# Scouting After a Herbicide Application and Confirming Herbicide Resistance

Lesson 4



WSSA
WEED SCIENCE SOCIETY OF AMERICA

# Objectives

By the end of this lesson, you will:

- Understand the importance of scouting for herbicide-resistant weeds.
  - Know the factors that can contribute to weeds being present after a herbicide application.
    - Know how to identify herbicide resistance in the field.
      - Understand when to suspect and test for herbicide resistance in the field.
        - Know procedures for confirming herbicide resistance.


*Above: Italian ryegrass is a weed that is known to be resistant to several herbicides.*

*Image number 5387406 at www.invasive.org.*

# The Importance of Scouting

Many factors can contribute to the presence of weeds in the field after a herbicide application and later in the growing season. Scouting is the only way to know which weeds are present, and their patterns in the field can help to understand why they are present.

**Scouting will be helpful in documenting changes in the weed population that occur over time in response to land management practices, including the evolution of herbicide-resistant weeds.**

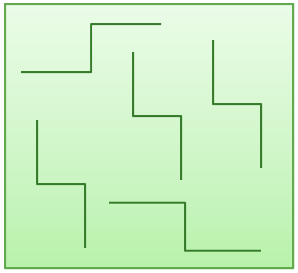
Changes in crop and weed management practices based on scouting help to:

- ✓ Maximize crop yield and profitability by reducing weed competition
- ✓ Reduce weed seed production
- ✓ Maximize remedial management tactics within the same growing season

# Scouting After a Herbicide Application

Begin scouting 7 to 14 days after each herbicide application, and continue at regular intervals until harvest.

- Move across the field in a scouting pattern covering the area.
- Observe and record:
  - Weed species (proper identification is important)
  - Spatial patterns (if present) of weeds across the field
  - Weed densities
  - Presence of live and dead weeds
  - Herbicide symptomology on live weeds



*Above: Example of a scouting pattern in a field.*

# If Weeds are Present after an Application, Determine the Reason *Consider the following factors:*

1. Field history

2. Weed biology

3. E[illegible]

5. Crop cultural practices

6. Herbicide resistance

Investigate and rule out all other factors affecting herbicide performance before suspecting herbicide resistance.

# Field History

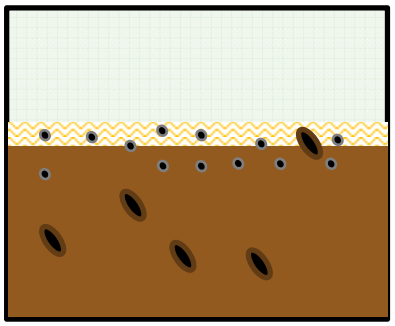
Past cultural, chemical, and mechanical weed management practices have all influenced the current weed community. These practices can also provide insight into the likelihood that weed populations may become herbicide-resistant. Some important information to consider includes:

- Number of herbicide mechanisms of action used
- Number and kinds of crops in rotation
- Use of mechanical and cultural weed management practices
- Presence of weed species, including density and distribution

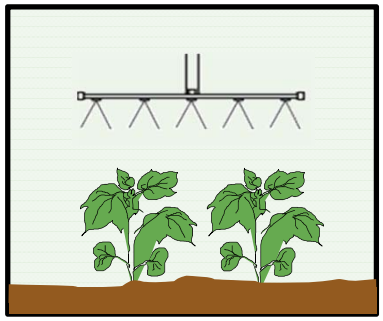
- The probability for herbicide-resistant weed populations to evolve is increased as diversity in weed management practices is reduced.
- Keeping records on weed populations, including density and distribution, will help you to note important changes that may be underway.

# Weed Biology

- Time of emergence in relation to application
- Weed seed size and depth in soil
- Size and age of plants at application



*An example of weed seeds that were below the treated layer of a soil-residual herbicide product (shown in orange)*



*An example of weeds that were too large for the application of a postemergence foliar product*

# Environment

- Soil moisture before and after application
- Plant residues on the soil surface may interact with soil-residual herbicide
- Rain-free period too short
- Soil characteristics (e.g., pH, texture, organic matter)

- Weeds under stress before and/or after herbicide application

*An example of plant residue on the soil surface*

*An example of a weed under stress*

# Application Problems

Problems during a herbicide application can reduce the performance of herbicides and therefore, increase the presence of weeds. Problems can be related to the equipment (E), choice of herbicide (H) and related products, herbicide rate (R), or herbicide incorporation and soil conditions (S).

