

Appropriate packaging for crop protection products

Packaging integrity is very important as containers must keep crop protection products in a way that is safe, secure and protects the product from degradation.

Features of good packaging

- Made of materials that are compatible with the product ingredients.
- Contains the product with robust closures to prevent leaks.
- Practical, safe to handle, transport and store.
- Easy to pour to reduce the risk of spills.
- Protects the product from damage or contamination.
- Protects from climatic elements such as temperature extremes, humidity, light, air or micro-organisms.
- Environmentally friendly and recyclable.
- Aid recycling by ensuring the container can be easily rinsed which means it should be shaped so that product is not trapped in the container during the rinsing process.
- Identifies the product with printed information about use, manufacturer, ingredients, etc.

Regulations

What regulations govern crop protection packaging?

For products to be registered in New Zealand, they must satisfy the regulations of two organisations – the Ministry for Primary Industry (MPI), and the Environmental Protection Authority (EPA).

New Zealand regulation regarding packaging is similar to other regimes such as Australia and the EU.

MPI - ACVM

MPI's Agricultural Chemical and Veterinary Medicine (ACVM) guidelines say that "*packaging must be designed to manage the associated risks*".

When registering a product the registrant must provide the ACVM with information on inherent chemical or physical characteristics that impact on packaging.

For example, the information should cover:

- porosity;
- permeability;
- impact strength;
- closure type;
- stability (photolytic and hydrolytic stability of biodegradable packaging).

EPA

The EPA has several generic performance requirements for packaging, including the containers which must:

- have the ability to contain the substance;
- be compatible with the substance over the whole lifecycle;

- contain the substance for the range of environmental conditions in which packages are used.

The EPA has extensive regulations which set out packaging tests based on a United Nations model. These include tests for the physical characteristics of the packaging (eg. drop tests from various heights, stacking tests).

Packaging is also covered by land transport legislation and multiple agencies are responsible for administering various aspects of dangerous goods transport and storage.

What Is The Correct Packaging?

The first step is to determine the right packaging material for the particular crop protection product.

In New Zealand, this is mostly plastic. There is a wide range of plastics and many are unsuitable for storing chemicals (eg, plastics used for food storage are not usually suitable for crop protection products).

It's very important to use the correct type of plastic as the product might react with the packaging during storage. This could damage the packaging and change the chemical make-up of the product.

Agcarm's crop protection member companies invest considerable resources into packaging, and also improving the performance of the packaging.

Improvements might include lighter packaging to reduce the weight of plastic to be recycled, and reducing energy required to transport product.

Types of plastic

The most commonly used plastics are high-density polyethylene (HDPE). HDPE mixed with other plastics or other polymer layers may be added to HDPE to improve toughness.

These plastics are strong and chemically inert, so they shouldn't react with the crop protection product.

- HDPE is usually used for water-based crop protection products.
- HDPE mixes (eg. HDPE and polyamide) are used for solvent-based crop protection products.

By using the correct plastic, crop protection products can be stored for extended periods of time safely.

Packaging strength

Damage to packaging can be due to external or internal causes.

External causes might include dropping the package, or environmental extremes. Temperature or altitude can also affect the pressure within the container.

Internal causes can be due to chemical reactions which take place within the container. Sometimes these reactions result in gases being formed so that pressure builds within the package.

Another possibility is that the crop protection reacts with oxygen in the container. This reduces the pressure (creating a partial vacuum) inside the container. If the walls of the container aren't thick or strong enough, the pressure difference can cause the packaging to distort.

Some plastic containers have vents to allow the pressures to equalise to prevent packaging deformations.

Other plastic containers are treated with fluorine gas (see below) to stop the product damaging the plastic.

This specialised packaging can cost more to manufacture.

Container treatments and linings

Some containers are treated or lined to control any unwanted chemical activity. These added extras include fluorine gas treatment, and fluoropolymer linings.

Fluorine gas treatment

Fluorinated containers are plastic bottles that have undergone a special fluorination treatment to make them safe for packaging certain chemicals that react with plastic.

These reactions result in panning, permeation, or material loss. As a result these products would have to be packaged in heavier and more expensive glass or metal containers.

The process of fluorination bombards the plastic with fluorine ions. This replaces the hydrogen atoms on the surface of the packaging with fluorine atoms, which are larger. It essentially plugs the holes in the plastic so the product can't escape and air can't get in.

Using plastic containers that are fluorinated is a solution for providing strong, light packaging.

Facilities to fluorinate plastic containers are not available in New Zealand so Agcarm members either ship their containers to Australia to be treated, or import the product fully made up. Fluorination adds to the cost of producing the products but makes them safer.

Fluoropolymer linings and membranes

The company W.L. Gore & Associates, which produces the well-known GORE-TEX fabric, developed fluoropolymer linings.

Fluoropolymer linings can act as membranes, meaning they allow some substances to pass through but not others. The linings and membranes are permeable to gases but not liquids.

These membranes are made of polytetrafluoroethylene (eTFE).

The membranes line the container and the cap of the container, to let gases pass in and out.

There are different types of polymer membranes which can have variable pore sizes and surface properties.

Some liquid crop protection with a very low viscosity can clog the micro-pores in the membrane.

To counter this there are different types of membranes - some are hydrophobic (repel water) and others are oleophobic (repel oils).

This means that water or oil slides off the membrane, which helps prevent the liquid from leaking through the membrane.

These specially lined containers cost more to use but are important in maintaining the crop protection product and packaging integrity

Plastic recycling

The advantage of all these types of plastic is that they can be recycled. Triple-rinsed plastic is recycled in a variety of ways around the world and used to make pipes, fence posts, electrical conduit, and cable covers.

In New Zealand, Agcarm is one of the founders of the Agrecovery rural recycling programme.

Agrecovery was established in 2005 to enable farmers to recycle plastic containers, rather than bury or burn them.

For more information, see <http://www.agrecovery.co.nz/>

Summary

- Manufacturers must choose the right container for their product.
- Containers are very important to keep crop protection products secure
- Selecting the correct type of plastic container is integral to safe storage, transport and use of crop protection products.
- Specialised packaging costs more to manufacture.
- Plastic containers should be recyclable.
- Agcarm member companies work continually to improve the performance of the containers and maintain their crop protection product integrity.