



WARRANT® HERBICIDE MICRO-ENCAPSULATION TECHNOLOGY

What You'll Learn...

- Longer residual weed control and improved crop safety are the benefits of using micro-encapsulation technology.
- Release of the herbicide from microcapsules into the soil solution is gradual, activated by soil moisture.
- Electron microscope images are used to show the herbicide microcapsules and the gradual release of acetochlor over time.

Warrant® Herbicide

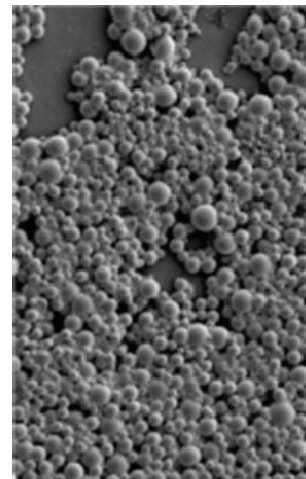
Warrant Herbicide is a water-based formulation made by the micro-encapsulation of acetochlor. The product is labeled for preemergence (PRE) and postemergence (POST) use in corn, cotton, soybeans, sorghum, and peanuts, as well as POST use in sugarbeets. The herbicide provides PRE control of grasses and small-seeded broadleaf weeds including foxtails, pigweeds, lambsquarters, nightshade, and waterhemp. The product will not provide control of emerged weeds at the time of application, but can be applied in a tank-mixture with products that provide POST control of weeds, such as Roundup® brand agricultural herbicides.

Micro-encapsulation Technology

Micro-encapsulation is the formulation of herbicide active ingredients into very small polymer based shells or microcapsules (Figure 1). Warrant Herbicide microcapsules are generally around 10 microns in size. A 10 micron sphere is about the size of a grain of pollen, and not visible to the human eye. For comparison, human hair has a diameter of about 100 microns. The microcapsule shell wall is pliable with the ability to flex, allowing it to be durable and stay intact when it encounters an abrasive surface during handling and spraying.



Figure 1. Diagram illustration of micro-encapsulation technology and electron microscope picture showing microcapsules of Warrant® Herbicide.



The objective of micro-encapsulation technology is to control the rate at which the herbicide is released or leaves the microcapsule, referred to as “controlled release.” The release of acetochlor is gradual over time, and begins after exposure to soil moisture from rain or irrigation. Soil moisture is required to activate the herbicide and move it into the weed germination zone for control of unemerged weeds. The amount of rainfall or irrigation required depends on existing soil moisture, soil type and organic matter, but 0.5 inch is normally adequate.

The controlled release of Warrant Herbicide into the soil solution provides the potential to obtain effective residual weed control for a longer period of time. In addition, the micro-encapsulation allows for the gradual release of acetochlor, which can provide improved levels of crop safety over oil based and emulsifiable concentrate formulations.

The benefits of micro-encapsulation technology in Warrant Herbicide include:

- Improved crop safety with preemergence and postemergence applications, and
- Extended length of effective residual weed control for up to 30 days.

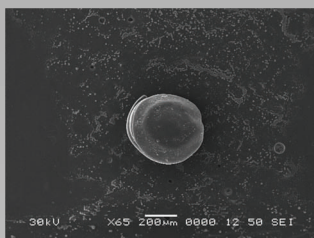


WARRANT® HERBICIDE MICRO-ENCAPSULATION TECHNOLOGY (CONTINUED)

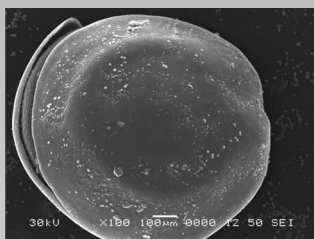
Electron Microscope Images

A Scanning Electron Microscope (SEM) is used to show the relative size of Warrant® Herbicide microcapsules when mixed with water and sprayed onto a Palmer amaranth seed (Figure 2). The seed is used to help show the size, and this has no relationship to how the herbicide works.

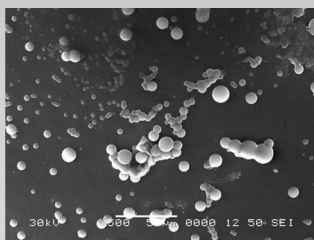
Figure 2. SEM images of the surface of a Palmer amaranth seed sprayed with Warrant Herbicide.



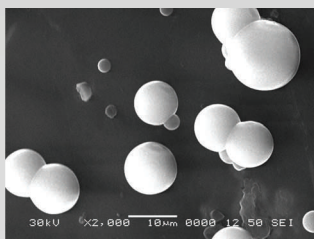
Palmer amaranth seed magnified 65X.



Palmer amaranth seed magnified 100X showing herbicide capsules now visible on the seed surface.



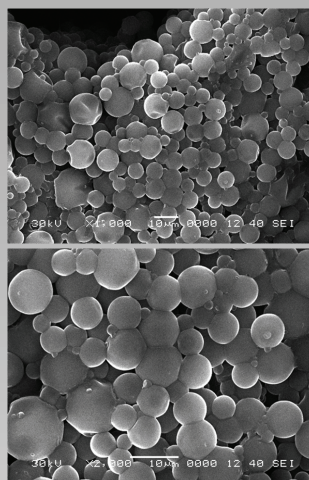
Palmer amaranth seed magnified 500X showing distribution of herbicide capsules on the seed surface.



Palmer amaranth seed magnified 2000X showing herbicide capsules around 10 microns in size.

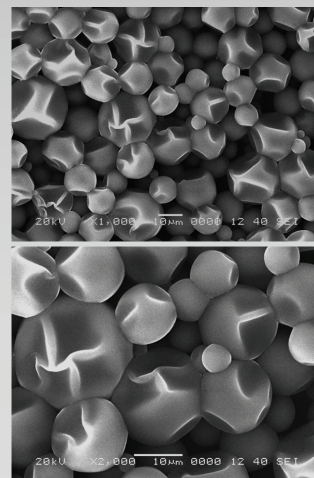
SEM images also used to show the gradual release of herbicide from the capsules after exposure to water (Figure 3).

Figure 3. SEM images showing herbicide release and response to water.



Capsules magnified 1000X (top) and 2000X (bottom) at the beginning of herbicide release after exposed to water.

Capsules magnified 1000X (top) and 2000X (bottom) showing the collapse of capsules from the gradual release of herbicide after 3 weeks of being exposed to water.



Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Warrant® Herbicide is a restricted use pesticide and not registered in all states. Warrant® Herbicide may be subject to use restrictions in some states. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local Monsanto dealer or representative for the product registration status in your state. Roundup Ready PLUS®, Roundup® and Warrant® are registered trademarks of Monsanto Technology LLC.
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