Visual Guide to Pennsylvania's Noxious Weeds

Provided to you by: Pocono Northeast Resource Conservation and Development Council

Pocono Northeast
Resource Conservation & Development Council

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USDA-NRCS,
Lebanon Field Office
2005

PENN STATE
Vegetation Management
Department of Horticulture
College of Agricultural Sciences

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Pennsylvania's Noxious Weed Control Act 1982-74 (*selected sections*)

Section 4. Sale or Propagation.

When a weed is declared noxious it shall be a violation of this act to sell, transport, plant, or otherwise propagate that weed within the Commonwealth, except that the secretary may permit exceptions for specific horticultural or experimental use.

Section 8. Noxious Weed Control List.

The noxious weed control list shall include the following weeds:

a) *Cannabis sativa*, commonly known as Marijuana

b) *Cirsium arvense*, commonly known as Canadian thistle

c) *Rosa multiflora*, commonly known as Multiflora rose

d) *Sorghum halepense*, commonly known as Johnson grass

e) *Polygonum perfoliatum*, commonly known as Mile-a-minute

f) *Pueraria lobata*, commonly known as Kudzu-vine

g) *Cirsium vulgare*, commonly known as Bull or Spear Thistle

h) *Carduus nutans*, commonly known as Musk or Nodding Thistle

i) *Sorghum bicolor*, commonly known as Shattercane

j) *Datura stramonium*, commonly known as Jimsonweed

k) *Lythrum salicaria*, commonly known as Purple Loosestrife, including all cultivars

l) *Heracleum mantegazzianum*, commonly known as Giant Hogweed

m) *Galega officinalis*, commonly known as Goatsrue

Section 10. Penalties.

Any landowner who fails to comply with an order of the secretary shall be guilty of a summary offense.

Any landowner who interferes with the agents of the secretary, or with a municipality and the discharge of its duties hereunder, shall be guilty of a misdemeanor of the third degree.
(10 amended July 7, 1994, P.L. 439, No. 72)

Introduction to this Guide

This publication provides two pages of information for each of the 13 weeds designated as Noxious by the Pennsylvania Department of Agriculture. One page features images illustrating key features to identify the species, and the second page provides a summary of management information.

This guide is primarily intended for participants in federally funded conservation programs. Management recommendations will likely differ from those provided against these weeds in crop settings. Where herbicide trade names are used for reference, the products will be labeled for Conservation Reserve Programs, fallow, or non-crop settings.

Weed Management Basics

Management recommendations will be based on the principles of Integrated Pest Management (IPM), which include

- well defined land management objectives,
- proper pest identification,
- knowledge of pest life cycle and biology,
- establishment of pest thresholds to determine when management is viable,
- consideration of all available methods, and
- critical evaluation of program success.

The brief summaries provided in this publication will focus on the weed's life cycle and plant type, and the management approaches available.

Weed Life Cycles

Weeds are typically classified as annual, biennial, or perennial. These basic categories can be expanded to provide the following life cycles and plant types.

Annual - a plant that lives one growing season and reproduces only by seed.

Summer annual - an annual weed that completes its life cycle between the spring and fall.

Winter annual - an annual weed that overwinters, completing its life cycle between the fall and the spring.

Biennial - a plant that overwinters after its first growing season and flowers,

produces seed, and dies the following growing season. Biennials only reproduce by seed, and they must overwinter to flower. Biennials typically germinate in the spring, and therefore live longer, grow larger, and produce more seeds than annuals.

Perennial - a plant that lives more than two growing seasons.

Herbaceous perennial - a non-woody perennial. The perennial part of the plant is underground, and gives rise to annual stems that die back at the end of the growing season.

Woody perennial - a perennial with persistent stems that give rise to new growth each spring from overwintering buds. These are trees and shrubs.

Weed Control Methods

The techniques used to manage weeds are classified as cultural, mechanical, biological, and chemical.

Cultural - methods that can be described as 'indirect' weed control. Includes practices such as planting weed free seed, cleaning equipment of seed and plant propagules before it leaves weed infested areas, and planting and establishment practices to enhance the growth of crops or competitive groundcovers.

