CHAPTER 5

Weed Biology

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The biggest challenge that organic producers face today is weed management. This chapter is devoted to weed biology, which is an aspect of weeds necessary in understanding how to manage them. The next two chapters, Chapter 6—Weed Management, and Chapter 7—Weed Profiles, address specifics in weed management and identification. Additionally, weed management for specific crops is mentioned in the Soybean, Corn, Small Grains, and Forages chapters.

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Figure 5-1. ***Lambsquarters and other weeds in corn.***

Table 5-1. Risks due to weeds.

Compete with crops for moisture
Compete with crops for light
Use nutrients crops need
Attract detrimental insects
Vector disease
Multiply in soil seed banks creating future problems
Interfere with crop harvest
Reduce crop yield
Reduce crop quality

Weeds become a farming risk when they reduce crop yields or lower crop quality (Table 5-1). Their characteristics allow them to compete with crops for light, moisture, and nutrients (Table 5-2). Fields often have a weed community rather than a single species, requiring a variety of management techniques rather than a single cure-all. Farmers can reduce their risk by learning to recognize weed species, focusing on weed emergence, and reducing weeds and their buildup in the seed bank through sound management and equipment care.

Table 5-2. Characteristics of weeds and crops.
Adapted from Mohler et al. 2001.

WEEDS	CROPS
Very high overall growth rate	High overall growth rate
Low early growth rate	High early growth rate
Very high nutrient uptake rate	High nutrient uptake rate
Small seed size	Large seed size
Small seedlings	Large seedlings
High reproductive rate	Varying reproductive rates
Dormancy mechanisms	No dormancy mechanisms
Germinate in response to tillage	Do not germinate in response to tillage
Often long seed longevity in soil	Short seed longevity in soil
Tolerant to stress	Less tolerant to stress

Some organic producers have had issues with neighbors turning them in to county weed inspectors because of weeds in their fields. Sometimes, being organic can draw extra attention.

There are serious consequences to not managing field weeds, in terms of crop quality and quantity as well as cultural and aesthetic reasons. Every state has a Noxious Weed Law, which lists species that must be controlled if present (see Minnesota Noxious Weeds at right). Additionally, organic farmers may be specifically affected by society's perspective that the presence of weeds equates to farming skill—regardless of crop yield, farm profitability, or environmental concerns.

Minnesota Noxious Weeds

A noxious weed is considered to be injurious to public health, public roads, environment, crops, livestock, and other property. The state of Minnesota has a primary listing of 11 weeds that are noxious statewide (Table 5-3). According to Minnesota law, these primary noxious weeds must be controlled on all private and public land in the state. There is also a secondary listing of over 50 weeds that are noxious depending on the county (Table 5-4).

Table 5-3. Primary noxious weeds

COMMON NAME	SCIENTIFIC NAME
Field bindweed	*Convolvulus arvensis*
Hemp	*Cannibis sativa*
Poison ivy	*Toxicodendron radicans*
Purple loosestrife	*Lythrum salicaria* *L. virgatum*
Leafy spurge	*Euphorbia esula*
Garlic mustard	*Alliaria petiolata*
Perennial sowthistle	*Sonchus arvensis*
Bull thistle	*Cirsium vulgare*
Canada thistle	*Cirsium arvense*
Musk thistle	*Carduus nutans*
Plumeless thistle	*Carduus acanthoides*

Table 5-4. Some secondary noxious weeds

COMMON NAME	SCIENTIFIC NAME
Wild buckwheat	*Polygonum convolvulus*
Giant foxtail	*Setaria faberii*
Redroot pigweed	*Amaranthus retroflexus*
Common ragweed	*Ambrosia artemisiifolia*
Woolly cupgrass	*Eriochloa villosa*
Velvetleaf	*Abutilon theophrasti*
Quackgrass	*Agropyron repens*
Wild oat	*Avena fatua*
Black nightshade	*Solanum nigrum*

What is a weed?

To start thinking in weed management mode, what is a weed? A weed is considered any plant that a person does not want. It might be a particular plant species, or maybe a volunteer crop plant (Figure 5-2). Many weeds fall into broad categories such as agricultural, turf, or roadside weeds. Agricultural weeds are those that have adapted to farm life and the cycle of crop planting. Plants that become weeds have several qualities that promote their success, including high seed production, a rapid growth rate, competitive nutrient uptake, adaptability to climate, seed dormancy mechanisms, good dispersal mechanisms, and self-pollination. Learning more about weedy plant traits helps farmers become better weed managers and reduce risk of crop loss in the long run.

STRAND MEMORIAL HERBARIUM

Figure 5-2. ***Volunteer corn in soybean field.***

WEED LIFE CYCLES

Most plants have one of three main life cycles—annual, biennial, or perennial. An **annual** plant completes its life cycle in one year as it germinates, grows, flowers, sets seed, and dies (Figure 5-3). Most of the weeds in agricultural fields are annuals such as pigweeds and foxtails. Most crops are also annuals.

