

Chapter 4: Weed Scouting and Mapping

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Summary

Scouting is central to understanding what weed populations are present in a field, leading to targeted and efficient management. This chapter discusses the benefits of scouting, conventional procedures for scouting and mapping weeds, and emerging technologies to improve weed scouting.

Introduction

Scouting for weeds was once a commonplace practice, but its habitual use has decreased in modern agronomic production. Simpler weed management, aided by effective herbicides and herbicide-resistant crops, may have led to this decrease. However, scouting is the only way to identify the weed species present, growth stage, and infestation severity. The overall goal of an effective weed scouting program is to detect weeds present in a field and to understand how the weed community can affect the crop. This information is important for several reasons:

- Many weed species are only effectively controlled when they are small. Timely scouting finds small, susceptible weed seedlings present in a field.
- Weed species present determines the specific herbicide(s) that should be used. For instance, glyphosate is effective for a wide range of species, while other herbicides, such as carfentrazone (Aim®), are effective for only a few species.
- Scouting allows for early identification of new species, providing opportunity to control them before they move within the field or to other fields.
- Injury from herbicide applications, weed shifts, and herbicide-resistant species can be monitored to protect crop yield, and build an effective weed management program.
- Allows to evaluate if weed control tactic was successful or if an additional treatment is needed.

Weed Scouting Tools

Several tools and equipment are used to scout weeds. These tools include a clipboard, scouting forms, field maps, field history information, a hand lens, weed identification references, camera, trowel, knife, bags for samples, tape measure, pencils, and markers. Some farms and agricultural companies are use scouting software and

phone apps. Global Positioning System (GPS) units can mark weed infestation locations, and monitor them over time to determine the effectiveness of weed management programs. In the near future, the use of drones (or Unmanned Aerial Vehicles) may become typical, both for scouting and other means of collecting field information.

Scouting Procedure

Data collected through scouting includes the weed species present, life cycles, growth stage and size, and distribution throughout the field. For a thorough scouting, choose several sample areas. Each sample area should represent no more than five acres; this allows for an accurate count of the various weeds present in the whole field. For example, in a 50-acre field, select 10 sampling areas that are distributed throughout the field. They could be randomly selected, or they could be distributed a certain distance apart in order to ensure that all sections of the field are covered.

At each sampling area, walk 100 feet and record weed species present, growth stage and height. Next, record the severity of the infestation. If a large infestation is encountered within that transect, count the number of weeds found in 10 feet of row. For small infestations, count the number over 100 feet of row.

In many cases, weed infestations cluster in a certain area of the field. In these cases, it is possible that crop scouts walking random transects could miss an important weed population. Various scouting patterns (e.g. zig-zag, "M"- or "U"-shapes, and grid) could be used during the season in order to accurately sample weed populations and to verify if they are increasing or decreasing, if there is a future risk from problem weeds left uncontrolled, and if new species are invading. Walking different patterns in the field with each visit will help increase the likelihood of spotting localized infestations. Walking a higher number of areas per field also improves precision. UAV technology is also being tested for its ability to identify weed clusters remotely (see Aerial Weed Scouting, below).

When to Scout for Weeds

Scouting early and often allows identification of small weeds and allows time to consider a wider range of tactics. Continue scouting after the crop is harvested, until the killing frost. In most cases, three or four times per season is adequate. Specific times vary among crops, but scouting in a timely fashion allows effective control options and assessment (Figure 4.1). Observe later emerging weeds whenever scouting for other reasons (for instance, insects, diseases, fertility)

Crops	Dec-Mar	April	May	June	July	August	Sept	Oct	Nov
Corn or Soybeans		Weed survey 1-2 WBP (esp. no-till)		Weed survey 3-5 WAP	Evaluate treatments		Weed survey (before frost)		
Fall-seeded small grains	Weed survey			Final weed survey (before harvest)			Weed survey 1-2 WBP (esp. no-till)		Weed survey 3-6 WAP
Fall-seeded forages	Weed survey					Weed survey 1-2 WBP (esp. no-till)		Weed survey 3-6 WAP	
Spring-seeded forages	Weed survey 1-2 WBP (esp. no-till)		Weed survey 3-6 WAP			Weed survey			
Established forages	Weed survey		Between cuttings				Weed survey		

Figure 4.1. Suggested scouting periods for corn, soybean, small grain, and forage. WBP = weeks before planting; WAP = weeks after planting (Adapted from Penn State Extension by Klodd, VanGessel, and Lingenfelter, 2017).

For many weed species, control at the seedling stage is critical - many herbicides are most effective on seedlings and lose efficacy as the plants mature. The same is true for mechanical weed control. Regular scouting throughout the season helps identify weed cohorts (or flushes) as they emerge. Appropriate action can then be taken to prevent severe infestations.