Mechanical - refers to practices such as pulling, digging, cutting, or mowing.

Biological - the introduction of a pest, such as an insect or disease from the native range of a weed that will infest the weed and reduce its vigor. Biological control is usually intended to reduce a weed population rather than eliminate it.

Chemical - the application of herbicides to control weeds. The following terms make finer distinctions between herbicidal techniques.

postemergence - application of an herbicide to an emerged plant, usually to the foliage or stems.

preemergence - application of an herbicide to the soil prior to germination of the weed to prevent its establishment.

non-selective - an herbicide that injures all plant types

selective - an herbicide that injures certain plant types or species, while leaving other plant types or species uninjured. The most common example would be applying an herbicide to a lawn that suppresses 'broadleaf' weeds such as dandelions while leaving the lawn grasses uninjured.

Herbicide Examples

Herbicides are named by their common name, or active ingredient, and by the trade name. Many active ingredients are generic, and are available as a number of nearly identical products. The following table provides product examples for the active ingredients named in the management descriptions.

Table 1. Examples of herbicide products listed by active ingredients. The listed products can be used in Conservation Reserve acres. This list is not comprehensive for herbicides labeled for conservation reserve area, nor is it comprehensive for trade names for each active ingredient.

herbicide	trade names	formulation[1]
2,4-D	Barrage HF Opti-Amine Unison	4.7 E 3.8 S 1.74 E
2,4-D + aminopyralid	Forefront R&P	3 S (2.67 + 0.33)
2,4-D + dicamba	Weedmaster	3.87 S (2.87 + 1.0)
2,4-D + triclopyr	Crossbow	3 E (2.0 + 1.0)
aminopyralid	Milestone	2 S
clethodim	Envoy Plus Clethodim	0.97 E 2 E
clopyralid	Stinger	3 S
dicamba	Banvel Clarity	4 S 4 S
glyphosate	Aquamaster Aquaneat Glyphomate 41 Rodeo Roundup PRO Roundup WeatherMAX Roundup Ultra Dry	4 S 4 S 2.8 S 4 S 3 S 4.5 S 65 SP
glyphosate + 2,4-D	Campaign	2.4 S (0.9 + 1.5)
glyphosate + imazapic	Journey	2.25 S (1.5 + 0.75)
metsulfuron	Escort XP	60 DF
pendimethalin	Pendulum AquaCap	3.8 ME
sethoxydim	Poast	1.5 E
triclopyr	Garlon 3A Pathfinder II	3 S 0.75 RTU
triclopyr + clopyralid	Redeem R&P	3 S (2.25 + 0.75)

[1]Formulation codes: The number indicates percent by weight for dry formulations and lbs/gallon of acid equivalent for liquids. DF=dry flowable (=dispersible granule), E=emulsifiable concentrate, ME=micro-encapsulated, S=water soluble liquid, SP=water soluble powder, RTU=ready-to-use. For combination products, concentrations in parentheses are in the order of active ingredients listed in first column.

Weed Management by Life Cycles

How you use the weed management tools at your disposal will depend on the life cycle of the target weed.

Annual Weeds

With annuals, your goal is to prevent seed production, and reduce the amount of viable seed in the soil (the *seedbank*).

The best way to prevent establishment of annual weeds is to have a competitive groundcover in place. In grassland plantings, a dense stand will greatly reduce opportunities for weeds to germinate. Another way to prevent establishment of annual weeds is to apply a preemergence herbicide. *Pendimethalin* is an example of a preemergence herbicide that has no foliar activity, and must be applied prior to germination and 'rained in' to the upper layer of the soil be effective. The herbicide *imazapic (*see 'Journey', Table 1) has foliar and soil activity, and it is pre-mixed with the foliar herbicide *glyphosate*. 'Journey' is an example of an herbicide that can be applied after weeds emerge, control the weeds that are present and prevent subsequent germination of annual weeds.

