Chapter 2: Identification and Characteristics of Weeds

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Summary

Weed identification is essential for development of a successful management plan. Identification of all weeds present lends information on how to best manage individual weeds and the weed population as a whole. Similarly, knowledge of weed characteristics allow farmers to exploit weaknesses of a weed when making management decisions. It is important to have resources available to aid in weed identification efforts.

Introduction

The first step to planning a successful weed management program is weed identification. Weeds vary widely in their responses to individual management tactics. Without proper identification of all weeds present in the field, control measures are likely to fail (Ross and Lembi 1985). Correctly identified, characteristics of each weed can be used to better manage both individual weeds and the overall weed population. For example, a weed's life cycle (annual, biennial, or perennial) can drastically influence the effectiveness of a herbicide application. A weed's germination period can be used to change tillage operations in a stale seed bed approach or alter planting date to avoid weed competition.

Weed Identification Resources

In practice, weed identification can be very difficult. A weeds appearance can vary greatly among different growth stages and environments. There are a number of excellent resources available, many of which are available online free of charge. Local Extension educators, agricultural professionals, and neighbors also can be good resources. Weed identification is important to successfully implement crop scouting (see Chapter 4: *Weed Scouting and Mapping*). See Appendix 2 for a list of weed identification resources.

Weed control is most successful when weeds are in the seedling stage, but identifying plants at this stage can be challenging. Having a variety of weed identification resources is important. Some basic features used for identifying monocots (grasses and sedges) and dicot (broadleaves) are included in Appendix 1.

Characteristics of Weeds

Most plants are not weeds. A weed is simply an undesirable plant. One person's weed may be another person's flower. Therefore, designating a plant as a weed is somewhat arbitrary. Worldwide, only about 250 species (0.1% of all plants) are economically important weeds. A weed's appearance can vary greatly among different growth stages and environments.

Certain traits allow a plant to behave as a weed. Weeds possess one or more of the following characteristics:

Abundant seed production

Most weeds, especially annuals, are prolific seed producers (Table 2.1).

Rapid population establishment

Weeds can germinate and establish quickly, especially under favorable weather conditions. Left unchecked, weeds outcompete crops. Even under unfavorable environmental conditions, weeds can produce viable seed in as little as six weeks.

Table 2.1. Seed production from various weed species. Adapted from Ross and Lembi 1985.

Weed	Approximate number of seeds per plant
Barnyardgrass	7,000
Giant foxtail	10,000
Common ragweed	15,000
Velvetleaf	17,000
Curly dock	40,000
Common lambsquarters	72,000
Redroot pigweed	117,000
Horseweed	200,000*
Palmer amaranth	600,000

*Bhowmik and Bekech, 1993

Adapted to a range of conditions

Weeds are capable of adapting to their environment and may develop differently in different environments. For instance, when grown in low light environment, plants often grow taller but thinner; emerging late in their life-cycle they enter reproduction phase soon after emergence. This phenomena is known as phenotypic plasticity.

Seed dormancy

Various mechanisms of seed dormancy ensure a weed does not germinate under unfavorable environmental conditions. Seed dormancy also ensures that not all of a weed population germinates at the same time, which results in weed emergence over a prolong period of time.

Long-term survival of buried seed

Most seeds live for less than three or four years due to germination, predation, decomposition, and other factors. However, there are some weed seeds that can remain viable for many years if left undisturbed (Figure 2.1 and Table 2.2).

