



envu™

Grain protectant

Guidebook



K-OBIOL™

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Introduction

K-Obiol™ is a modern liquid pyrethroid formulation containing deltamethrin, synergised with piperonyl butoxide for the control of a wide variety of stored product insects known to infest grain and pulses. Available in two formulations a single admixture treatment can provide protection for up to 12 months.

With unrivalled efficacy against the most common insect pests K-Obiol™ is the product of choice for the treatment of grain storage facilities and as an admixture for longer term grain storage.

Used as part of an Integrated Pest Management (IPM) approach K-Obiol™ will provide the highest level of protection for your valuable stored crops.

Why Envu has produced this guide

Farm assurance schemes require farmers and growers to plan and record their grain storage strategy and activity.

This guide book will help you to:

- Understand the insect problem
- Develop and plan an integrated pest management approach
- Select the correct K-Obiol™ formulation
- Correctly use and apply K-Obiol™

Grain storage challenges

Grain is a living organism, which cannot be kept for a long time without changing. It is always at risk of deterioration and must be managed to maintain its intrinsic qualities for as long as possible.

Three factors influence the quality of the grain:

- Temperature
- Moisture content (MC)
- Storage period

These factors influence the germinating capacity of the grain. Thus when moisture content and temperature are favourable the metabolism of the grain accelerates and it germinates.

The development of micro-organisms and insects which are always present to a greater or lesser extent on the grain or in storage areas are also affected by these factors. The greater the quantity of grain, the greater is the risk of infestation. The conditions required for proper preservation of the grain therefore varies according to the quantity involved.

In the case of flat or floor storage, where the surface in contact with the air is large, the grain is more vulnerable to changes in the ambient humidity than is the case in vertical stores. This in turn may make it more vulnerable to deterioration.

It is estimated that over 90% of farm grain stores harbour at least one species of insect known to infest grain. The number of growers who use an insecticide to treat either the fabric of the building or the grain directly is estimated to be around 40%. When grain prices are high and with the possibility of growers choosing to store their grain for longer a planned approach to good grain storage is essential.

The insect problem

Stored product insects may be differentiated from each other by their diet, the environment or the duration of the succession of populations during storage.

The infestation of grain is characterised by a succession of insect species, which may be divided into three classes:

Class 1. Primary insect pests

Primary insect pests are capable of infesting whole grain rendering it suitable for the infestation by other insect species. They damage and contaminate grain but are not found in crops in the fields. The primary pests damage grain and raise temperature and moisture levels which will create suitable conditions for secondary pests and fungi. Typically, the source of insects infesting a newly stored commodity is from populations already infesting some previously stored material.



Grain weevil



Saw-toothed grain beetle



Red rust grain beetle



Lesser grain borer



Rice and maize weevil

Class 2. Secondary storage insects

Secondary storage insects such as australian spider beetles, booklice and fungus beetles will sometimes invade from nearby habitats such as haystacks.

The secondary pests develop on grain that has been already damaged by physical or biological action e.g broken or mouldy grain or previously infested by primary insects.



Fungus beetle



Australian spider beetle



Booklice



Rust-red flour beetle

Class 3. Mites

Mites are much smaller than the insect pests (typically less than 0.5mm long) and are a serious pest of stored cereals and oilseed rape causing direct damage and taint. In large numbers they can cause an allergic response in humans and livestock.



Mite

The basics of IPM

Integrated Pest Management (IPM) is a program of prevention, monitoring, and control strategies to limit the pest damage by the most economical means possible and with the least environmental impact which could lead to a reduction in chemical pesticides used.

Prevention

Maintenance

- The building has to be free from last year's grain and debris.
- Buildings must be made weatherproof. All roof leaks, broken sheeting, guttering should be repaired.
- Cracks, crevices and damage to the building structure should be repaired.



General store hygiene

- All grain store walls, floors and horizontal surfaces of any storage, holding or reception facility must be cleaned and where appropriate washed.
- Where livestock buildings are intended for use as grain storage or temporary holding facilities at least 5 weeks prior to storage they must be thoroughly cleaned, power washed and sanitised with a combined detergent/approved disinfectant.
- Ensure that the building is vermin proof, sealing up holes, repairing doors and brick works.

Chemical treatment

- The fabric of the building should be treated if there is a history of insect infestation or if a risk assessment indicates the need.

Monitoring

There are three things that should be monitored weekly during storage:

- 1 Insect activity using pit fall traps, insect monitoring traps or bait bags (not containing nuts)
- 2 Grain temperature.
- 3 Grain moisture – the optimum moisture levels for long term storage of cereals are below 14.5% and 7-8% for oilseed rape.

Where infestations of insects or mites are detected early, due to the monitoring put in place, it is sometimes possible to control the problem by using a combination of techniques such as cooling, cleaning or drying.

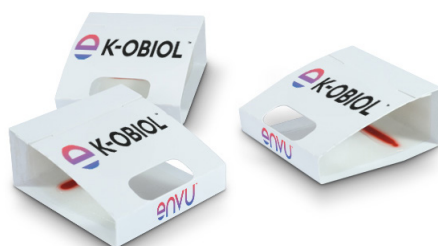
Control

However, in some situations apart from the physical techniques put in place, it may be necessary to consider the use of admixed insecticides (such as K-Obiol™) or fumigation where appropriate.

Biological controls which involve the use of predatory insect species are not used in stored combinable crops because there is a zero tolerance of any insects found in a grain sample dictated by end use markets.