A **biennial** is a plant that needs two growing seasons to complete its life cycle (Figure 5-4). The first year, biennials produce vegetative growth in the form of a rosette where all the leaves come from the center crown (Figure 5-5). Biennials go dormant over the winter and in the second year, regrow, flower, set seed, and die. Some common biennials are musk thistle and mullein.

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Figure 5-3. ***Redroot pigweed is an annual.***

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Figure 5-4. ***Musk thistle is a biennial weed.***

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Figure 5-5. *The rosette of musk thistle.*

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Figure 5-6. *Canada thistle is a perennial weed.*

A **perennial** is a plant that lives for three or more years as it grows, flowers, and sets seed in a continuous cycle over several seasons (Figure 5-6). Canada thistle and quackgrass are perennials. Additionally, perennials have special underground parts (rhizomes, tubers, stolons) that allow them to spread vegetatively as well as by seed.

REPRODUCTION IN WEEDS

Plants have two main modes of reproduction, by seed or vegetatively. Most annuals and biennials reproduce by seed, and in the case of weeds, the production is often quite prolific. For example, redroot pigweed can produce over 100,000 seeds/plant (Table 5-5).

Perennials can reproduce by seed as well as by vegetatively via rhizomes and stolons. A rhizome is an underground stem that sends out roots and shoots from its nodes (Figure 5-7). A stolon is an aboveground stem that grows from an existing stem at a node, like a strawberry runner. A tuber

Table 5-5. Amount of seed produced per plant by different weed and crop species.
Adapted from Renner, 2000.

	SPECIES	SEEDS/PLANT
WEED	Canada thistle	680/stem
	Giant foxtail	900
	Cocklebur	900
	Wild mustard	1,200
	Wild buckwheat	1,200
	Common ragweed	3,500
	Yellow foxtail	6,500
	Common sunflower	7,200
	Velvetleaf	7,800
	Eastern black nightshade	10,000
	Giant ragweed	10,300
	Hemp dogbane	12,000
	Kochia	14,600
	Dandelion	15,000

	SPECIES	SEEDS/PLANT
WEED	Smartweed	19,500
	Waterhemp	23,000
	Common chickweed	25,000
	Burdock	31,600
	Shepardspurse	38,500
	Common purslane	52,300
	Lambsquarters	72,500
	Redroot pigweed	117,400
	Horseweed (marestail)	200,000
	Common mullein	223,200
CROP	Corn	800
	Soybean	50
	Winter wheat	110

Figure 5-7. *Quackgrass rhizomes.*

is a thickened part of a rhizome or stolon that is used as a place of storage for starch (e.g. Jerusalem artichoke, yellow nutsedge). Many plants that have above ground stolons also form horizontal, belowground rhizomes.

Seeds, rhizomes, stolons, and tubers are all considered *propagules* because they are able to generate entire new plants. Weeds potentially produce very many propagules per plant, but actual productivity is much lower in competition with the crop or at high weed densities. The crop-weed interaction can reduce potential weed seed production dramatically, as much as 50 percent.

Reducing risk: life cycles and reproduction. **Decrease weed risk by identifying the plant life cycle and reproduction mode of your problem weed species. For example, annuals can be contained through tillage or mowing prior to seed production. On the other hand, tillage can increase a perennial by breaking up the roots and creating new plants more quickly.**

WEED SEEDBANKS

It is hard to imagine the number and variety of weed seeds in a field (Table 5-6 and Figure 5-8). Once a weed has produced seed and dispersed them in the soil, the majority of the seeds remain for a long period of time. This reservoir of viable seeds in the soil is called a seed bank. If those weeds are allowed to grow and go to seed, an ugly cycle of weed seed replenishment can frustrate even the most attentive farmer. In any given year, only a small percentage of seeds in the seed bank germinate due to a variety of seed dormancy mechanisms. The rest of those seeds remain waiting for the next opportunity to grow.

A critical aspect of weed management is reducing weed seed production. Crop competition can reduce potential weed seed production (Table 5-7). Thus, weed seedbanks can be decreased in response to good management, while seedbank increases will occur in years with poor weed management. Producers should remember that prevention is better than finding a cure!