Preventive methods will greatly reduce weed establishment, but there will likely be some escapes. It is important to keep these escapes from producing seed. If numbers are small, pulling is effective. Mowing annual weeds before they flower will greatly reduce the vigor of the regrowth and the amount of seed set that they produce. Repeated mowing may prevent seed-set altogether, but usually weeds will continue to regrow, and if left untreated, the stunted plants do end up producing a small amount of seed. Postemergence herbicides are more likely to kill the plants. Selective herbicides are preferred when you are controlling weeds in a desirable groundcover, to prevent 'holes' in the cover that will promote more weed growth.

Biennial Weeds

Biennials can be thought of as 'big annuals'. They reproduce only by seed, but they live longer and grow larger. The management goal with biennials is to prevent seed set and reduce the seedbank.

The same preventive methods that are effective against annuals are effective against biennials. However, many biennials can germinate throughout the season. Preventing establishment in the spring may still result in biennials becoming established in the summer or early fall.

Biennials do not go dormant over the winter, and begin active growth early in the spring. This provides a considerable window of opportunity to treat biennials with postemergence herbicides into late fall, and quite early in the spring. The key is to control biennials before they flower. Mowing will prevent seed set, but biennials typically have substantial taproots with a lot of stored energy. It will take several mowings to exhaust the plant's ability to regrow and produce seed.

Perennial Weeds

It is always important to prevent seed set, but with established perennials the key to successful management is to injure the vegetative *propagules* - the part of the plant that produces the new growth each year. Common example of perennial propagules are roots – both taproots (dandelion) and creeping roots (Canada thistle); and rhizomes (below-ground) and stolons (above-ground), which are creeping stems that can produce roots or shoots.

For herbaceous perennials, and woody plants that 'sucker' (produce new stems from their root system) it is essential to kill the root or rhizome system of the plant. Non-suckering woody plants (such as multiflora rose) are easier to control because if their stems are killed the root system cannot generate replacement stems and the plant dies.

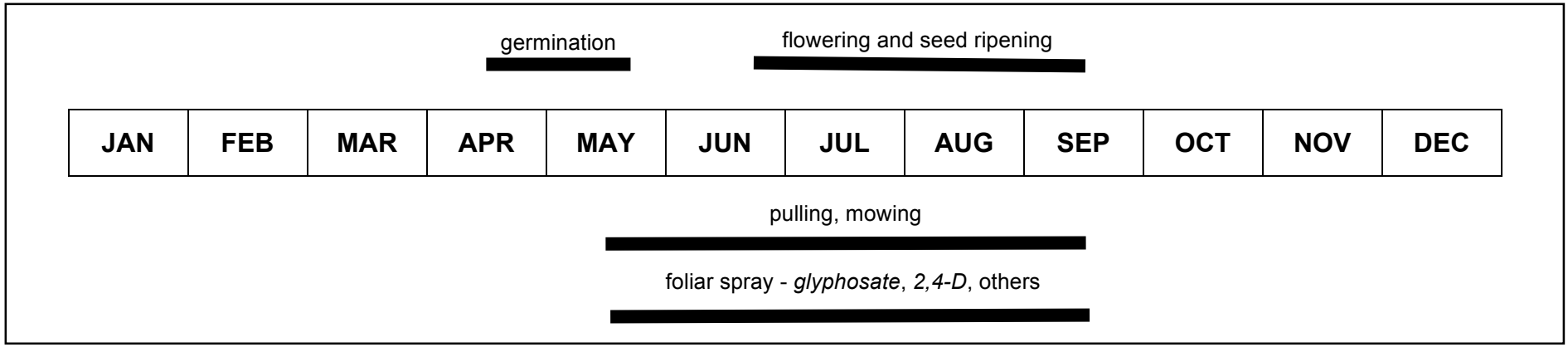
Competitive groundcovers and timely cutting will reduce the vigor and spread of perennial weeds and greatly aid in control, but a truly effective program will include systemic herbicides to kill the underground propagules.

Timing is critical when trying to control underground plant parts. To get herbicide into the root system of a perennial plant, it has to be applied at a time of year when energy (sugars) produced by photosynthesis in the leaves is being sent to the root system. This is usually later in the growing season. Early season growth of perennials relies on energy stored in roots, rhizomes, and stems (woody plants) the season before. A perennial plant cannot begin to replenish the stored energy in its roots until there are enough leaves to support the continued growth of the canopy and the roots.