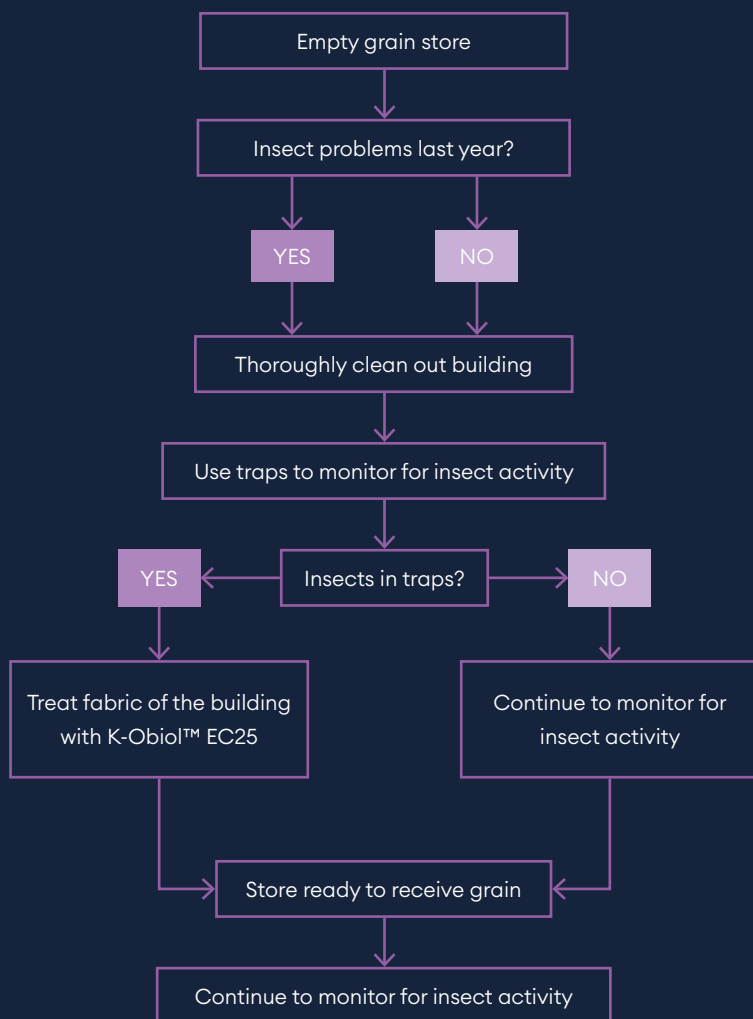


Monitoring insect activity using pit fall traps or bait bags

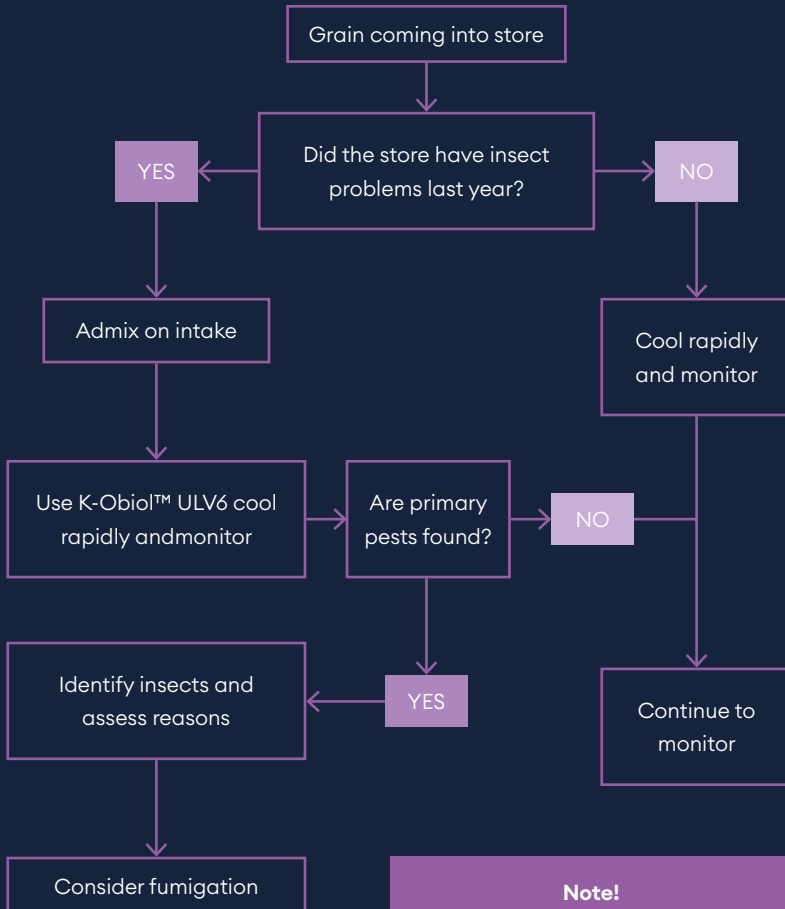


Decision trees

PRE-HARVEST



GRAIN STORAGE



Note!

The end market and intended use of the grain may determine which products may be used. Please check before use.



Pre-harvest store preparation

Empty grain stores can harbour many insects, ready and waiting to infest incoming grain. Action should be taken well before grain intake to ensure an insect-free environment. Cleaning alone will not guarantee eliminating risks of all pests in empty stores, nor will solely using a pesticide treatment. This is why an IPM strategy is a must!

Equipment maintenance

- Clean, check and service key equipment.
 - Review electrical and mechanical safety.
-

Repair structural problems

- Repair any leaks in the roof or broken gutters.
- Look for structural defects in walls or evidence of groundwater ingress.
- Eliminate dead spaces that trap residues or cause problems with cleaning.
- Proof against rodent and bird entry. Stores should be monitored for signs of rodents. Care must be taken that non-target animals cannot access rodenticides by following the CRRU (Campaign for Responsible Rodenticides Use) code (www.thinkwildlife.org/about-crru-uk).
- Use shatterproof covers on lights to avoid any glass contamination on the intake.

Store hygiene

- Use an industrial vacuum cleaner. Remove rubbish (including vacuum cleaner contents) immediately after cleaning.
 - Dispose of rubbish well away from store.
 - Consider cleaning grain to reduce pest risk.
 - Make final inspection for waste residues.
 - Store all feedstuffs and similar commodities away from the main store.
-

Monitoring & treatment

- Monitor store for insects by placing insect traps in corners and at wall/floor junctions at 4-5m intervals and check them regularly. If live insects are found or if there is a history of insect infestation treat the structure of the building with K-Obiol™ EC25 and protect incoming grain. No grain should be stored until the surfaces treated are completely dry.

Fabric of the building treatment using K-Obiol™ EC25

K-Obiol™ EC25 should be applied by using spraying equipment that allows you to treat the structure of the building up to 15 metres in height to the point of run off and with a reasonable pressure such that it will disturb and penetrate dust lying on beams and roof spaces. These areas can frequently be a place of insect harbourage.