Reducing risk: weed seedbanks. **Practice good weed management on the whole farm to prevent increases in weed seedbanks. Prevent weeds from going to seed as much as possible. Clean tillage equipment to prevent movement of underground reproductive structures.**

Table 5-6. Number of viable weed seeds in four agricultural fields in Minnesota. *Soil was sampled to a depth of 6 inches. Adapted from Robinson, 1949.*

LOCATION	COUNTY	SEED/FT^2	SEED/ACRE (in millions)
Sacred Heart	Renville	118	5.1
Danube	Renville	184	8.0
Morris	Stevens	586	25.5
Waseca	Waseca	7661	333.7

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Figure 5-8. Weed seeds have a variety of sizes, shapes, and colors. *Seeds of 12 weed species are shown. Field bindweed, Canada thistle, giant ragweed, johnsongrass, kochia, orchardgrass, Pennsylvania smartweed, quackgrass, redroot pigweed, velvetleaf, wild proso millet, and woolly cupgrass.*

Table 5-7. Percent reduction of weed seed production *when weeds emerge after crop emergence as compared to when weeds emerge with crop. The amount of seed is dramatically reduced when weeds emerge after the crop. Adapted from Sprague, MSU Extension, 2008.*

WEED	CROP	WEED EMERGENCE (# WEEKS AFTER CROP)	% WEED SEED REDUCTION
Waterhemp	Corn	3	95
Waterhemp	Soybean	3	81
Giant ragweed	Corn	6	99
Giant ragweed	Soybean	6	78
Velvetleaf	Corn	3	60

WEED DISPERSAL

Most agricultural weeds (~75 percent) lack any obvious dispersal mechanisms and fall close to the parent plant. But weeds do move around, and dispersal mechanisms are as varied as the number of weed species. Weed seed dispersed by wind (e.g. dandelion, thistles) usually has structural modifications making them very lightweight in the air (Figure 5-9). Flooding and irrigation are good dispersal mechanisms as most seeds can float and can live in the water for some time. Birds and animals can move seed great distances (Figure 5-10). Seed contamination via weed mimicry (e.g. clover in alfalfa) is also a source of dispersing weed seeds to new sites. Agricultural activities like planting contaminated crop seed, using unclean harvest equipment and tillage equipment, and moving machinery between fields are significant weed seed dispersal procedures (Table 5-8). Spreading manure is another common way to disperse weed seed (Figure 5-11). Composting manure can eliminate some weeds. Knowing the potential sources of weed contamination and cleaning equipment are good starting points to reducing new infestations and lowering farmer risk.

STRAND MEMORIAL HERBARIUM

Figure 5-9. *Bull thistle seed.*

STRAND MEMORIAL HERBARIUM

Figure 5-10. *Eastern nightshade berries are eaten and then dispersed by birds.*

Table 5-8. Scale of distance of weed seed dispersal mechanisms. *Dispersal can be as a result of human activity (irrigation) or as a result of natural activity (wind). Adapted from Mohler et al., 2001.*

	-------------------DISTANCE	-----------------------------	
DISPERSAL MECHANISM	WITHIN FIELDS	BETWEEN FIELDS	BETWEEN REGIONS
Livestock (transported)		✔	✔
Contaminated seed		✔	✔
Irrigation water		✔	
Manure		✔	
Combines	✔	✔	
Livestock (walking)	✔	✔	
Birds	✔	✔	
Plows	✔	✔	
Wind	✔	✔	
Insects	✔		
Rain	✔		

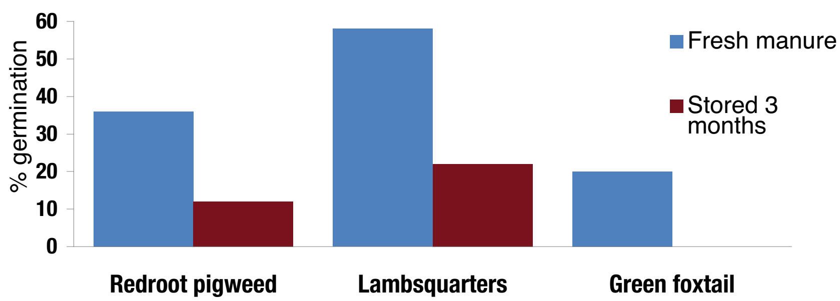

Figure 5-11. Percent germination of three weeds *in fresh manure and manure that has been stored for three months. Green foxtail had zero percent germination after three months. Weed seed can still remain viable after livestock digestion and even after storage. Adapted from Renner, MSU Extension, 2000.*

Reducing risk: weed dispersal. **Be aware of the routes of dispersion. Always start with clean, weed-free seed or certified seed. Inspect and clean machinery. When using compost instead of manure, ensure it has been properly composted to kill as many weed seeds as possible.**

DORMANCY

Weed seed dormancy is another type of dispersal—dispersal through time instead of space. When seed is dispersed, most does not immediately germinate. It remains dormant in a sort of sleeping stage until conditions are right. The factors that break dormancy are unpredictable and dependent on the species, the weather conditions, even physiological factors within the seed

Table 5-9. Weed and crop seed persistence in soil. The approximate number of years it takes to reduce weed seed populations by 50 and 99 percent.
Adapted from Michigan State University, 2005.

