

## 2,4-D Resistant Waterhemp found in Nebraska

Mark Bernards, Javier Crespo, Greg Kruger and Roch Gaussoin

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A waterhemp population from southeast Nebraska has been confirmed to be resistant to 2,4-D. The resistant population is believed to be limited to a few fields.

In 2009 we received a report of a warm season grass field with a waterhemp population that was no longer being controlled by 2,4-D. Seed from this field was collected in 2009 and 2010 and greenhouse dose response trials were conducted to determine if the population was herbicide resistant.

When compared to a susceptible population, the suspect population was 10-fold more tolerant to 2,4-D. In the greenhouse, a dose of 5 fl oz/ac of 2,4-D (Lo-vol ester, 3.8 lb ae/gal) reduced growth of the susceptible population by 50%. In contrast, 54 fl oz/ac were required to reduce the growth of the suspect population by 50%. In a 2011 field study to confirm the greenhouse results, plants were treated with 2,4-D doses of 0.25 to 64 qt/ac (64 times a typical use rate). At 28 days after treatment, plants treated with 64 qt/ac were stunted compared to untreated plants and showed injury symptoms characteristic of 2,4-D, but they were recovering. In this study plants survived all 2,4-D doses applied and recovered sufficiently to produce seed.



**Figure 1. Waterhemp 28 days after treatment with 4 quarts of 2,4-D ester.**

We believe these results warrant labeling this population as “2,4-D resistant.” This is the sixth herbicide mechanism-of-action (Synthetic auxins) to which waterhemp has developed resistance in the United States, and the third reported in Nebraska.

**Know how. Know now.**

## Why Waterhemp?

Waterhemp is the predominant pigweed (*Amaranthus*) species in eastern and south central Nebraska fields, and is problematic throughout much of the Corn Belt. It is well adapted to reduced tillage cropping systems that rely primarily on herbicides for weed control. Waterhemp has succeeded because it emerges from May through August, allowing late emerging plants to avoid herbicides.

Waterhemp is a dioecious species, which means that male and female flowers occur on separate plants. Because of this and the large number of seeds produced per female plant, genes favorable for survival rapidly spread throughout a population. When a single herbicide is used repeatedly over many years, there is a high risk of herbicide resistant populations developing. Since 1993 waterhemp populations have been reported to have evolved resistance to atrazine (Photosystem II inhibitors), imazethapyr and chlorimuron (ALS-inhibitors), fomesafen and lactofen (PPO-inhibitors), glyphosate (Glycines), and mesotrione and tembotrione (HPPD-inhibitors).

## Multiple Herbicide Resistance Populations

Of particular concern are populations where individual plants are resistant to three or more herbicide mechanisms-of-action. In these instances, growers have fewer effective weed management options. When populations with multiple-herbicide resistance are then managed with the one or two remaining herbicide mechanisms-of-action that are still effective, the likelihood of the population evolving resistance to those herbicides is high. The herbicide use pattern in the field where the resistant population was collected included an annual burndown application of atrazine, metolachlor, and 2,4-D followed by a postemergence application of 2,4-D. Research is underway at UNL to determine whether this waterhemp population has developed resistance to additional herbicide mechanisms-of-action.

## Reducing the Spread of Herbicide Resistance

New technologies that confer resistance to 2,4-D and dicamba (both synthetic auxins) are being developed to provide additional herbicide options for postemergence weed control in soybean and cotton. The development of 2,4-D resistant waterhemp in this field is a reminder and a caution that these new technologies, if used as the primary tool to manage weeds already resistant to other herbicides such as glyphosate, atrazine or ALS-inhibitors, will eventually result in new herbicide resistant populations evolving. This will limit the value of those technologies to farmers.

To minimize the risk of developing herbicide resistant weeds:

- rotate effective herbicide mechanisms of action

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- tank-mix multiple effective herbicides
- use effective doses

Where possible, use an integrated weed management plan that also includes non-chemical weed control tactics such as crop rotation and tillage. Carefully monitor fields for changes in susceptibility to the herbicides being used and contact a UNL extension staff when resistance is suspected. If some plants in a field appear to have developed herbicide resistance, it may be prudent to remove any plants that survive herbicide applications before they produce seed.

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