Examples

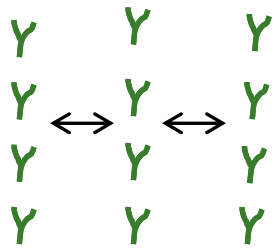
- Sprayer skips (E)
- Poor sprayer calibration and/or equipment failures (E)
- Herbicide rate too low (R)
- Dust/soil on plant leaves at application (R)
- Poor spray coverage (R)
- Selection of ineffective herbicide for weed spectrum (H)
- Improper choice of adjuvant (H)
- Soil incorporation too shallow, too deep, and/or not uniform (S)
- Soil conditions at time of application (S)

# Crop Cultural Practices

The crop selected for a given field and the practices used to grow the crop can have a significant influence on the effectiveness of weed management programs.

Example

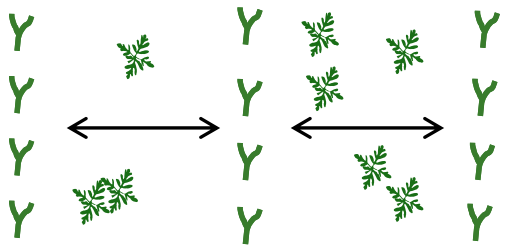
A wide row spacing results in slower canopy closure compared to narrow row spacing. Mid-season weeds can germinate between wide rows and grow after a soil-residual herbicide has lost its effectiveness.



15-inch row spacing

versus

30-inch row spacing



# Patterns: Field Observations in the Absence of Herbicide Resistance

Multiple weed species are present.

A uniform response of individuals within a population is observed.

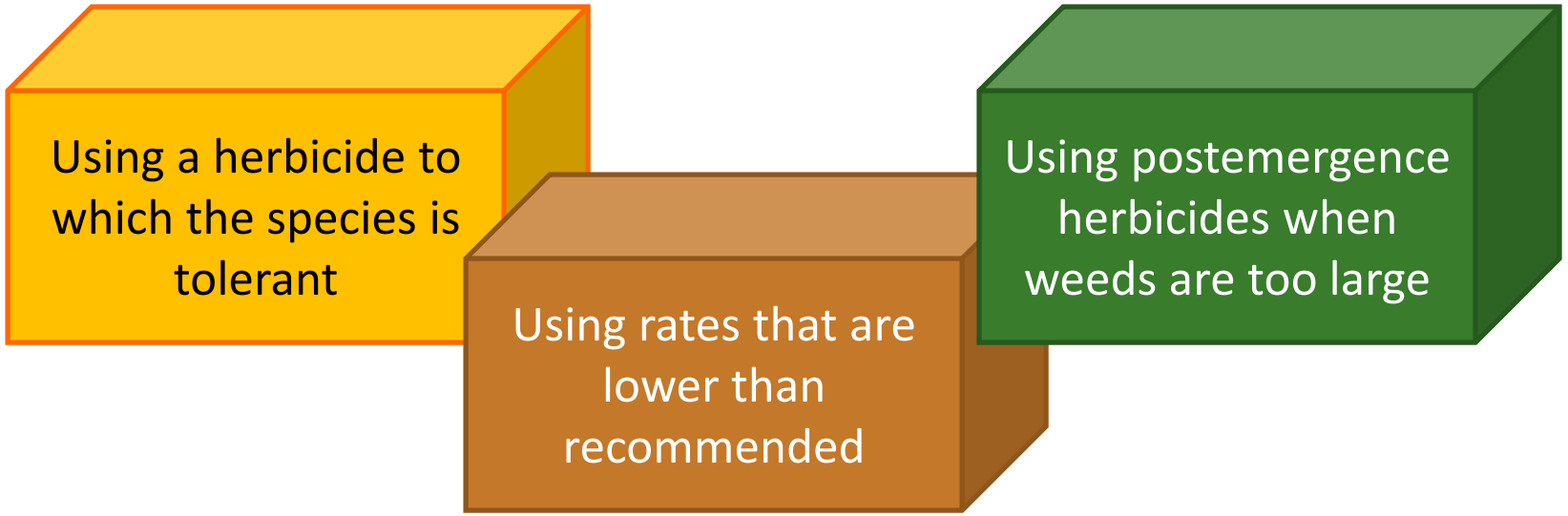
The spatial pattern of plants remaining in the field can be correlated with the herbicide application.