Treating perennials early in the season is not effective as a stand-alone operation because the underground parts are not injured. However, an early season cutting or herbicide application is often a very useful part of a multi-step control program. For example, cutting or treating Canada thistle with herbicide at flower bud stage will prevent flowering and seed set. It will not injure the root system directly, but these operations do force the plant to expend reserve energy from the roots to produce new stems at a time when energy reserves are already at a season-low. This prevents vigorous growth of the thistle root system, and makes the plant more susceptible to injury from a late season herbicide application.

marijuana (*Cannabis sativa*)

annual forb



Characteristics and Management

Marijuana (or *marihuana*) is a summer-annual dicot native to Asia. It has been cultivated since at least 2800 B.C. It exists as two 'forms'. 'Marijuana' refers to the *Cannabis* grown as a source of the psychoactive drug *tetrahydrocannabinol* (THC), while 'hemp' refers to *Cannabis* grown for fiber, which has a very low THC content.

In the guise of marijuana, *Cannabis* is classified as a Schedule I Drug in the U.S. Controlled Substances Act of 1970. As such, its regulation is administered by U.S. Department of Justice, Drug Enforcement Agency (DEA). It is this status that has placed marijuana on the PA Noxious Weed List. As a weed, *Cannabis* has little impact on Pennsylvania agriculture or natural resources.

The less notorious, but more common form is *hemp*, a fiber crop grown throughout the world. Hemp was a prominent fiber source in the U.S. until the cotton gin was invented, and was still commercially grown until the passage of the 1937 Marihuana Tax Act in 1937. Hemp production was reinstituted during World War II to replace natural fiber sources that were blocked by the Japanese.

Cannabis may then appear on your property in two different forms. The less likely scenario is the occurrence of 'ditchweed', the wild form of the low-THC hemp grown for fiber. More likely, *Cannabis* will appear as marijuana because someone identified your property as an isolated location to cultivate it.

Cannabis will likely be present in low numbers, and therefore control is feasible, and can be limited to postemergence practices. The simplest is to pull the plants, or mow them to the ground. If you believe the plants are 'ditchweed', removing and destroying the seed will suffice. If the plants were planted as marijuana, you should contact your local law enforcement agency as the DEA tracks marijuana destruction to the individual plant.

You can treat ditchweed with foliar-applied herbicides. *Cannabis* will not be that difficult to control, but large plants will probably take a considerable dosage to effectively control compared to seedlings or small plants.

Table 2. Cannabis is an annual plant that typically occurs in low numbers and can be effectively controlled by pulling or spot-treating with herbicides.

treatment	details
hand-pulling	You can pull plants as soon as you can recognize them. Remove the roots to prevent regrowth. If ripe seed are present, remove and destroy them. If the plants have been planted for drug use, notify law enforcement officials to have them destroyed.
foliar herbicide spot-treatment	If you find it easier to treat then pull, spot treatment with a *glyphosate* or *2,4-D*-containing product should be effective and inexpensive. Product labels will provide directions for mixing small-batch spot treatment mixtures to be applied on a 'spray to wet' basis. Large *Cannabis* plants can be 10 ft tall, and would require significant spray solution. It may be easier to pull these plants or cut them at ground level.