Application rates

Treatment	Application Rate	Period of protection
Fabric of the building		
Porous (absorbent) (EC only) to treat 100m ²	40-60ml diluted in 10L of water	Up to 2 months
Non-porous (non-absorbent) (EC only) to treat 100m ²	40-60ml diluted in 5L of water	Up to 2 months

Personal Protective Equipment (PPE)

When K-Obiol™ EC25 is used as a surface treatment spray gloves, rubber boots, face protection (faceshield) and suitable respiratory protective equipment (disposable filtering face piece respirator) should be worn unless a Control Of Substances Hazardous to Health (COSHH) assessment shows that engineering controls may replace the recommended PPE. Use plant protection products safely, always read labels and product information before use.

Note

- Ensure that properly trained staff or contractors (PA1, PA6 certified) apply treatments to clean, empty stores.
- Use only pesticides registered for use in empty grain stores, and approved by your end customers.



Insecticide treatments approved for use on grain and in grain stores

The production of food, from growing the crop through harvest and processing, requires considerable human and financial resources. In the case of post-harvest some of these investments are lost.

Insecticides which are applied directly to the grain as it enters the store are known as admixtures. In storage or transit sites, the choice of an effective insecticide which guarantees the lowest level of residue is crucial.

Those responsible for the preservation of cereals will choose a high performance product, which also ensures the minimal hazard for users and consumers.

The K-Obiol™ range is unique in that there are two formulations available which both provide preventative and curative protection against stored product insects. Both formulations can be used as admixture treatments, post-harvest and will offer up to 12 months protection. A significant advantage of K-Obiol™ is that when either of its formulations are applied at their recommended rate, the residue level is only 0.25mg/kg – this is 4 times lower than the Maximum Residue Limit (MRL) for grain. K-Obiol™ also has no withholding period meaning that any grain treated by K-Obiol™ can be processed straight away.

K-Obiol™ EC25 has been formulated to treat the fabric of grain silos and storage facilities prior to the introduction of grain. This fabric treatment provides up to 2 months protection.

K-Obiol™ is accepted for use by the Brewing Research International (BRI), the National Association of British and Irish Millers (NABIM) and the Trade Assurance Scheme for Combinable Crops (TASCC).

Pyrethroid formulation

Both formulations contain deltamethrin which acts by contact and ingestion, at the level of the nervous system and on the membrane of nerve cells, specifically the sodium channel, where it modifies or blocks the transmission of nerve impulses. The rapid penetration of deltamethrin associated with its mode of action on the nervous system results in rapid paralysis of the insect resulting in knockdown.

Procedure for calibrating spraying equipment

Calculate the grain flow rate:

- 1 Weigh a quantity of grain to be treated in tonnes
- 2 Activate conveyor
- 3 Add the grain and time flow
- 4 Calculate tonnes per minute of flow
- 5 Choose dose rate from the label (1L of product)
- 6 Choose water volume from the label (99L of water)
- 7 Calculate dose rate per tonne of grain (1L of product in 99L of water to treat 100 tonnes of grain)
- 8 Note tonnage of grain to be treated
- 9 Calculate water and insecticide required for tonnage to be treated
- 10 Select running time – Tonnage x Flow rate (tonnage/min)
- 11 Determine required output of nozzles (flow rate/min)
- 12 Check output of nozzles (collect the nozzles flow over a min and measure the output)
- 13 Adjust pressure/flow control or change nozzles if the nozzle output is not accurate
- 14 Carry out a 'dummy run' on a known quantity of material to check accuracy of application
- 15 Add the insecticide and water required to the tank
- 16 Activate equipment for the running time previously determined

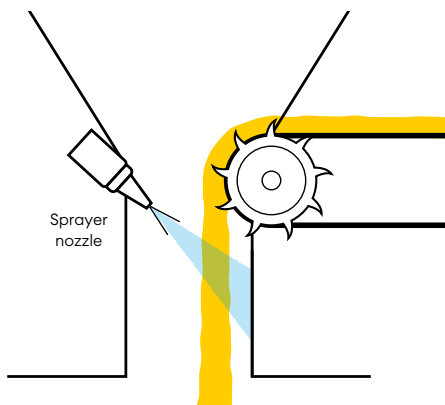


Applying K-Obiol™ EC25

Emulsifiable Concentrates (K-Obiol™ EC25) – Water required

K-Obiol™ EC25 is an emulsifiable concentrate for dilution in water in the reservoir of the sprayer before application to the grain by means of semi-automatic or manual pumps.

K-Obiol™ EC25 can be used for both fabric of the building treatment and as an admixture for application directly onto the grain. This formulation contains 25g/litre of deltamethrin synergised with 225g/litre of piperonyl butoxide.



The above diagram is for guidance only

Application rates

Treatment	K-Obiol™ EC25	Period of protection
Admixture per 100 tonnes of grain	1L diluted in 99L water e.g. 10ml/tonne	Up to 12 months from 1 application
Fabric of the building Porous (absorbent) (EC only) to treat 100m ²	40-60ml diluted in 10L of water	Up to 2 months
Non-porous (non-absorbent) (EC only) to treat 100m ²	40-60ml diluted in 5L of water	Up to 2 months

How to apply it

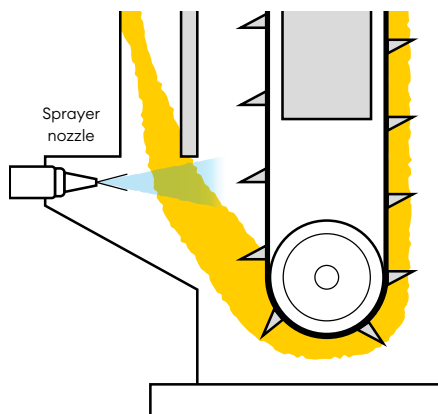
- Single nozzles are employed for the application of K-Obiol™ EC25. The K-Obiol™ is propelled to the nozzle by means of a pump. The reservoir – pump unit may be located for easy access some way from the nozzle, or, in certain cases directly on the combine harvester for immediate treatment when the grain hopper is emptied. The nozzle can generate droplets between 150 - 300 micron in diameter, depending on the choice of nozzle.
- A fine medium spray would be recommended for the application of K-Obiol™.
- When choosing a nozzle it is worth considering choosing a low drift nozzle to avoid any unnecessary drift.
- The placement of the nozzle is vital in order to ensure efficient application and optimal effectiveness of the treatment which should be determined during the calibration process (see diagram on P14).
- The nozzle should be positioned at the foot of the elevator, on a conveyor belt or where the grain falls.
- The control cabinet, the pumps and automated devices are arranged at another location easily accessible for filling with K-Obiol™, or directly on the equipment for a mobile treatment station. An anti-drip facility and stop valve make it easier to handle the insecticide.
- The treatment must always be performed in compliance with local legislative requirements for the application of insecticides.