	SPECIES	50% REDUCTION (YEARS)	99% REDUCTION (YEARS)
Broadleaves	Lambsquarters	12	78
	Velvetleaf	8	56
	Cocklebur	6	37
	Pennsylvania smartweed	4	26
	Redroot pigweed	3	20
	Shepardspurse	3	19
	Curly dock	3	17
	Waterhemp	2	16
	Common ragweed	1.5	10
	Wild mustard	1	7
	Common sunflower	0.5	2
	Hemp dogbane	0.5	2
	Giant ragweed	0.5	2
	Kochia	0.5	2
Grasses	Yellow foxtail	5	30
	Barnyardgrass	2	10
	Large crabgrass	1.5	8
	Giant foxtail	1	5
Crops	Wheat	1	2
	Canola	2	4
	Soybean	1	2
	Corn	2	4

itself. Over time seeds that do not germinate go from dormant to non-viable (dead). Weed persistence in the seedbank will vary among species (Table 5-9). Again, this is species and climate condition dependent but can be further manipulated by farmers who have identified their weed problems and are proactive about crop rotation and weed seed burial via tillage.

SEED CHARACTERISTICS

Weed seeds have general characteristics that producers can use to manage them. Here are some general rules:

- Seed of broadleaves are more persistent in the soil compared to grasses.
- Annuals and non-rhizomatous perennials tend to be persistent in seed banks.
- Small, round seeds tend to be more persistent than large or elongated ones.
- Small seeds are more likely to go dormant immediately.
- Large seeds are less susceptible to allelopathic compounds such as from a rye crop.
- Small seeds do not emerge well from depths greater than two inches (Table 5-10).

Table 5-10. Seed size and depths at which inhibition of seed germination or emergence occurs. *There are depths at which weed seed will not be able to emerge, usually corresponding to seed size. Adapted from Benvenuti et al., 2001 and others.*

SPECIES	SEED SIZE (MM)	50% INHIBITION (IN.)	100% INHIBITION (IN.)
Common purslane	0.6	1.5	3.1
Common chickweed	1.0	1.4	3.1
Redroot pigweed	1.0	2.1	3.9
Wild mustard	1.5	1.7	3.9
Lambsquarters	1.5	1.9	3.9
Black nightshade	1.6	2.1	3.9
Prostrate knotweed	2.0	2.1	3.9
Large crabgrass	2.5	1.6	3.1
Jimsonweed	2.5	2.4	4.7
Canada thistle	3.0	2.1	3.9
Velvetleaf	3.0	2.8	4.7
Barnyardgrass	3.5	2.1	3.9
Johnsongrass	4.0	2.5	4.7
Field bindweed	5.0	2.7	4.7

Producers can use traits such as persistence and germination depths of different weeds as a guide to the effectiveness of burying weed seed with tillage. Thus, shallow cultivation will keep seeds on top and reduces germination by not providing them with conditions like adequate moisture that encourage germination. Deep cultivation will bury large seeds like cocklebur. Large seeds are less persistent and if buried deep enough, they will not survive. However, small weed seed survival is increased by burial, as they will go dormant until conditions bring them back to the surface.

Reducing risk: dormancy and seeds.

Be aware that some field operations will expose weeds to conditions that break seed dormancy. Viable buried seed that is brought to the surface via deep tillage may germinate. Reduced or shallow tillage may leave dormant seeds buried, preventing germination, but can also leave small seeds closer to the surface, providing them greater opportunity to germinate.

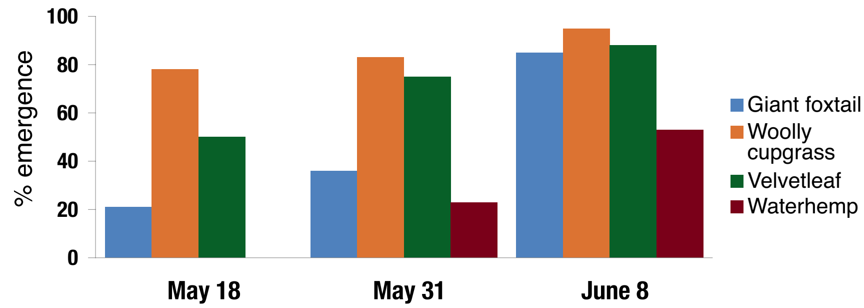

Figure 5-12. Percent emergence by date for four weeds *in Ames, IA. In this example, weeds like giant foxtail, woolly cupgrass, and velvetleaf will mostly be emerged by June 8th, while the waterhemp population is only halfway finished. Adapted from Buhler et al., 1997.*

WEED EMERGENCE

Weeds rarely emerge in a single uniform flush. Emergence for each weed species is based on a wide variety of factors depending on the weather, soil type, tillage system, prior crop, and crop rotation. But year to year emergence, and the duration of emergence, of a known species is fairly consistent (Figure 5-12 & Table 5-11). Some weeds emerge over a span of two to three weeks (giant ragweed and woolly cupgrass), four to seven weeks (lambsquarters, common ragweed, and yellow foxtail), and others over a more prolonged eight to ten weeks (velvetleaf, giant foxtail, and waterhemp). A variety of computer tools, usually based on soil type, growing degree days, and tillage are available to farmers (see Sidebar on decision tools).