Marijuana

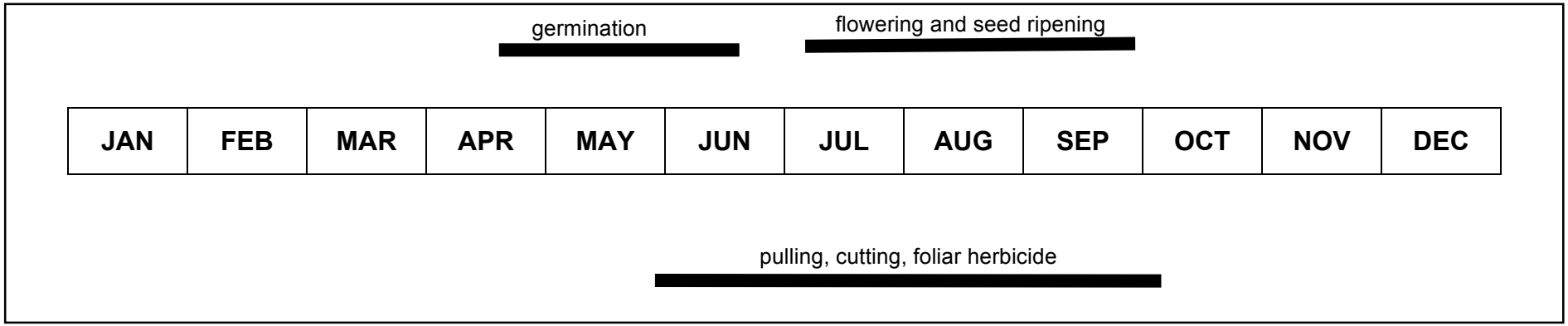
Cannabis sativa

Control:

Hand pull young plants and destroy. Targeted applications of systemic herbicides such as *glyphosate* or *2,4-D* may also be effective.

jimsonweed (*Datura stramonium)*

annual forb



Characteristics and Management

Jimsonweed is an annual forb of the nightshade family found throughout the U.S., except for the northern plains and Pacific Northwest states. The origin of jimsonweed is not clear - some authors believe it is native to North America, while others believe it to be Asian in origin. The earliest remaining herbarium specimens are from the 1700's, and the name is believed to be a corruption of 'Jamestown' weed. It got this name after reports of poisoning of many British Soldiers attempting to quell Bacon's Rebellion in 1676. It is also known as thornapple, moonflower, and locoweed.

All parts of Jimsonweed are poisonous, particularly the seeds. Jimsonweed contains the toxic tropane alkaloids atropine, scopolamine, and hyoscolamine. It has a long history of use in folk medicine, as well as recreational use (usually once) by those seeking hallucinatory experiences. It is a common reason for calls to poison control centers and visits to the emergency room.

Jimsonweed emits a rank odor, has smooth, coarsely-toothed leaves, and produces showy, tubular flowers that produce spiny, egg-shaped seed pods about the size of a golf ball. The plants are variable in size according to growth conditions, but can easily reach 6 feet in height and produce dozens to hundreds of seed pods. Jimsonweed seed can remain viable in the soil for 100 years.

Though is it certainly 'weedy', it is the poisonous nature of jimsonweed that gives it the status of Pennsylvania Noxious Weed. Livestock typically avoid it, but poisoning can occur if jimsonweed is a contaminant in forage.

As an annual weed, jimsonweed is not difficult to control. Isolated plants can be pulled, or cut off at the ground before going to seed. If the plants have gone to seed but the pods have not yet opened, you can pluck the pods and burn them to kill the seed.

You can treat jimsonweed with herbicides such as *glyphosate* or broadleaf herbicides containing *2,4-D. Glyphosate* is non-selective and will injure all plants contacted by the spray, while broadleaf herbicides will allow you to selectively treat jimsonweed in grasses.

Because jimsonweed seed is so long-lived, the best way to prevent

Table 3. Jimsonweed is an annual forb common throughout the warmer regions of the world. Jimsonweed seed can survive in the soil for over 100 years.

treatment	details
mechanical	Small plants can be readily pulled. Wear gloves to prevent exposure to the poisonous constituents.
mowing	Mowing will prevent seed set, and if you can mow at ground level, regrowth will be prevented.
postemergence herbicide	Spot treatment with *glyphosate* is effective any time, but needs to be done prior to seed set. Treating plants when they are small will limit the damage to adjacent non-target plants from overspray. Broadleaf herbicides containing the inexpensive ingredient *2,4-D* are effective, and provide selective control where jimsonweed is growing in desirable grasses.