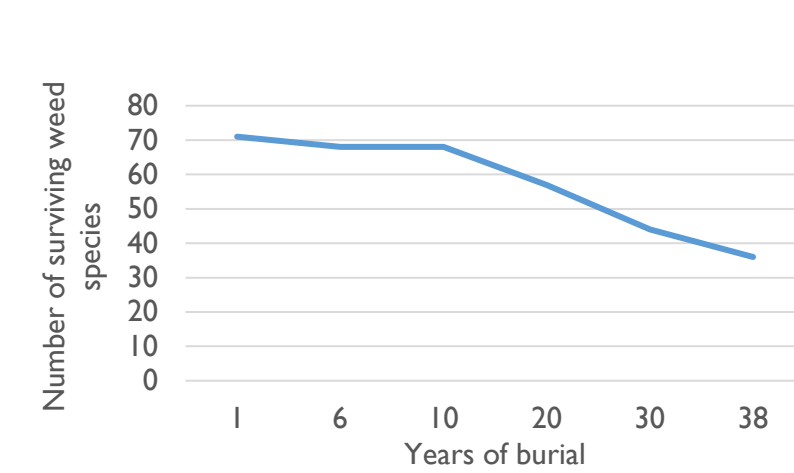

Figure 2.1. Long-term survival of buried weed seed. Data interpretation continues in Table 2.2. Adapted from Klingman et al. 1975.

Table 2.2. After 38 years of burial, the following weeds species germinated. Adapted from Klingman et al. 1975.

Weed species	% seed germinated
Jimsonweed	91
Common mullein	48
Velvetleaf	38
Evening primrose	17
Common lambsquarters	7
Green foxtail	1
Curly dock	1

Adaptation for spread

Weed seeds spread by natural forces, such as wind and water, or by clinging to animals (Photo 2.1). Weed seed also can be spread by passing through the gut of animals. For example, Palmer amaranth can remain viable after passing through deer and has been found in the guts of 11 different bird species including migratory birds (DeVlaming and Vernon 1968; Farmer et al. 2017; Proctor 1968).

Photo 2.1 Seed adaptations for spread. Left: curly dock seed floats allowing dispersal on water; Center: common milkweed seed is adapted for dispersal by the wind; and Right: common cocklebur seed adapted for spread by clinging to animal fur or clothing (Photo credit: Virginia Tech, Weed Science).

Weeds are also spread by farm equipment (Ross and Lembi 1985). Some weed species keep their seed attached to the plant through crop maturity making them more likely to be spread by harvest equipment. Mowers and tillage equipment also commonly spread weed seeds (See Chapter 6: *Prevention of Weeds*).

Vegetative reproductive structures

Unlike annual weeds, many perennial weeds possess special vegetative structures that allow them to reproduce without seed. These perennial structures contain food reserves and have numerous buds (meristem tissue) in which new plants can arise. Examples of these vegetative reproductive structures are shown in Photo 2.2.

Photo 2.2. Perennial reproductive structures. Top left: stolons are aboveground horizontal stems that root at the buds (bermudagrass); top center: rhizomes are below ground thickened stems that grow horizontally near the soil surface (quackgrass); top right: tubers are starch storage structure at or below the soil surface that produce new shoots (yellow nutsedge); bottom left: thickened root adapted to spread and produce new stems (hemp dogbane); and bottom right: bulbs are modified leaf tissue located at the base of the stem and produce new shoots (grape hyacinth) (Yellow nutsedge photo credit: R. Prostak, Univ of Mass; all other photos Virginia Tech, Weed Science).

In addition to these vegetative reproductive structures, many perennials reproduce by seed. Some depend heavily on reproduction by seed (e.g. dandelion), while for others it is less important (e.g. yellow nutsedge).

Classification of Weeds by Life Cycle

While weeds can be classified in many ways, a weed's life cycle is the most prominent factor guiding an effective weed management program, as a weed's susceptibility to a management tactic varies by life cycle and time of year. All life cycles include both monocots (grasses and sedges) and dicots (broadleaves) (Photo 2.3).

Annual

Annual weeds germinate, produce seed, and die in less than one year (Photo 2.3; Table 2.3). Annuals are competitive in disturbed sites common in annual cropping systems, such as tilled fields or those treated with a non-selective herbicide. Annuals also are competitive in perennial cropping systems during the crop's dormant period, such as the winter for alfalfa. Annual species seldom germinate at one time; they often germinate over extended time period as separate "flushes" or cohorts.