Applying K-Obiol™ ULV6

Ready to use Ultra Low Volume (K-Obiol™ ULV6) – No water required

K-Obiol™ ULV 6 is a ready to use formulation applied directly to the grain by means of automatic or semi-automatic pumps, according to the type of installation and size of the storage facility. Operators are not required to dilute the product or be exposed to it directly.

The pack connects directly to the application equipment so there is no measuring or pouring required. The system reduces the risk of application errors, has no concentrate to expose to operators and allows consistent load rates to be maintained.



The above diagram is for guidance only

Application rates

Treatment	K-Obiol™ ULV6	Period of protection
Admixture per 100 tonnes of grain	4.2L undiluted. Ready to use e.g. 42ml/tonne	Up to 12 months from 1 application

How to apply it

- A twin fluid nozzle is employed involving two fluid inputs: one for the K-Obiol™ solution, the other for compressed air.
- The K-Obiol™ is propelled from the reservoir to the nozzle by means of a pump. The compressed air ensures the disintegration of the K-Obiol™ into very fine droplets, 20 microns in diameter.
- This enables the number of droplets to be multiplied by 10, relative to classical mechanical/hydraulic spraying. In addition, when applied to falling grain the most uniform treatment is achieved.
- The placement of the nozzle is vital in order to ensure efficient application and optimal effectiveness of the treatment (see diagram on Page 16).
- The nozzle should be positioned on the elevator – at the bottom or the top of the elevator according to the installation as the grain falls.
- Alternatively, the nozzle can be positioned on the conveyor belt – at the end of the belt, as the grain falls, avoiding contact with conveyor belt. The conveyor belt can be treated with grease-resistant material in order to prevent corrosion of the belt.
- The control cabinet, pumps and automated devices are arranged at an independent location, easily accessible for filling reservoirs or changing drums of K-Obiol™ ULV6.
- This location must comply with local legislative requirements with regard to the storage and use of insecticide products. Periodic inspection and maintenance of the equipment ensures efficient application and optimal protection of the stored grain.
- K-Obiol™ ULV6 can only be used as an admixture treatment.



Application of insecticides and COSHH regulations

An insecticide formulation needs to achieve the following:

- Be effective
- Safe to the operator
- Safe for the environment
- Cost effective
- Adequately packed and recyclable material

Formulation	K-Obiol™
Application	Mixed as per label. Applied with a knapsack sprayer for fabric of building. As admix applied via a fixed nozzle at appropriate point on auger or conveyor belt. (K-Obiol™ ULV applied via pump system on elevator)
Operator hazard	Moderate hazard. PPE equipment must be worn including gloves, rubber boots, eye protection,
Other hazards	Avoid extreme temperature and direct sunlight. Harmful if swallowed and very toxic to aquatic organisms.

Under the Control Of Substances Hazardous to Health (COSHH) regulations, before a pesticide is used an employer or self-employed person must carry out a suitable and sufficient assessment of the likely risks to health. The purpose of a COSHH assessment is to minimise the risk associated with substances that are hazardous to the health of employees. COSHH is essential to ensure that all necessary precautions have been taken before, during and after a pesticide treatment. Accurate records should show the name of the product being used including MAPP & PCS (being replaced by BPR & IE/BPA) numbers, the risk to health that may result from the product being used, the steps taken to prevent exposure. Other information should show the measures that are used to maintain and control exposure, health surveillance of operators and training and instruction given to those using the products.

Training and certification

The user of any pesticide should always seek advice on selecting and using the appropriate product from a qualified BASIS advisor.

Before using application equipment a user should ensure they are trained and hold the necessary certificates. Operators who are applying pesticides should have PA1 and PA6 certifications for a knapsack sprayer and PA1 and PA12 certifications for a continuous process application such as a conveyor or auger.

Pesticide treatment records

The information that should be recorded when a pesticide has been used is the date of application, the type of product used, reason for the application, the dose rate and water volume and the name and address of the operator. These records should then be kept for 3 years.

Packaging disposal

The used K-Obiol™ packaging should never be reused for any other purpose and should always be disposed of in line with current guidelines. Before disposing of a used container it should be empty and then it should be triple rinsed and fully drained. Containers should not be punctured or crushed due to the potential contamination. Labels should not be removed and all waste should be removed from the site by a licensed waste disposal contractor. No empty containers should be stored on the site for longer than 12 months.

Poor application

The main problem with a poor application or treatment is lack of efficacy. The insects that are present at the time of application are not controlled and the insects are likely to build up resistance to that particular product. This is costly and time consuming. Poor control will lead to re-infestation of stored products the result being a reduction in quality of the stored grain, which will affect the end market value.

Example of COSHH form

COSHH Risk Assessment			
Product Name: K Obiol EC25			
Company name:			
Describe the activity or work process. <i>(Inc. how long/ how often this is carried out and quantity substance used)</i>		Insecticide application to grain on moving conveyor belt.	
Location of process being carried out?			
Identify the persons at risk:		Employees ☐	Sub-contractors ☐
Name the substance involved in the process and its manufacturer. <i>(A copy of a current safety data sheet is attached to this assessment)</i>		K Obiol EC25 2.5% w/w deltamethrin and 22.5% w/w piperonyl butoxide. Emergency number: 0800 220876 (24h) or nearest National Poisons Information Centre	
Classification (Hazard warning symbol)			
 ☐ Toxic	 ☒ Irritant		
 ☐ Oxidising	 ☐ Flammable		
 ☐ Corrosive	 ☒ Environmental -aquatic organisms		
 ☒ Harmful-lung damage if swallowed			
Hazard Type			
☐ Gas	☐ Vapour	☒ Mist	☐ Fume
☐ Dust	☒ Liquid	☐ Solid	☐ Other (State) _____
Route of Exposure			
☒ Inhalation	☒ Skin	☒ Eyes	☒ Ingestion
☐ Other (State) _____			
Workplace Exposure Limits (WELs) please indicate n/a where not applicable			
n/a			
State the Risks to Health from Identified Hazards			
EC Classification: R10-Flammable R20/22 Harmful by inhalation and if swallowed. R23/25 Toxic by inhalation and if swallowed. R37 Irritating to respiratory system. R41-Risk of serious damage to eyes. R50/ 53-Very toxic to aquatic organisms. R65 Harmful may cause lung damage if swallowed. R66 Repeated exposure may cause skin dryness or cracking.			