Jimsonweed

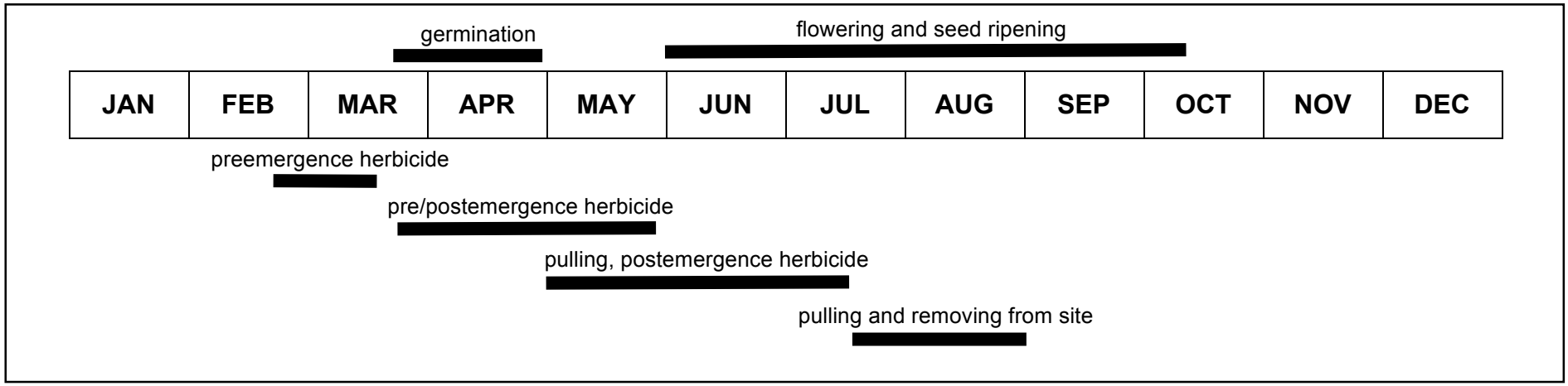
Datura stramonium

Control:

Hand pull young plants. Targeted applications of systemic herbicides such as *glyphosate* or *2,4-D* are effective.

mile-a-minute (*Polygonum perfoliatum*)

annual forb



Characteristics and Management

Mile-a-minute (MAM) is a summer annual vine native to East Asia. It was introduced to the U.S. as seed in rhododendron stock planted in Pennsylvania in the late 1930's. It is indeterminate, so once flowering begins, it continues until killing frost. The vines can reach 20 feet in length, and branch freely. Many dozens to hundreds of spherical, shiny black seed are produced per plant, surrounded by a fleshy blue covering that makes the seed attractive to birds. The seed passes through the birds intact, and is spread in their droppings. MAM seed floats, and is readily spread along waterways.

MAM begins to germinate fairly early, giving it a head start on other plants. Germination can begin in late March, and usually continues through April. Flowering begins in June, and the first blue, fleshy fruit bearing ripe seed appear a few weeks later. The vines continue to grow and flower right up to killing frost, meaning some seasons there might be four full months of seed production by MAM.

The seed are viable in the soil for at least five years. Successful control requires prevention of new seed for at least that long. MAM typically grows in disturbed, non-maintained areas, and sprawls over the vegetation that is present. This makes control challenging later in the season as it is difficult to treat MAM without also treating the plants it is smothering.

Because of the long flowering period, it is critical to control MAM early in the season. Preemergence herbicides will prevent establishment, and limit your later season efforts to treating escapes and new infestations.

There are herbicides available that will control emerged seedlings and provide residual control. The young vines are readily detected about a month after germination, and can then be effectively controlled by pulling, cutting at the soil line, or postemergence herbicides. Pulling after July requires removal of the plant material and seed from the site to remove the seed.

Table 4. Mile-a-minute is a summer annual vine that flowers from June until killing frost. Effective control requires several years of preventing seed set to exhaust the seed bank.

treatment	details
pulling, mowing	Mile-a-minute can be pulled successfully, but thick gloves are required for protection against the downward-pointing spines. Once significant seed set has occurred, pulling is only useful if the plants are bagged and removed for incineration or disposal in a landfill. Mowing is only truly useful if the stem is cut at ground level, prior to seed set.
preemergence herbicide	Applications of *pendimethalin* ('Pendulum AquaCap' at 3 to 4 qts/ac) prior to germination will prevent establishment. *Pendimethalin* must be applied well in advance of germination to be effective.
postemergence herbicide	After mile-a-minute has emerged and is large enough for easy detection, but before it has set significant seed, it can be controlled with herbicides such as *glyphosate (*'Roundup Pro' at 32 oz/ac*), triclopyr* ('Garlon 3A' at 24 oz/ac), *dicamba* ('Clarity' at 16 oz/ac), or *aminopyralid* ('Milestone' at 3 oz/ac).