Reducing risk: emergence. Be able to identify weed seedlings on your farm. Know the timing and emergence of weeds to synchronize mechanical weed control operations.

Table 5-11. Relative emergence of weeds in Minnesota. *Adapted from Iowa State University, 2000.*

	Group 0	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
WEED SPECIES	Horseweed Downy brome Field pennycress Shepards-purse Biennial thistles	Foxtail barley Kochia Prostrate knotweed Wild mustard Russian thistle White cockle	Quackgrass Orchardgrass Giant ragweed Pennsylvania smartweed Lambsquarters Wild oats Hairy nightshade Common sunflower	Smooth brome Common ragweed Woolly cupgrass Velvetleaf Wild buckwheat	Canada thistle Giant foxtail Yellow nutsedge Redroot pigweed Cocklebur	Green foxtail Common milkweed Hemp dogbane Barnyard grass Yellow foxtail Wild proso millet	Black nightshade Shattercane Venice mallow Waterhemp Jerusalem artichoke	Fall panicum Crabgrass Jimson-weed Witchgrass
APPROX. DATE IN MINNESOTA	Fall	April	Early May	Early to mid May	Mid to late May	Late May/ early June	Early to mid-June	After mid-June
CONCURRENT FIELD OPERATIONS	Fall tillage	Spring tillage Seedbed prep Small grains planting	Seedbed prep	Pre-emergent weed control Corn planting Seedbed prep	Pre-emergent weed control Corn planting Soybean planting	Post-emergent weed control Soybean planting Alternative crop planting	Post-emergent weed control Cultivation	Cultivation

WEED SEED FATE AND SEEDLING MORTALITY

Like all seeds, a weed seed's fate in a field is no mystery. It can germinate and live, be removed by wind or water, germinate and die, decay over time, become inviable (dead), stay dormant, or get eaten! Weed seed mortality is derived in three main ways: seed predation in the soil, aging of the seed over time, and germination at the wrong depth or time of year (Figure 5-14). The ultimate fate of a weed seed will vary by species (Figure 5-15).

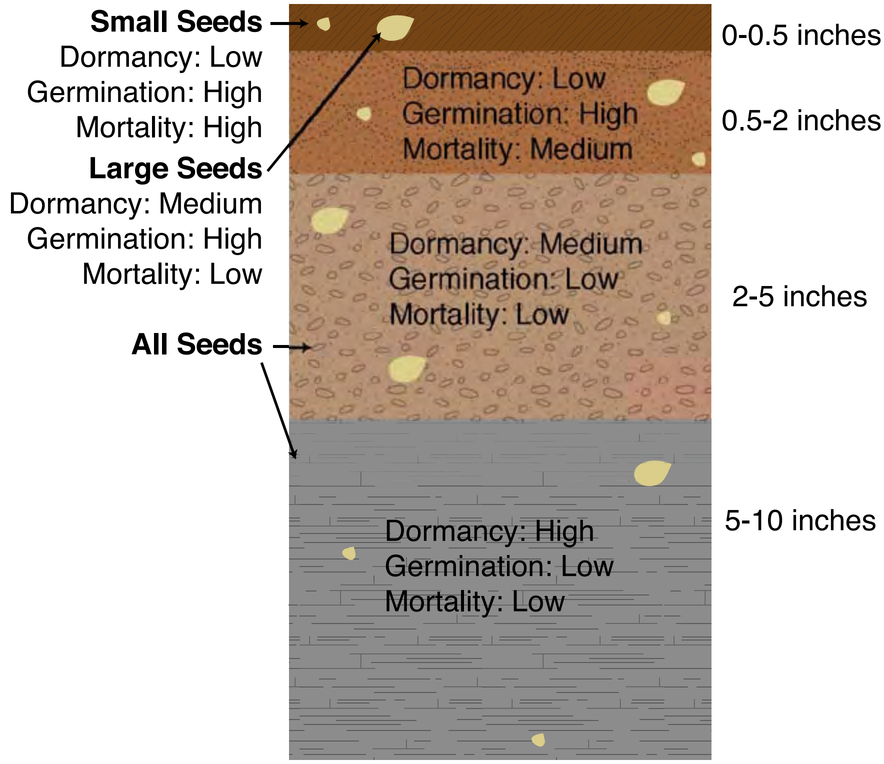

Figure 5-14. Weed seed fate *depends on placement in the soil profile. Once seeds are past 1/2-inch soil depth, fates are similar regardless of size. Adapted from Michigan State University Extension, 2005 and Mohler, 2001.*

