by future regulations.

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