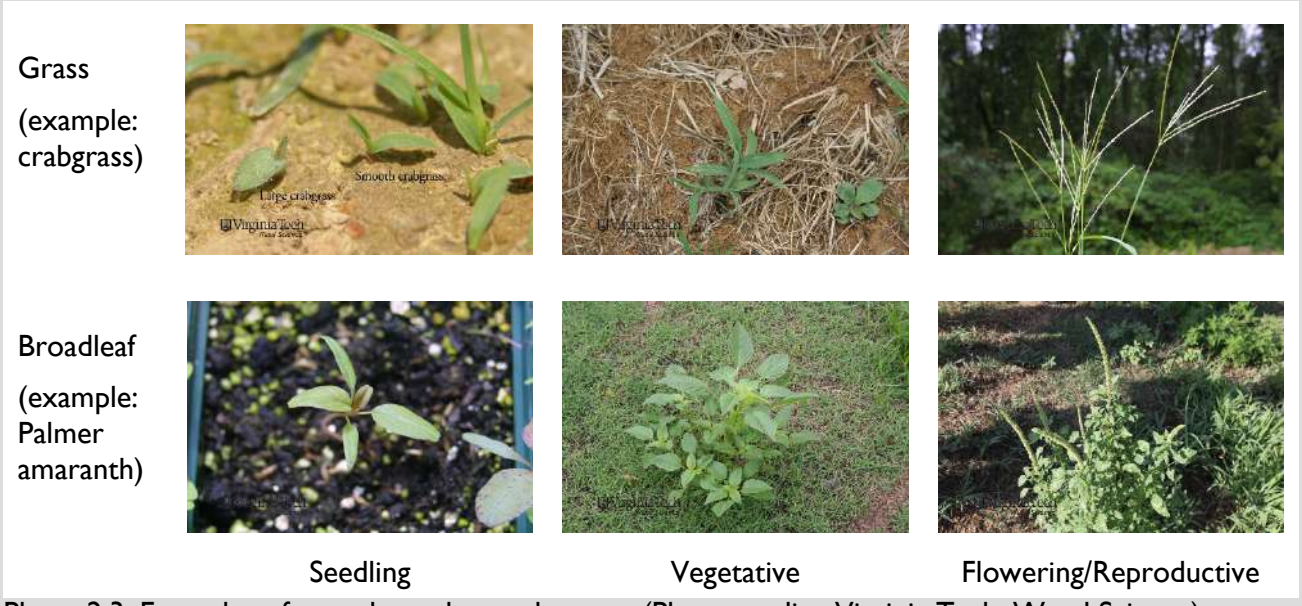

Photo 2.3. Examples of annual weed growth stages (Photo credits: Virginia Tech, Weed Science).

Winter annual weeds typically germinate from late summer or fall to early spring, but they complete their life cycle within a year. Some winter annual weeds, such as horseweed (also known as marestail), can germinate in the fall and early summer.

Summer annual weeds germinate in late spring or summer. Summer annuals that germinate in the mid to late summer will produce flowers in a very short timeframe. It is not uncommon for weeds emerging in August to produce a flower within four weeks of emergence.

Biennial

A biennial weed completes its life cycle in two years (Table 2.3). Germination and establishment occur in the first year and results in a rosette growth stage (Photo 2.4), which is the most effective time for most weed control tactics. In the second year, the weed flowers, produces seed, and dies. Biennials start each life cycle from seed and are most competitive in areas of infrequent management such as roadsides, pastures, or hayfields.

Seedling Rosette Mature

Photo 2.4. Common burdock, a biennial weed, at various growth stages (Photo credit: Virginia Tech, Weed Science).

Perennial

Perennial weeds live for longer than two years and may live indefinitely. Some species are classified as perennials, but seldom live longer than one year and are often referred to as short-lived perennials. Perennials have various structures (often underground structures) that the plant can use to regenerate each year (see Photo 2.2). The spread of some species is not as dependent upon seed, as annuals or biennials. Perennial weeds often more common in perennial crops such as alfalfa and grass forages due to a less disturbed environment. Once established in no-till or perennial systems common in the Mid-Atlantic, perennial weeds can be difficult to control; successful control requires killing both underground structures and aboveground vegetation.