Weed Management Decision Tools

One of the most important decisions that organic producers make is when to time weed control operations for effective results. Knowing when the weeds will be present and when they will most easily be controlled is an integral part of this decision. There are several weed software programs that can aid in the decision-making process. WeedCast is an example useful for producers in the Midwest. Weather and site data are entered by a producer and emergence information about particular weeds in their fields are displayed (Figure 5-13). This software is available for free from the following website http://www.ars.usda.gov/services/software/download.htm?softwareid=112#downloadForm

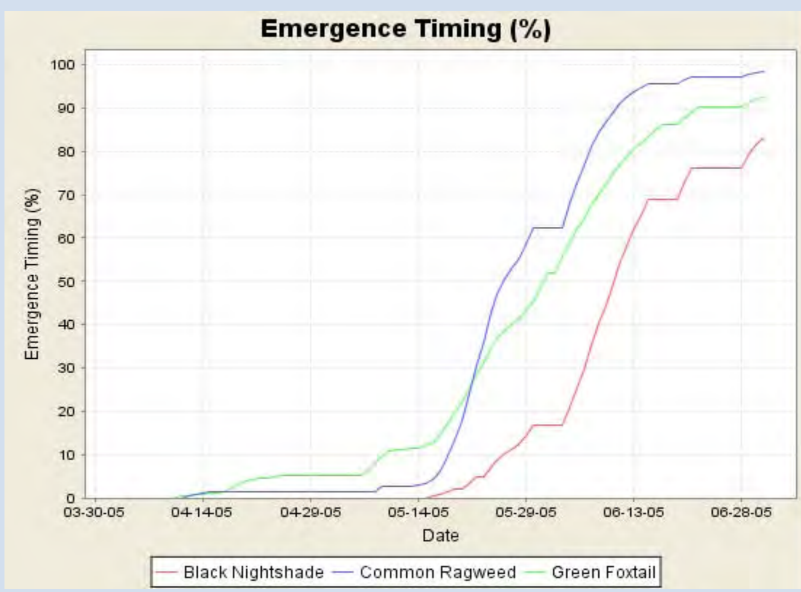

Figure 5-13. Example output from WeedCast *showing emergence timing for black nightshade, common ragweed , and green foxtail.*

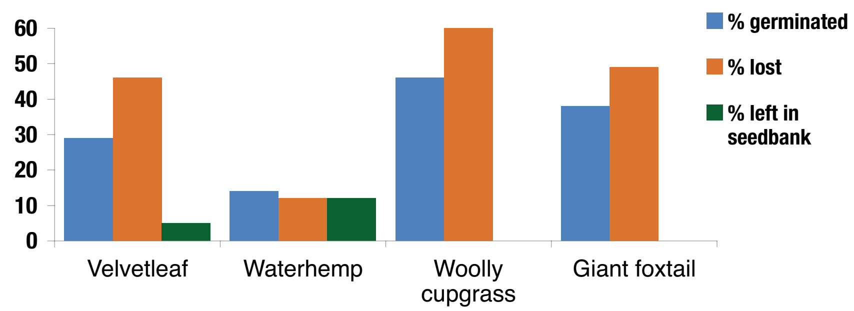

Figure 5-15. Percent of germinated seed, percent remaining in seed bank and percent remaining seed of four weeds in soil after four years. *Woolly cupgrass and giant foxtail seeds are more quickly depleted from the seedbank compared to velvetleaf and waterhemp seeds. Adapted from Buhler and Hartzler, 2001.*

But for seeds that do germinate and live, weed seedling survival after emergence is very high. Rates of natural mortality due to disease, herbivory and drought are low for established weeds in annual crops. So, if a weed makes it to seedling stage, its rate of survival to maturity is 25-75 percent, up to even 90 percent. Mortality also decreases with increasing plant size and age.

Despite starting small, weed seedlings quickly catch up with crop seedlings—they like the same growing conditions as the crop seed does. Weed seedlings have a very high relative growth rate (amount of growth/biomass) and quickly establish a fine root network for nutrient uptake. Smaller seeds have small reserves compared to crops, making them more dependent on soil nutrients.

WEED DENSITY

Weed density is a function of the weed seedbank and its emergence rate (Table 5-12). The density of a weed cohort has several consequences. Farmer risk with respect to weed density includes yield loss and problems of future weed management. It is worth noting that density, at least at initial germination, may not be indicative of later plant densities, as some plants will die due to crowding, crop competition, and various climate factors.

Weed effects on crops

The negative effects of weeds are well-known. The level of damage to a crop will be dependent on factors relating to weeds such as species present and weed density, but the crop itself will also be a factor. Both the weeds and crop are considered when determining the weed thresholds where management options should be considered.

WEED THRESHOLDS

While weeds may not be wanted, how many are too many? Total eradication, while possible, could be excessively expensive, incur unacceptable environmental damage, and deprive the farmer of some of the ecological services—actual benefits—of having unwanted plants on the farm (see Weed benefits sidebar).