Control Measures:					
General Precautions: Keep locked away from the public, keep container closed and dry. Keep away from food, drink and animal feedstuffs. Do not eat, drink or smoke when using the product.					
Handle with care at all times, prevent spillages and have spill kit available. Avoid prolonged or repeated contact with skin and avoid inhalation of mist. All operators handling product to have relevant training and relevant PPE to be worn. Consult Product Label for instructions of use.					
Is health surveillance or monitoring required? Yes ☐ No ☒					
Personal Protective Equipment (state type and standard)					
 Dust mask	☐		 Visor	☒	Chemical resistant
 Respirator	☒	Conforming EN140 type filter	 Goggles	☒	Conforming EN166
 Gloves	☒	Chemical resistant gloves or gauntlets, PVC or rubber nitrile CE marked (0.4 mm thickness)	 Overalls	☒	Type 6 suit protection
 Footwear	☒		 Other	☐	
First Aid Measures					
Ingestion: Do not induce vomiting, wash out mouth with water, keep at rest and consult physician. Skin Contact: Remove all contaminated clothing, wash with soap and water, and apply Vitamin E cream. Eye Contact: Rinse with plenty of clean water, seek medical attention. Inhalation: Move victim to fresh air and keep at rest and call a doctor. Other:					
Storage					
Storage: Dry ventilated container under lock and key. Follow regulations for the handling of insecticides.					
Disposal of Substances & Contaminated Containers					
Hazardous Waste ☐ Skip ☐ Return to Depot ☐ Return to Supplier ☐ Other ☐					
Empty containers to be rinsed 3 times before recycling. Waste Key 020108 (If Other Please State):					
Risk Rating Following Control Measures					
High ☐	Medium ☐	Low ☒			
Assessed by: _____ Date: _____ Review Date: _____					

This is an example of a COSHH assessment, each COSHH assessment should be site specific.



Frequently asked questions

Practical application

Q What certification is required for the application of K-Obiol™?

A For K-Obiol™ EC25 a PA1 and PA6 are required if applying the product using a knapsack or hand held applicator. If applying K-Obiol™ ULV6 as a continuous process on an elevator or conveyor PA1 and PA12 are required.

Q When applying K-Obiol™ what personal protective equipment (PPE) is required?

A Use suitable coveralls, nitrile gloves, rubber boots, face shield and respirator (as per the label).

Q How soon can I re-enter a store following treatment of the fabric of the building?

A Normally after 4 hours following treatment or once the surfaces are dry.

What's on the label

Q Is there a lower rate for preventative treatment rather than curative?

A No, there is just one treatment rate on the label.

Q Can I use K-Obiol™ to treat the fabric of a store that will hold Oilseed Rape (OSR)?

A Yes you can treat the fabric of the store that is subsequently used to store OSR with K-Obiol™ EC25.

Q Can I apply K-Obiol™ onto OSR that is being stored?

A K-Obiol™ doesn't have approval for application onto any oily seeds such as OSR.

Q What crops can K-Obiol™ be applied to for long term storage?

A K-Obiol™ is approved for use on all cereal grains including wheat, barley, maize, rice, oats and triticale.

Q Can I apply K-Obiol™ directly onto the surface of a grain pile or heap?

A No, by applying K-Obiol™ in this manner the maximum residue level (MRL) would be massively exceeded in the first 10-15cm of grain.

- Q** Is there a withholding period once I have treated grain or a store?
- A** There is no withholding period for either treatment.
- Q** How long does K-Obiol™ ULV6 give protection for when applied directly to grain?
- A** When applying K-Obiol™ ULV6 to grain as it enters a store, K-Obiol™ protects the grain for up to 12 months.
- Q** How many applications per year would be possible?
- A** As an admixture using either K-Obiol™ EC25 or K-Obiol™ ULV6 one treatment per batch will give up to 12 months protection. When using as a treatment for the fabric of a building and grain handling machinery one treatment per annum.
- Q** Can I apply K-Obiol™ to Malt?
- A** No, as malt has been through a process the outer husk of the grain will be broken so any K-Obiol™ applied to it will penetrate into the grain.
- Q** Can K-Obiol™ be used for thermal or cold fogging?
- A** No, K-Obiol™ can't be applied through a fogging machine, but AquaPy™ can be applied in this way. Contact pestsolutions@envu.com to find out more.
- Q** If I'm crimping or cracking grain for animal feed can I apply K-Obiol™ to it?
- A** No, as any K-Obiol™ applied to this grain would penetrate into the endosperm and exceed the MRL.



Frequently asked questions

Product performance

Q How should K-Obiol™ be stored?

A K-Obiol™ should be stored in cool, dry, well ventilated conditions. It should not be allowed to freeze or be stored in direct sunlight.

Q Is the performance of K-Obiol™ affected by temperature variations?

A No, K-Obiol™ is not affected by variations in temperature, including those caused by grain dryers and cooling systems.

Q Do variations in moisture affect the performance of K-Obiol™?

A No, K-Obiol™ isn't affected by moisture.

Q Does K-Obiol™ have a strong smell?

A K-Obiol™ is a low odour formulation.

Q Is K-Obiol™ approved by the National Association of British and Irish Millers?

A Yes.

Q Is K-Obiol™ approved by Brewing Research International?

A Yes.

Q Is K-Obiol™ a product accepted by the organic association?

A No, as K-Obiol™ is a synthetic pyrethroid.

Q What is the MRL for K-Obiol™?

A The MRL for deltamethrin is 1ppm, K-Obiol™ is four times lower than this when applied according to the label.

Q Does K-Obiol™ affect the germination of seed?

A K-Obiol™ has no effect on seed germination.

