

# Putting Mode of Action and Site of Action To Work

**SITE OF ACTION  
AND MODE OF  
ACTION ARE  
RELATED BUT NOT  
THE SAME**

**MODE OF ACTION**  
how the  
treatment works

**SITE OF ACTION**  
where the  
treatment works

There can be multiple ways to deal with weeds and insects, including physical management methods, chemical applications and rotating crops. When working with crop protection products, the terms "site of action" and "mode of action" are often used. Although the terms are sometimes used interchangeably, they are not the same.

Understanding the distinction between mode of action and site of action can help farmers create a long-lasting pest management plan that helps slow the development of resistance.

## Mode of action

The mode of action for a herbicide, insecticide or fungicide refers to how the product works or what physiological or biochemical process is hindered or impaired within the pest. For example, with a herbicide, the mode of action could be something like hampering enzyme production or disrupting a specific aspect of development within a weed.<sup>1</sup> A herbicide like 2,4-D is a known growth regulator – that's its mode of action.<sup>1</sup> When applied to susceptible plants, it alters how the plant grows. Typically, what you would see in the field would be a deformation of leaves and stems followed by damage to the root system. There are thought to be a finite number of modes of action available for use in crops.

## Site of action

Site of action is similar as it references something occurring within the targeted pest, but it is focused on a specific location instead of a process. The site of action is a more precise descriptor of the biochemical location being altered.<sup>2</sup> It is part of the mode of action. For example, 2,4-D choline's site of action is absorption through the leaves that is then translocated to the meristems of the plant. Some products can have multiple sites of action within the mode of action.

## Preventing resistance development

Relying too heavily on the same modes of action or sites of action provides an opportunity for weeds and insects to develop resistance. Rotating modes and sites of action to manage pests can protect the function of herbicides, insecticides and fungicides.

If a pest develops resistance to a site of action, any product with only that site of action will no longer work. But products may have more than one site of action. For example, if a weed is resistant to ALS inhibitors, then it would appear, based on mode of action, that group 2 and group 9 herbicides, which have that mode of action, would no longer work. However, this is not necessarily the case because some herbicides – like group 9 herbicide glyphosate – have different sites of action and would still be effective. Herbicides can be classified by site of action to help farmers rotate product use.

Understanding the difference between mode of action and site of action adds precision to the discussion of products used to manage pests. Knowing how to navigate these specific attributes of a herbicide, insecticide or fungicide can help with long-term management planning making it simpler to design a system that incorporates multiple, different modes of action and sites of action.

**Check out this  
convenient herbicide  
classification chart.**



<sup>1</sup> University of Nebraska Extension, "Weeds: Mode of Action." Accessed June 16, 2023. <https://cropwatch.unl.edu/soybean-management/weed-mode-action>

<sup>2</sup> Manuchehri, Msha, "Herbicide How-To: Understanding Herbicide Mode of Action," February 2017, <https://extension.okstate.edu/fact-sheets/herbicide-how-to-understanding-herbicide-mode-of-action.html>