Table 5-12. Weed seed bank densities and seedling emergence in row crops in Morris, MN. *Densities will be dependent on the weed species and the initial weed populations in the seed bank. Adapted from Forcella et al.,1993.*

	Mean densities per m²			
	Green foxtail	Redroot pigweed	Lambsquarter	Other weeds
Seeds in seedbank at start of season	972	672	379	59
Seedlings prior to crop planting	16	0	6	4
Seedlings after crop planting	43	10	8	4
Seedlings after interrow cultivation	13	4	7	1

Weeds aren't all bad: weed benefits

It may be difficult to imagine, but weeds can provide ecological benefits (Table 5-13). If seed production can be prevented, producers may be able to take advantage of some of these benefits.

Table 5-13.

WEED BENEFITS
Protect again soil erosion
Fix nitrogen (if weed is a legume)
Add organic matter
Provide habitat for beneficial organisms
Conserve soil moisture
Scavenge nutrients
Contribute forage
Increase biodiversity

A weed threshold is the number of weeds it takes before a producer deems them necessary to control.

In developing thresholds, the number and timing of weed control operations need to be balanced against minimizing crop injury, soil damage, and costs. Good yields rely on the relative timing of emergence of crop versus weeds, the time it takes for the crop to reach a good height over the weeds, and how rapidly the canopy of the crop closes.

Weed thresholds are one of two main categories—competitive or economic. *Competitive thresholds* are the levels at which weeds negatively affect yield. They are determined by weed density, duration of interference, and crop reduction. Crops are not equal in their ability to compete with weeds, and weeds vary in their ability to compete with the crop (Table 5-14). Often, if more than one weed species is present, the competitive effects are not additive. As weed density increases, weeds compete with the crop and each other—making it hard to predict yield loss. Crops can tolerate weeds up to a point—but a critical period arrives at which weeds must be managed to avoid crop loss (Figure 5-16). Critical periods vary between crops.

Economic thresholds examine the value of the management decision—at what point is the cost of management worth the amount of yield gain? Economic thresholds are more difficult to estimate as they must account for a given crop, weed community, cost of management, commodity price, and amount of potential yield loss.

Table 5-14. Risk levels of weed species on corn and soybean yield.

BROADLEAF WEEDS	RISK	GRASS WEEDS	RISK
Giant ragweed	High	Johnsongrass	Moderate
Common sunflower	High	Quackgrass	Moderate
Common cocklebur	High	Barnyardgrass	Low
Velvetleaf	High	Giant foxtail	Low
Lambsquarters	High	Green foxtail	Low
Common ragweed	High	Yellow foxtail	Low
Jimsonweed	High	Large crabgrass	Low
Common waterhemp	Moderate	Fall panicum	Low
Redroot pigweed	Moderate	Witchgrass	Low
Kochia	Moderate		
Pennsylvania smartweed	Moderate		
Canada thistle	Moderate		
Field bindweed	Low		
Horseweed	Low		
Eastern black nightshade	Low		

A producer from Lac Qui Parle County says that crop competitiveness is an important aspect to consider. When choosing a soybean variety, he likes ones with large leaves that will form a canopy in at least one month in his 30" rows. That way, he can cultivate for weeds at two weeks after planting and be done.

Reducing risk: weed thresholds. Be observant of weeds levels and yields for your farm to develop an idea of weed thresholds for individual situations. Good record keeping will be helpful. When weed thresholds are met, apply appropriate measures. Realize that there will be times when weeds may not need to be controlled.

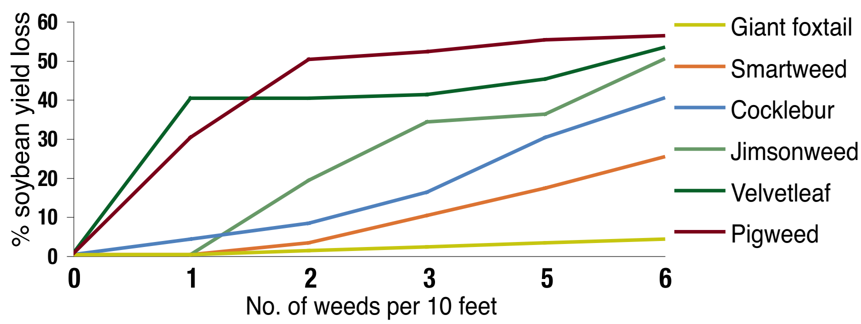

Figure 5-16. Approximate yield effects of early weed infestations in soybean. *Giant foxtail reduces yield much less at low population levels when compared to pigweed or velvetleaf. Adapted from Purdue University, 2007 and Michigan State University, 2005.*

