

on the efficacy of fumigations (recommended or low dosages) on *Tribolium* spp. eggs. In the two cases, when the average temperature during the fumigation was 30°C or more, between 65 to 100% of eggs were killed depending on conditions.

Conclusion

The main factor of successful fumigations with low dosages is the temperature (particularly to control *T. castaneum* eggs). The fumigations (with recommended or low dosages) below 25°C seem to provide disappointing results, that's why the increase of temperature in order to reach 30°C at minimum allows to:

- reach for sure 100% of egg mortality (with recommended dosages) for *T. castaneum*,
- improve the egg's mortality with low dosages fumigations,
- reduce the gas exposure time,
- reduce the necessary amount of gas.

To conclude, this study confirms other studies (Reichmuth et al., 2003), the dosage can be reduced "intelligently" with good results in disinfestations of stored products pests. The fumigations carried out without controlling all the eggs of the populations of *Tribolium* spp. have allowed to kill all the others stages of these pests (larvae, pupae and adults). Moreover, with low dosages, even if the fumigations don't kill all the eggs of *Tribolium castaneum*, the most tolerant species to sulfuryl fluoride (Bell et al., 2002), the treatment may control all or almost all the stages of others species of insect pests. It is therefore a good alternative to the ban of dichlorvos.

Maybe the best way consists to combine the fumigations, with low dosages of sulfuryl fluoride, with heat in order to reach 30°C inside the mills before and during the treatment but the economic impact of that combination needs to be assessed.

Literature

- Bell C.H., Savvidou N., Wontner-Smith T. J. (1998). The toxicity of sulfuryl fluoride (Vikane®) to eggs of insect pests of flour mills. In: Proceedings of the 7th International Working Conference on Stored Product Protection - Volume 1, 14-19 October 1998, Beijing, P.R. China, pp 345-350.
- Bell C.H., Wontner-Smith T.J., Savvidou N. (2002). Some properties of sulfuryl fluoride in relation to its use as a fumigant in the cereals industry. In: Proceedings of the 8th International Working Conference on Stored Product Protection, 22-26 July 2002, York, UK, pp 910-915.
- Howe R. W. (1956). The effect of temperature and humidity on the rate of development and mortality of *Tribolium castaneum* (Herbst) (Coleoptera, Tenebrionidae). Ann. appl. Biol. 44 (2), 356-368.
- Howe R. W. (1960). The effects of temperature and humidity on the rate of development and the mortality of *Tribolium confusum* Duval (Coleoptera, Tenebrionidae). Ann. appl. Biol. 48 (2), 363-376.
- Reichmuth C., Raßmann W., Binker G., Fröba G., Drinkall M. J. (2003). Disinfestation of rust-red flour beetle (*Tribolium castaneum*), saw-toothed grain beetle (*Oryzaephilus surinamensis*), yellow meal worm (*Tenebrio molitor*), Mediterranean flour moth (*Ephestia kuehniella*) and Indian meal moth (*Plodia interpunctella*) with sulfuryl fluoride in flour mills. In: 8th Internat. Working Conf. Stored Product Protection, 22-26 July 2002, York, UK, pp 736-738.

15 - Post harvest protection against insects in the bulk grain supply chain the views of economic operators

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Abstract

European (EU-27) grain & oilseeds storers are regularly facing insect management issues. Under worldwide trading standards, the grain industry is committed to maintaining the "zero tolerance" for live insects (WTO-SPS agreements). The grain being harvested each year therefore has to be stored in a manner which ensures that these standards are met. The presence of living insects in stored grains would jeopardize the supply of the grain & oilseeds supply chain, both for food and feed as well as for exports. In this context, our survey covers a quantity of agri-product that is equivalent to 5% of the EU-27 production. Results show that storage operators need several modes of action in order to prevent and cure the build-up of insect infestations in grain while avoiding pest resistance. Ventilation, silo cleaning and fumigation are important aspects in the implementation of an integrated pest management. Because of legislative restrictions, we now rely on one fumigant and on only a limited number of residual storage insecticides. As a result, we show that European operators will face difficulties to combine the available management technique. Therefore we stress the need for legislative development together with an

increase in research and development of new active substances. In addition, flexibility should be given to producers which are willing to submit a product composed with a generic active substance.