- Q** How soon ahead of harvest should I treat the fabric of the grain store?
- A** Ideally 2 months before new grain enters the store.
- Q** How important is it to clean out a store before harvest?
- A** It is critical that stores are thoroughly cleaned out of all dust and debris ahead of treatment. Ensure that areas such as ledges, roof spaces and handling machinery are also cleaned.
- Q** Do the solvents in K-Obiol™ corrode seals in application equipment?
- A** K-Obiol™ does not corrode seals but it is recommended that all application equipment is serviced at regular intervals and washed out after use.
-

Insect activity

- Q** Which insects does K-Obiol™ control?
- A** K-Obiol™ will control all of the common stored product insects such as grain weevil, lesser grain borer, red rust flour beetle, red rust grain beetle, saw toothed grain beetle and stored product moths. Remember to always check the label.
- Q** Will I be able to control mites with K-Obiol™?
- A** No, K-Obiol™ does not have mites on the label.
- Q** How quickly does K-Obiol™ control insects?
- A** At the adult stage insects are controlled between 24 and 48 hours.
- Q** Does K-Obiol™ kill the eggs of insects?
- A** No, the insects are only controlled once they emerge from grain in the adult stage of their life cycle. This is where they come into contact with the deltamethrin on the outer husk of the grain or on the fabric of the building.
- Q** I've treated my grain with K-Obiol™ but I'm still seeing insects in the grain.
- A** It depends on the life cycle of the insect in question. In the right conditions and temperature the life cycle will still continue and only at the adult stage are the insects controlled once they emerge from the egg, larval or pupae stages.



Cereal storage pests

Grain weevil (granary weevil)

Sitophilus granarius

Identification

The adults are 3-4mm in length and are dark brown to nearly black in colour with a shiny appearance. They have 8 segmented antennae; a prothorax with distinct elongated punctures and the hindwings are absent. They are unable to fly.

Symptoms

Weevil damaged grain can be readily recognised by the presence of large holes which are the exit holes of the emerging adults. They are regarded as primary pests of grain since they are able to infest otherwise undamaged grain.

Life-cycle

The grain weevil can only breed in grain with a moisture content of more than 9.5% and at temperatures within the range 13-35°C. The female lays about 200 eggs at a rate of 2-3 per day depending upon temperature and humidity, placing each one in a small hole bored in the grain and sealing it with a mucilaginous plug of saliva. At 18-20°C the eggs hatch in 8-11 days to give small, white, legless larvae which feed in the endosperm of the grain.

Only one larva develops in small grains such as wheat and rice but large grains such as maize will support the development of several. Larvae are never free living and develop entirely within the grain. They moult four times, finally pupating within the grain after 6-8 weeks. The adults emerge after a further 5-16 days and will live for about 9 months. If disturbed they will feign death by drawing their legs up to their bodies and remaining still.

At 15°C and a grain moisture content of 11% the full life-cycle take 6 months. The life-cycle of the rice and maize weevils follow a similar course to that of the grain weevil.

Importance

Traditionally grain weevils were the prime pest of stored grain in the UK on account of their ability to bore into seeds as well as being able to survive the winter in unheated buildings. Whilst they are encountered in all temperature and warm temperature climates throughout Europe their importance in the UK has declined but they are still regularly found.

The following damage may be caused:

- Reduction in the weight and quality of grain as a result of the larvae feeding on the endosperm. The germ (embryo part of the seed) is not always attacked so germination may take place, producing a weak seedling which vulnerable to attack by moulds, bacteria and other insects. The larvae and adults both feed on grain
- Tainting with white, dusty excreta which contain the product as well as rendering it unpalatable
- Heating of the grain, accelerating development of the insects and making the commodity liable to caking, moulding and even germination. Temperatures may be attained which actually kill the insects

Management of storage pests

- Use trapping methods to identify and measure insect infestations
- Clean stores thoroughly before harvest and seal all building cracks and crevices
- Store grain at <15% MC and <15°C
- Where appropriate apply insecticides to the fabric of stores or apply grain protectants

For further information on the management of storage pests see



Pictures

- 1 Grain weevil adults
- 2 Grain weevil damage
- 3 Grain weevil adult





Cereal storage pests

Lesser grain borer

Rhyzopertha dominica

Identification

The adults are 2.3-3.0mm in length and are dark red brown/black in colour. They have a cylindrical body and elytra (hardened wing cases) with well defined rows of punctures. The antennae have usually less than 11 segment with a loose 3 segmented antennal club. The prothorax more or less covers the downward-turned head which is not readily visible from above.

Symptoms

Lesser grain borers are primary pest of grain and will therefore attack undamaged grain rendering it susceptible to attack by secondary pests. Both the adults and larvae feed on the grain creating floury dust and potentially leaving little but empty husks. The adults are active and may infest a large number of kernels whilst the larvae bore into the kernels and develop within the grain. Infestations in wheat can lead to reduced flour yields and will affect the quality of dough. Both volume and loaf characteristics can be adversely affected. Commodities may be tainted by insect excreta and secretions. Heavily infested wheat is reputed to have a honey-like odour.

Life-cycle

The female lesser grain borer lays between 300-500 eggs over a period of approximately three weeks. They are laid singly or in clusters form 2-30 and are often attached to the grain. Depending upon temperature the eggs hatch in 7-18 days to give white larvae with brown heads and relatively small legs. These bore into the grains where they feed and develop into fleshy forms with a typical 'C' shape.

There are up to five moults leading to pupation in the grain. The pupal stage lasts about one week. The total life-cycle lasts from 24-133 days depending upon temperature. At 26°C and 70% RH (14% MC in commodities) the life-cycle lasts 45 days. Adults can live for 10 months.

Importance

The lesser grain borer originated in South America but is now a cosmopolitan pest especially in warm countries and thrives in temperatures above 23°C. It is associated with a wide variety of vegetable materials including wheat, barley, maize, rice, millet, sorghum, dried potatoes, dried herbs and biscuits. Infestations have also been recorded in wood and books. In Australia and India it is a serious pest of grains. Infestations are encountered in grain stores including ship holds, flour mills and animal feed mills.