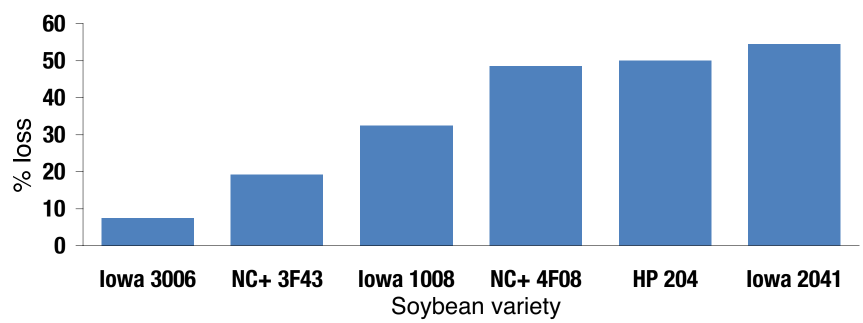

Figure 5-17. Yield loss due to weeds (as compared to weed-free controls) *among six soybean varieties. Some varieties may yield better than others when in competition with weeds. Adapted from Seidel and Hepperly, 2005.*

CROP COMPETITIVENESS

Weeds and crops are in constant competition in the field. Weed management is confounded by emergence, density, and diversity of species, but crops do have some innate tools against weeds. Crop density (planting rates, row spacing), competitive crops like rye and alfalfa, crop varieties developed for rapid canopy closure, rapid emergence, higher seedling growth rate, and weed tolerance are examples.

Changes in timing of tillage, planting date (early or delayed), increased crop rotation, increased crop variety, interseeding, etc. can break a weed cycle and lower the farmer risk of crop loss. Factors producers can manipulate include all of the following: planting date, cultivation, mulch, use of allelopathic crops, row spacing, planting density, intercropping, and selection of fast-growing cultivars (Figure 5-17).

These topics will be discussed further in the next chapter on Weed Management. Take the following quiz to determine your knowledge of weed biology.

Reducing risk: crop competitiveness. **Choose varieties and cultural practices that promote crop competitiveness.**

Weed Biology Risk Management Quiz

	Points	Score
1. Do you have good weed identification skills?		
Yes	3	
No	0	
2. Do you know which weeds are noxious in your county?		
Yes	2	
No	0	
3. Do you know the life cycles of the different weeds on your farm?		
Yes	3	
Yes, for most of them	2	
No	0	
4. Do you know at which stage your weeds are most vulnerable to control?		
Yes	3	
Yes, for most of them	2	
No	0	
5. Do you have an integrated weed management plan for your farm?		
Yes	3	
No	0	
6. Do you have flexibility in your weed management plan to adapt to new weed issues?		
Yes	3	
No, I do the same thing each year	0	
7. Are you attentive to the timing and density of weed emergence in your fields each year?		
Yes, always	3	
Yes, most of the time	1	
No, not really	0	
8. Do you anticipate probable weed pressure in planning your weed management strategy?		
Yes, always	3	
Yes, most of the time	1	
No, not really	0	

	Points	Score
9. Do you clean your equipment before moving from one field to the next?		
Yes, always	3	
Yes, most of the time	1	
No, not really	0	
10. Do you ensure that the seed you plant is clean and does not contain weed seed?		
Yes, always	3	
Yes, most of the time	1	
No, not really	0	
11. Which of these weed management strategies do you currently use?		
Give yourself 2 points for each used strategy.		
Tillage	2	
Diverse crop rotation	2	
Varying planting dates	2	
Varying varieties	2	
WeedCAST modelling	2	
Competitive varieties	2	
Increased planting density	2	
Interseeding	2	
Cover crops	2	
Adequate fertilization	2	
12. Which of the above strategies do you plan on implementing in the future? *Give yourself 1 point for each strategy you plan to use from the above list.*		
	TOTAL	

If your score is:	Your risk is:
29 or greater	Low
28 - 20	Moderate
19 - 0	High

FOR MORE INFORMATION

Applied Weed Science Research. Department of Agronomy and Plant Genetics, University of Minnesota. http://applied-weeds.cfans.umn.edu/

The Eleven Primary Noxious Weeds of Minnesota. Martinson, K., B. Durgan, and R. Becker. http://www.extension.umn.edu/distribution/livestocksystems/DI8489.pdf

The weeds page: integrated weed management. The Rodale Institute. http://newfarm.rodaleinstitute.org/depts/weeds/index.shtml

Weedsoft—software to assist in weed management decisions (primarily for conventional producers, not directly related to MN). http://weedsoft.unl.edu/Index.htm

Weedsoft Yield Loss Calculator—Producers can enter in their crop and weed data and the calculator with figure out the yield losses. http://driftwood.unl.edu/weedsoft/YieldLossCalc/YieldLossOne.php

WeedCast http://www.ars.usda.gov/services/software/download.htm?softwareid=112

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