# Weed Shifts

With the repeated use of a herbicide, certain weed species may become dominant due to selection for those that are tolerant.

These populations are not herbicide-resistant.

Weed shifts due to herbicide use can be caused by:



# Patterns: Field Observations Related to Herbicide Resistance

A single weed species is present, especially late in the season. All other weed species on the label should be controlled.

The response of individual surviving weeds can range from little or no injury to death.

The spatial pattern of surviving weeds is random or consists of multiple plants within a patch.

# Response of Herbicide-Resistant Individuals

*The response of individual plants is usually different between high-level and low-level resistance.*

**High-level Resistance:** Plants are slightly injured to uninjured with few plants having intermediate herbicide responses. Susceptible plants can be present in the population.

*Above: In this example of high-level resistance, the common ragweed is uninjured.*

**Low-level Resistance:** A continuum of plant responses from slightly injured to nearly dead is observed with the majority of plants displaying an intermediate herbicide response. Susceptible plants will be present in the population, especially when resistance is determined early.

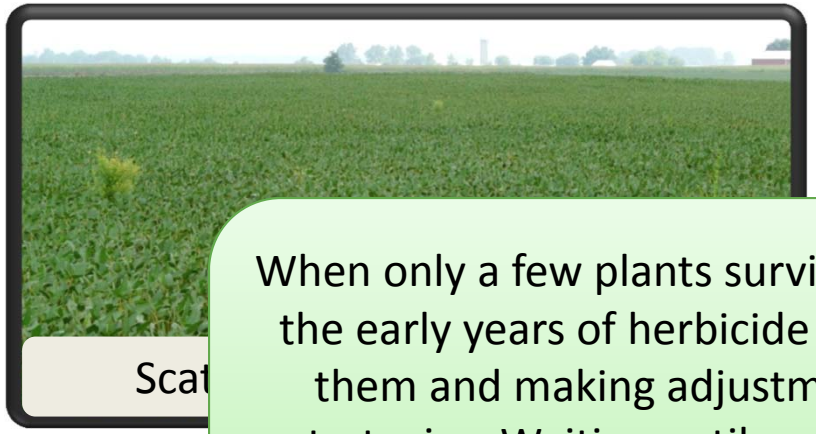
*= dead* *= intermediate*
*= slightly injured*

To learn more about scouting for low-level resistance, click the green button.