Perennial weeds can be divided into two groups: simple and creeping. Simple perennials form a deep taproot and spread primarily by seed dispersal. Creeping perennials may be either herbaceous or woody and can spread by both seed and vegetative structures, such as rhizomes or stolons (Photo 2.2).

Perennial species emerging from seeds can quickly develop their perennial vegetative and reproductive structures. Some species begin to develop their structures as soon as four weeks after emergence (Bhowmik 1994; Donald 1994).

Table 2.3. Examples of common weeds classified by life cycle.

Annuals			Perennials		
				Creeping	
Winter	Summer	Biennials	Simple	Herbaceous	Woody
Grasses					
annual bluegrass	crabgrass	common burdock	chicory	Canada thistle	brambles
annual ryegrass	foxtails	poison hemlock	common pokeweed	common milkweed	multiflora rose
cheat	barnyardgrass	teasel	curly dock	horsenettle	ground ivy
downy brome	goosegrass	bull thistle	dandelion	hemp dogbane	Japanese knotweed
	fall panicum	wild carrot	plantain	johnsongrass	bamboo
				quackgrass	poison ivy
Broadleaves				yellow nutsedge	Virginia creeper
common chickweed	common cocklebur				
henbit	common lambsquarters				
horseweed or marestail	common ragweed				
mustards	pigweeds				

Most Effective Weed Control Timings and Methods Based on Life Cycle

The effectiveness of a weed control practice depends on the life cycle of the weed and the growth stage targeted. Annual weeds, as well as biennials and perennials reproducing from seed, are most effectively controlled when the weed is young and actively growing. At this time, it is generally susceptible to many control tactics, including tillage, herbicides, flaming, and others. Once an annual weed flowers, it is much harder control and it is difficult to stop viable seed production.

Biennial weeds are most susceptible when young and actively growing or in the rosette stage (Photo 2.4).

Established perennial weeds are generally most susceptible to herbicides once energy reserves in their underground structures have been depleted. Herbicide should be applied to most established perennials during the early-budding (just prior to flowering) to flowering stage. Alternatively, autumn applications take advantage of the plant's carbohydrate movement from foliage to underground storage structures. Mowing established perennials requires multiple and consistent cuttings to effectively starve the plant (see Chapter 13: *Pre- and Post-Plant Mechanical Weed Control*).

Key Points

- Weed identification is essential for development of a successful management plan.
- Weeds have many characteristics that make them successful in our cropping systems.
- The life cycle and growth stage of a weed largely determines optimum timing of control strategies.
- Weeds emerging from seed are most susceptible to control tactics while young and actively growing.
- Established perennial weeds are difficult to control and generally require multiple, sequential, and well-timed control tactics.
- Successful control of established perennial weeds requires depleting food reserves in underground vegetative structures.

References

Bhowmik PC (1994) Biology and control of common milkweed (*Asclepias syriaca*). Rev Weed Sci 6:227-250

Bhowmik PC, Bekech MM (1993) Horseweed (*Conyza candensis*) seed production, emergence, and distribution in no-tillage and conventional-tillage corn (*Zea mays*). Agron Trends Agric Sci 1:67-71

DeVlaming V, Vernon WP (1968) Dispersal of aquatic organisms: viability of seeds recovered from other droppings of captive killdeer and mallard ducks. Am J Bot 55:20-26

Donald WW (1994) The biology of Canada thistle (*Cirsium arvense*). Rev Weed Sci 6:77-101

Farmer JA, Webb EB, Pierce RA, Bradley KW (2017) Evaluating the potential for weed seed dispersal based on waterfowl consumption and seed viability. Pest Manag Sci 73:2592:2603 doi:10.1002/ps.4710

Klingman GC, Ashton FM (1975) Weed Science: Principles and Practices. New York: John Wiley & Sons, Inc. Pp 41

Proctor VW (1968) Long-distance dispersal of seeds by retention in digestive tract of birds. Science 160:321-322

Ross MA, Lembi CA (1985) Applied Weed Science. Minneapolis, MN: Burgess Publishing Company. Pp 6, 215, 222