Management of storage pests

- Use trapping methods to identify and measure insect infestations
- Clean stores thoroughly before harvest and seal all building cracks and crevices
- Store grain at <15% MC and <15°C
- Where appropriate apply insecticides to the fabric of stores or apply grain protectants

For further information on the management of storage pests see



Pictures

- 1 Lesser grain borer adults
- 2 Lesser grain borer damage
- 3 Lesser grain borer adult



Cereal storage pests

Mites

Acarus, *Lepidoglyphus* and *Tryphagus* spp.

Identification

The three species of mite most commonly found in UK grain stores are the grain mite *Lepidoglyphus destructor*, the flour mite *Acarus siro*, and *Tryphagus longior*, and these often occur together. Mites are just visible to the naked eye (0.5mm in length) and can be seen moving slowly on the surface of grain or associated produce. Under the microscope they are white/translucent in appearance and with 8 legs (although the first larval stage has only 6 legs).

Symptoms

Mites feed on cereal germs (embryo part of the seed) and contaminate grain with allergens adversely affecting feed palatability.

Life-cycle

Mites can be found on the surface of bulks of grain, in spaces between grains and in dust and debris in most grain stores if relative humidity is high enough. After hatching they pass through 1 larval stage and nymphal stages before adulthood. Under ideal conditions this can be completed in 10-14 days. They thrive in warm, moist conditions (optimum relative humidity 80% and optimum temperature 20°C). Whilst mites are able unable to exist at very low temperature they are unable to survive in dry environments due to desiccation (such as grain with a MC of less than 14%). At a grain MC of 16°C and above they are considerably more successful.

Importance

Mite population in grain stores can be built up very quickly. Mites damage grain by feeding on the germ, tainting the produce with allergens and spreading fungal spores.

Management of storage pests

- Clean stores thoroughly before harvest
- Monitor grain heap surfaces for mite infestations
- Reduce grain temperature to <5°C and MC <14°C
- Turn the grain through a long conveying run crushes the mites
- Physically remove by running through a grain cleaning auger
- Top dress stored grain with diatomaceous earth (DE) which can be incorporated into the surface of the grain heap. This contains absorbent silica which abrades the cuticles of insects and mites leading to desiccation and control
- Fumigate using phosphine, methyl bromide or carbon dioxide (applied by specialist contractors)

Pictures

- 1 Adult flour mites, *Acarus siro*
- 2 House dust mite, *Dermatophagoides pteronyssinus*





Cereal storage pests

Rust-red flour beetle

Tribolium castaneum

Identification

The adults are 2.3-4.4 mm in length and are reddish-brown in colour. The antennae are distinct with a 3 segmented club at the tip.

Symptoms

Flour beetles are generally recognised as secondary pests of grain and therefore increase the feeding damage done by primary pests. When present in large numbers, flour beetles will:

- Cause flour to become prone to moulding and will also turn the product grey
- Taint commodities with secretions from scent glands

Life-cycle

Up to 450 eggs are laid singly at a rate of 2-10 per day, depending on temperature. The white eggs are sticky and rapidly become coated with food particles and other debris. At 22-27°C they hatch in 6-14 days. The larvae are white tinged with yellow and pass through 5-11 moults before reaching a full-grown length of 5mm.

This process takes 3-9 weeks. Pupae lie in the same foodstuff as the larvae. They are initially white, but gradually darken in colour prior to adult emergence after 9-17 days. Adults feed on the same food as the larvae and live for 15-20 months. There may be five generations per year.

Importance

The rust-red flour beetle can infest stored cereals and oilseeds but is more of a serious problem in cereal products such as flour and animal feeding stuffs. Other products which may be attacked are oil cake, nuts, dried fruit, spices, chocolate - even bones and other animal products. The beetles are not cold hardy, so they will only overwinter under warm conditions. They are active insects which will seek cover if disturbed and, because they are so small, can exploit the smallest crevice. They are a particular problem in machinery where cereal and other food residues accumulate.

Management of storage pests

- Use trapping methods to identify and measure insect infestations
- Clean stores thoroughly before harvest and seal all building cracks and crevices
- Store grain at <15 % MC and <15 °C
- Where appropriate apply insecticides to the fabric of stores or apply grain protectants

For further information on the management of storage pests see

Pictures

- 1 Rust-red flour beetle,
Tribolium castaneum
- 2 Confused flour beetle adults,
Tribolium confusum





Cereal storage pests

Rust-red grain beetle

Cryptolestes ferrugineus

Identification

The adults are shiny rust-red/mahogany colour with an oblong flattened appearance are 1.5-2.5mm in length. The long 'beaded' antennae are straight, un-clubbed and can be almost the same length as the body. Coming from tropical environments they are more active at higher temperatures and in hot summers they are able to fly to new locations. The larvae are 4mm in length with 2 brown horn shaped projections at the rear end.

Symptoms

Any slightly damaged grains allow access for the adults and the larvae to feed on the grain germ (embryo part of the seed) and on occasion they can also feed on the endosperm.

Life-cycle

Single eggs are laid in the crevices of individual grains and the emerging larvae burrow into the grain to start feeding. After passing through 4 moulting stages they pupate in the feeding area attached to grain or other suitable surfaces. The emerging adults continue the cycle which is ideal conditions (temperatures in excess of 30°C) can be completed in as little as 20 days.

Importance

Distributed globally the rust-red grain beetle is an important pest of grain in the UK as it is able to overwinter in unheated buildings and stores and will also infest and damage stocks of nuts, oilseeds and dried fruit

It is one of the three most common primary insect pests of stores grain in the UK along with the grain weevil and saw-toothed grain beetle. Different combinations of these and other insects are often found infesting grain in the same store.

Management of storage pests

- Use trapping methods to identify and measure insect infestations
- Clean stores thoroughly before harvest and seal all building cracks and crevices
- Store grain at <15 % MC and <15 °C
- Where appropriate apply insecticides to the fabric of stores or apply grain protectants

For further information on the management of storage pests see



Pictures

- 1 Rust-red grain beetle adult about to take off
- 2 Rust-red grain beetle adult





Cereal storage pests

Saw-toothed grain beetle

Oryzaephilus surinamensis

Identification

The adults are 2.5-3.5 mm long, dark brown in colour and with 6 teeth along each side of the prothorax (hence the name 'saw-toothed').

Symptoms

The larvae feed on the germ (embryo part of the seed) of damaged and broken grains (the supply of which increased with the advent of the combine harvester), so they can be regarded as secondary pests, and grains which are entire are less vulnerable to attack.