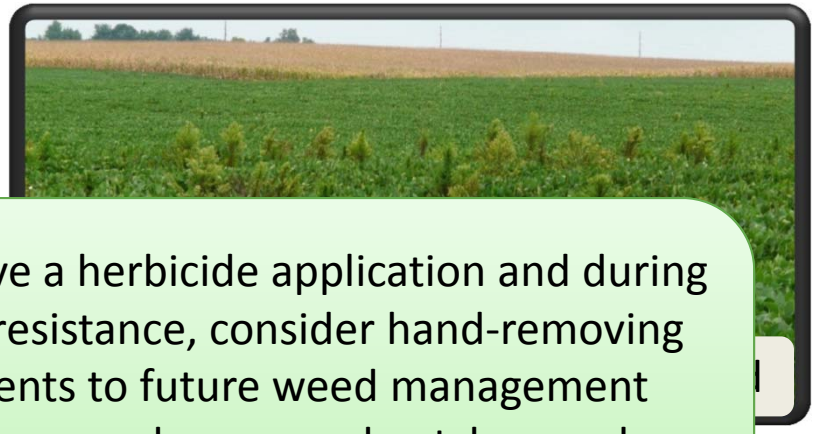
# Patterns of Herbicide-Resistant Weeds

Early years of herbicide resistance

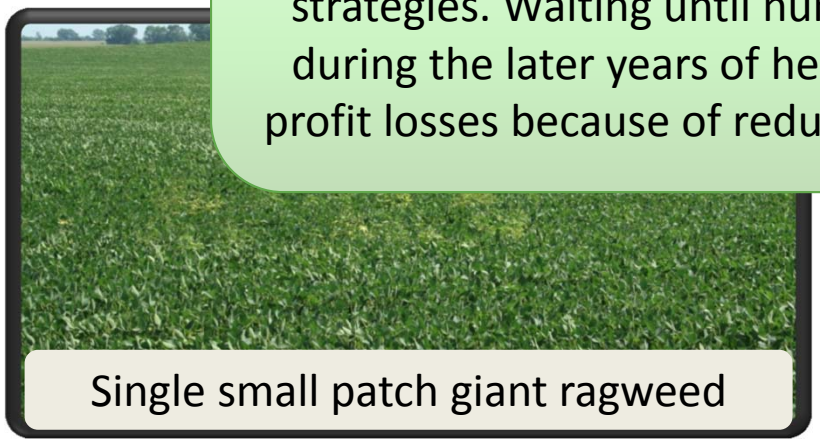
Later years of herbicide resistance



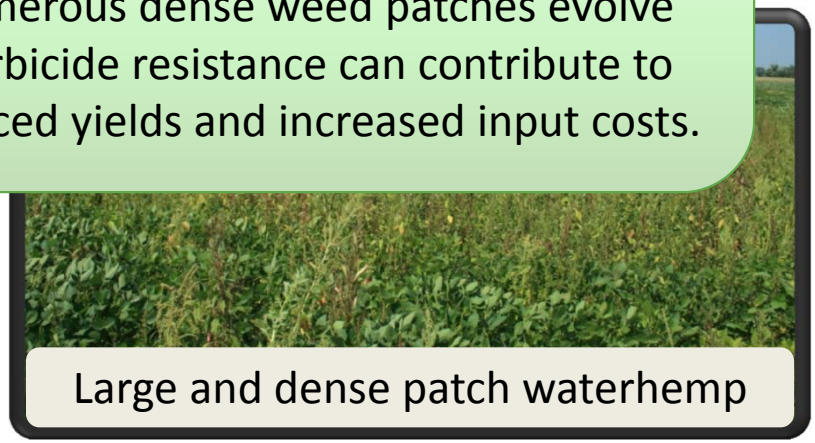
Scat



When only a few plants survive a herbicide application and during the early years of herbicide resistance, consider hand-removing them and making adjustments to future weed management strategies. Waiting until numerous dense weed patches evolve during the later years of herbicide resistance can contribute to profit losses because of reduced yields and increased input costs.



Single small patch giant ragweed



Large and dense patch waterhemp

# Check List for Scouting

- ✓ Scout 7 to 14 days after each herbicide application and near harvest.
- ✓ Identify and record the weed species present.
- ✓ Determine the distribution pattern of plants in the field.
  - Correlate with application pattern or identify as random
- ✓ Determine if plants present survived a previously applied herbicide or emerged after the last herbicide application.
- ✓ Observe individual plant responses, especially if plants survived a herbicide application.
- ✓ Look at previous field history to understand what changes may be occurring.

# Confirming Herbicide Resistance

Two methods for confirming herbicide resistance:

## Field


*Above: Corn field. Image number 5359219 at www.invasive.org.*

## Greenhouse

*Above: Screening for herbicide resistance in the greenhouse. Photo credit: Alan York, North Carolina State University.*

# Field Confirmation (Postemergence Foliar Herbicides)

**Flag In Field**

- Flag a **minimum** of 5, but preferably 20, of the healthiest weeds that survived the first herbicide application.

**Flag Outside**

- Find an area outside of the field that was not previously sprayed and contains the same species. Flag the same number of weeds.