Introduction

Each year, EU-27 exports about 9% of its grain crop and although these exports are extremely important to the European economy they represent only about 8% of the total world trade in grain. To maximize competitiveness with this small fraction of world trade, the European grain industry works to ensure products of consistently high quality. Within the supply chain operations, the bulk commodity trading system holds a couple of characteristics. Firstly, storage operates at most of the steps of the cereal & oilseed supply chain. Secondly the collection, trade, transport and processing of commodities is characterized by aggregation of many small consignment into large, uniform bulk shipments. Thirdly, aggregation and mixture takes place at all levels and economies of scale are most important. Finally, compliance with certain quality parameters is crucial. By continuous checks and inspections at the time of export by national authorities, this high quality will be officially granted by issuing a phytosanitary certificate, which is an absolute must with any export originating from the EU. The absence of live insects and other biological contamination have become an important consideration.

In this respect, insect management of stored grain is and was always an important tool for maintaining high quality. The ongoing review process of active substances in the European legislative framework has consequences for grain storage at any operating level. Most of the active compounds used for knockdown treatments (showing rapid effect on insect populations) were phased out in the review process under Directive EC 91/414. Equivalent treatments applied as an alternative are scarce (Deltamethrin, Pirimiphos methyl and Chlorpyrifos methyl) or not always easy to implement (fumigation). Any further loss of active substances will make it nearly impossible to manage infestations. In the light of this technical impasse; Coceral, Euromalt, Unistock, Euroflour and Euromaisiers have carried out a survey to get an accurate understanding of insect management as it is applied by the grain and oilseeds storekeepers.

Above all, the distinction must be made between active substances (ASs) used to knock-down the adult insects and other ASs used as preventive and long-lasting measure to destroy also the larvae and eggs. The survey shows that the use of Deltamethrin and Pirimiphos methyl, widely known as contact insecticides, will possibly increase. As a consequence this can lead to higher chemical residues in the grains and the development of pest resistance could occur even faster. At the same time, the development of pest resistance to widely used compounds could occur even faster than before.

As a consequence, operators will struggle to comply with the nil tolerance for live insect for the following reasons:

- The ASs having a knockdown effect are removed from the market.
- The fumigation, when safe and feasible, is fully efficient only if material is sealed for several days (depending on the temperature, the volume of grain and the silo).
- The 3 ASs that are still authorized have a poor knock down effect. However, their efficacy is rather constant on the long run.
- Pyrethroids are highly soluble in fat (eg Deltamethrin). Therefore, the number of storage insecticides for oilseeds is even more limited.

Efficient ventilation and cooling devices are used to obstruct and stabilize at a low level the growth of insect's population. On the other hand, in the major exporting countries the climate is such that cool air is not sufficiently available after the harvest. And higher air flow may be required for timely aeration. Experience shows that this is often considered as economically unfeasible. Therefore, chemical application is needed.

Nevertheless, ventilation, cleaning and fumigation cannot be the sole remedies for prevention of losses in stored grain. Efforts should continue to integrate other methods with these technologies, including insecticides.

The five mentioned European associations therefore stress the need for the legislation to take into account legislative constraints operators are faced with. In particular, both review process of MRLs and of existing substance should grasp the technical constraints of managing grain & oilseeds storage.

Even though especially small and medium sized companies continue to research and develop new active substances, interest in research gets weaker and weaker due to legislative pressure. The major insecticide producers usually focus on the field sciences and consider the next steps of the supply chain as negligible. Consequently, the grain industry, together with the grain traders urge the plant protection industry to focus more research effort on storage insecticides and alternative technologies in order to obtain effective and less hazardous formulations.

Trade & Services: COCERAL: the European grain & oilseeds traders, UNISTOCK: the European port silos operators , EUROFLOUR: the European wheat flour exporters.

First process industry: EUROMALT: the European malting industry , EUROMAISIER: the European maize milling industry