Relatively small numbers of insects can rapidly give rise to serious infestations. They are small, active insects which readily exploit cracks and crevices where they can hide.

Life-cycle

The female saw-toothed grain beetle lays up to 400 eggs, either singly or in small batches, at a rate of 6-10 per day. These are laid in, or adjacent to, a suitable food supply and at a temperature of 20-23°C hatch in 8-17 days to give flattened larvae about 0.9mm long. They are yellowish/white in colour, with brown flecks and a brown head. Typical of coleopterous larvae, they have a well-developed head, biting mouthparts and 3 pairs of legs on the thoracic segments.

The larval stage lasts 4-7 weeks during which the larvae go through 2-5 moults, attaining a length of 3 mm. They then construct a cell of food particles and other debris in which to pupate, emerging after

1-3 weeks as adults. On emergence the adult beetles live for 6-10 months, breeding within a temperature range of 17.5-40°C.

At 20°C the full life-cycle is completed in 12-15 weeks whilst at 32-35°C it takes only 20 days. Although they originate from tropical climates, they are sufficiently cold-hardy to be able to overwinter in crevices in unheated buildings.

Importance

The saw-toothed grain beetle is now the primary insect pest of grain stores in the UK (movement on imported and exported foodstuffs has contributed to the international population spread). They also infest processed cereal products, dried fruit, dried meats, oilseeds, nuts and rice.

When infestations in stores become heavy they cause the grain to heat. This in turn leads to caking, moulding and even sprouting. Both the quality and weight of the grain may be reduced.

Malting barley may be rejected because of poor germination, whilst milling wheat is adversely affected by tainting and discoloration. In grain, the mere presence of insects may result in rejection.

Management of storage pests

- Use trapping methods to identify and measure insect infestations
- Clean stores thoroughly before harvest and seal all building cracks and crevices
- Store grain at <15 % MC and <15 °C
- Where appropriate apply insecticides to the fabric of stores or apply grain protectants

For further information on the management of storage pests see



Pictures

- 1 Saw-toothed grain beetle adults
- 2 Saw-toothed grain beetle adult
- 3 Saw-toothed grain beetle adults





Stored product moths

Brown house moth, *Hofmannophila pseudospretella*,

White-shouldered house moth, *Endrosis sarcitrella*,

and **Indian meal moth**, *Plodia interpunctella*

Identification

Moths can be found in a variety of stored products. The 3 more commonly encountered moths in grain stores in the UK are the brown house moth, the white-shouldered house moth and the Indian meal moth.

The brown house moth has a 15-25mm wingspan with upper forewing a dark buff-brown with black-brown spots. The white-shouldered house moth similarly has a 15-25mm wingspan with upper forewing buff-coloured and speckled brown. It closely resembles the brown house moth, but can be distinguished because the head and thorax are covered in white scales. Both of these species are cosmopolitan and widespread.

Brown house moth larvae are glossy white and reach a length of 16 mm. Those of the white-shouldered house moth are dull white and rarely exceed 14mm in length.

The Indian meal moth is smaller in comparison with a 10-15mm wingspan. The inner third of the forewing is pale yellowish buff and the remainder bronze coloured. Also a cosmopolitan species which originated in South America and will survive all year round in warm conditions.

Life-cycle

The brown house moth and the white-shouldered house moth both have similar life-cycles and mixed infestations frequently occur. The brown house moth lays up to 650 eggs, preferring rough open surfaces, whilst those of the white-shouldered house moth are sticky and laid in crevices. Larvae generally diapause for varying lengths of time, depending upon the conditions under which they have developed. Pupal cocoons are rough and incorporate foodstuff and debris.

Indian meal moth females produce up to 500 greyish-white eggs which they lay on the surface of the grain and these hatch in 1-18 days depending upon conditions. The larvae migrate over the foodstuff, covering it with silk as they move. Their colour depends upon the type of food: they are generally dirty-white but may be tinged pinkish-brown or green. After 4-7 moults the larvae are fully grown and 12 mm in length. In this species food and environmental conditions have a dramatic influence on the larval phase, so that development may take 13-288 days. When mature the larvae leave the foodstuff and spin thick white cocoons, in which the 7mm long pupae develop. After a pupation period of 12-43 days, the adults emerge. These moths may overwinter as larvae which diapause in a silken cocoon.

Importance

Moth larvae can cause damage to stored goods by feeding or by contamination with webbing and frass though serious damage in grain stores is rare. Adult insects are not responsible for damage as they either feed on liquid food and water or do not feed at all.

The white-shouldered house moth and the brown house moth both attack a wide variety of materials including cereals, cereal products, textiles, leather and cork. They are also found in animal feeding stuffs and poultry houses.

The brown house moth tends to scavenge whilst the white-shouldered house moth is generally found infesting food.

The Indian meal moth is a particular problem of the dried fruit industry. It will also attack cereals, oilseeds and shelled nuts. Larval webbing may occasionally reach problem proportions.

Other moths encountered include warehouse moths (*Euphestia cautella*), rice moths (*Corcyra cephalonica*) and grain moths (*Sitotroga cerealella*).

Management of storage pests

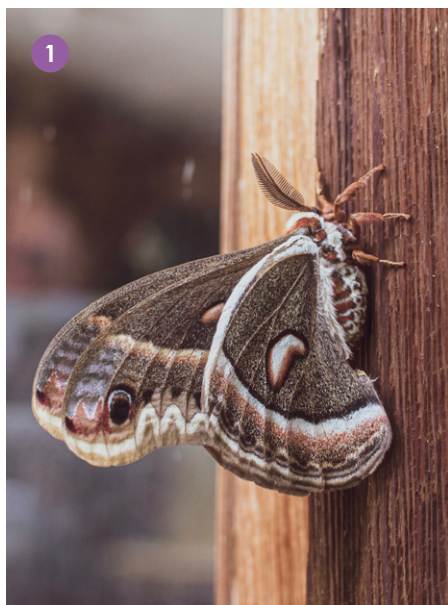
Infestations can be prevented or controlled using a combination of hygiene and application of insecticides where necessary.

For further information on the management of storage pests see



Pictures

- 1 Brown moth adult, *Hofmannophila pseudospretella*
- 2 Indian moth larvae
- 3 Indian moth, *Plodia interpunctella*





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