**Spray**

- Spray the weeds in both areas with the same herbicide in two strips – one labeled "rate" and another labeled "twice the labeled rate"[1].

**Evaluate**

- Evaluate all plants 10 to 14 days after herbicide application.

[1] *Crops sprayed with greater than labeled herbicide rates must not be harvested for grain or animal use.*

# Greenhouse Confirmation

The best method for confirming herbicide resistance in a weed species with no history of resistance, in a weed species suspecting of having resistance to multiple herbicides, and when laboratory tests are not available.

**Procedure:**

- Collect seeds from mature plants suspected of being herbicide-resistant and generate plants from these seeds in the greenhouse. Plants are sprayed with the herbicide of interest and the response of suspected population is compared to the responses of known herbicide-susceptible and -resistant populations.
- Contact your local extension specialist for instructions on seed collection procedures.
- Allow only those plants necessary for collection to flower and set seed and destroy all other surviving plants.

# Greenhouse Confirmation

Known herbicide-susceptible population

Test herbicide-resistant population

Untreated ← Treated →

Untreated ← Treated →

*Above: Screening for herbicide resistance in the greenhouse. Photo credit: Alan York, North Carolina State University.*

# Conclusions

- Scouting fields to determine the reasons for weed survival after a herbicide application is important.
- Field history, weed biology, environment, application parameters, crop cultural practices and herbicide resistance are factors that can contribute to weeds surviving the application of a herbicide.
- Symptomology may differ between the observations of low-level and high-level herbicide resistance.
- Confirming herbicide resistance early, when just a few weeds are present, and removing them by hand can decrease the spread of herbicide-resistant weeds, thereby reducing the costs required to manage them.

# Credits:

This lesson was developed by a WSSA sub-committee and reviewed by the WSSA Board of Directors and other WSSA members before being released. The sub-committee was composed of the following individuals.

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# Methods for Seed Collection

*Choosing the plants:*

Choose plants from areas known to have been sprayed.

**Soil-residual herbicides:** Areas where weeds emerged first, assuming the herbicide was adequately moved into the soil solution.

**Postemergence foliar active herbicides:** Areas with multiple herbicide applications.

Choose the healthiest plants, especially those with an intact main meristem. If there is no main meristem, choose plants with the greatest number of large branches.

Choose plants in which –

- 10 to 15% of seeds have fallen from the plant or greater than 50% of fruits have matured
- Seeds are firm and dark in color

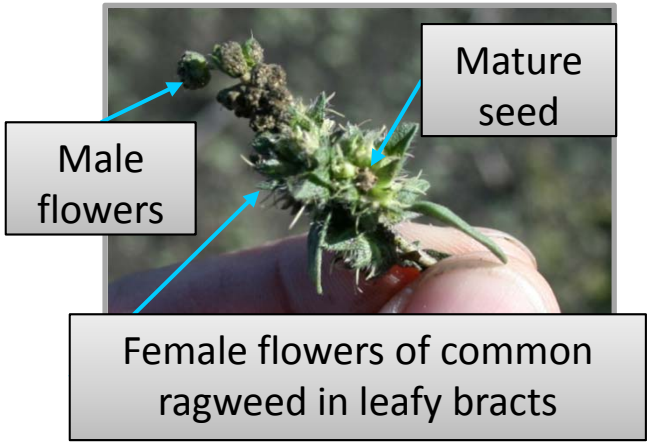
# Methods for Seed Collection

Example

CLICK HERE TO RETURN

*Collecting the plants:*

- Cut the plants below the lowest fruiting structures (90% of plant having seeds) and carefully place them in a large paper bag. Staple shut in the field to contain all seeds.
- Mark the bag to clearly identify sample location, weed species, herbicide(s) and rates applied, and collection date.




Female flowers of common ragweed in leafy bracts

- Harvest **a minimum of** 5 to 10 plants with larger quantities preferred. Place a single plant in a single bag.
- Upon return from the field, open bags to allow plants to dry before shipment. Re-staple the bags prior to shipment.
- For a dioecious species, such as Palmer amaranth or waterhemp, collect only the female plants (plants with seeds).