Preplant and early postemergence

Through early scouting farmers can evaluate the effectiveness of preplant herbicides or tillage used to control weeds and cover crops prior to planting, and take action before the crop is planted if needed. This is important particularly in no-till fields requiring an early preplant herbicide to control (“burndown”) winter annual weeds. Scouting no-till fields early also allows an applicator to customize the herbicide application for specific weed populations, spraying while weeds are at a susceptible stage, and before winter annual weeds flower and produce seeds. Scouting shortly after

planting also helps the farmer to evaluate the preemergence herbicide's efficacy and take action while escaped weeds are small.

Postemergence herbicides and post-plant cultivation are usually most effective when weeds are young and actively growing. Many postemergence herbicides work best on weeds less than four inches tall. To select the best possible herbicide and apply it at the optimum time to maximize control, the farmer should identify weed seedlings when they are small. For more information on weed emergence Chapter 3: *Weed Emergence, Seedbank Dynamics, and Weed Communities*.

Mid-season weed and crop survey

Effective scouting following crop emergence determines whether further management is needed and which tactics will be effective based on weed size. Scouting shortly after crop emergence also helps farmers maintain the critical weed-free period of crop growth (See Chapter 5: *Concept of Weed Thresholds*).

Following all weed control treatments

Throughout the season, scouting should be done seven to ten days after any type of weed control treatment, whether herbicide application, tillage, or cultivation. Scout to check treatment success, record any new weeds that have emerged, and record any crop injury that may have occurred. At this time, resistant weeds and weed species shifts will start to show if they are not controlled by the herbicides.

Late or final weed survey

Harvest time weed scouting is important for several reasons. If a problematic weed species is located prior to harvesting and is too dense to be removed manually, a farmer can avoid harvesting those plants, preventing harvest delays and additional spread of weed seeds. Scouting before harvest helps

Scouting Innovations in the Smartphone Age

Many smart phone and tablet applications are available to aid in crop scouting, in-field record keeping, and data sharing. Some of these applications include features that aid specifically in weed identification, weed scouting, and management.

These apps can be used while walking the field to record specific locations of weeds, write notes about the weeds, identify weeds based on photos, and to submit images and herbicide recommendations to coworkers.

Some common features of these apps include:

- Geographically plotting weeds
- Drawing polygons around infestations
- Weed ID
- Recording notes on weed size, growth patterns, and field conditions
- Storing field-specific information
- Uploading photos
- Sending notes, recommendations, and images to coworkers

Some examples of these applications are: ScoutPro, FarmLogs, eCropScout, Connected Farm, and AGRiplot.

determine if a herbicide is needed as a harvest aid. Harvest time scouting can allow for assessment of yearly weed management strategies as well as anticipate which weeds may be present the following season.

Scouting for Herbicide-Resistant Weeds

To find weeds resistant to certain herbicide sites of action, look for species with herbicide-resistant populations in the region or surrounding counties. However, keep in mind that the failure of a herbicide treatment does not mean that the plant is a herbicide-resistant weed. Other factors that must be considered include the following:

- A single weed species is spreading and increasing in density over time
- The survival of some individuals within a species after application of an effective herbicide site of action, while some plants did not survive. This could indicate that some plants of that species in the field are resistant, while others are not.

Detailed criteria for determining herbicide resistance can be found at Herbicide Resistance Action Committee website (www.hracglobal.com/herbicide-resistance/confirming-resistance). The International Survey of Herbicide Resistant Weeds website (www.weedscience.org) provides thorough up-to-date information about resistant weeds in each state.

Aerial Weed Scouting with Unmanned Aerial Vehicles

Aerial remote sensing of weeds via drones (or UAVs) and satellite imagery has gained increased interest among field scouts. The goal of aerial weed scouting is to remotely identify weeds and within a short period of time, develop a precise weed map to direct scouting efforts. Detailed aerial weed maps may help applicators to direct herbicide applications to specific areas, potentially saving time and money (Pena et al. 2015). Drone and imaging technology are still in development, and there is still much to learn about accurate weed identification and weed scouting with drones before these methods are widely marketed to the public. UAVs use multispectral cameras to capture differences in field vegetation. As the UAV flies over the field, the camera creates an image of the colors emitted from the plants in the field. Computer software then distinguishes weeds from crops based on subtle differences in pigmentation and growth patterns

Researchers are currently working to improve UAV technology and software for use in weed management (Pena et al. 2015). It can direct scouting efforts to problems in the field, and provide a relative estimate of weed severity throughout the field.

However, the technology should not replace walking the field. Physically walking fields and observing the status of the weeds and crop is still necessary.

Key Points

- Fields should be scouted for weeds before planting, after herbicide applications, and at or after harvest time.
- When scouting, identify and record all weeds found.
- When scouting, look for trends or new species and infestations; including suspected herbicide resistance.

References

Pena JM, Torres-Sanchez J, Serrano-Perez A, de Castro AI, Lopez-Granados F (2015) Quantifying efficacy and limits of unmanned aerial vehicle (UAV) technology for weed seedling detection as affected by sensor resolution. *Sensors* 15: 5609-5626