Mile-a-Minute

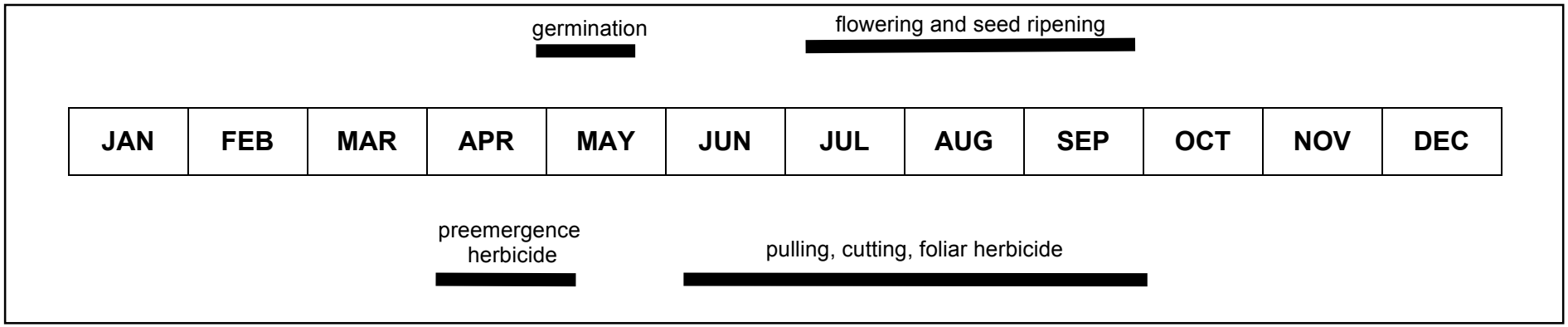
Polygonum perfoliatum

Control:

Remove by hand wearing protective clothing to avoid barbs. Repeated removal of new growth throughout the summer is necessary. Mowing throughout growing season will also restrict flowering. There are several herbicides available for preemergence or postemergence control.

shattercane (*Sorghum bicolor*)

annual grass



Characteristics and Management

Shattercane is a warm-season annual grass of largely unknown origin. It is the same species as cultivated sorghum, but displays weedy characteristics such as seed dormancy, and ready shattering of its seed. Shattercane grows 6 to 12 feet tall, and is primarily a pest of row crop agriculture. Johnsongrass and shattercane are closely related, but Johnsongrass is a rhizomatous perennial. These species are distinguished early in the season by pulling the plants and examining the roots. By the time Johnsongrass reaches a height of 12 inches, rhizomes will be apparent. Shattercane will simply have a fibrous root system with no rhizomes or perennial structures. When flowering begins, Johnsongrass has an open panicle with branches nearly horizontal, while the seedhead of shattercane is quite tight with the panicle branches more vertical.

Shattercane begins to germinate as soil temperatures exceed 50 degrees (F), and flowers after the daylength begins to decrease after the first day of summer. The plant will continue to tiller and flower through the late summer until killed by frost.

For management recommendations in crop settings, refer to *Johnsongrass and Shattercane Control: An Integrated Approach*, available from Penn State at http://cropsoil.psu.edu/extension/facts/agfact4.pdf

Shattercane is primarily a weed of disturbed sites (such as crop fields), so encouraging an intact groundcover will greatly reduce infestation.

If the number of shattercane plants is small, the simplest approach is to pull them out.

Mowing shattercane before the seedhead emerges will prevent seed formation, but the plant will continue to tiller at the base until frost or when you exhaust the crown's ability to support new growth from buds.

If shattercane is growing in larger patches, you can also spot-treat shattercane with a postemergence herbicide such as *glyphosate*. This is much easier if the plants are short - treat before they get taller than 3 feet or cut them and treat the regrowth. If shattercane is growing in desirable broadleaf plants such as forage legumes, you can spot treat with the grass herbicides *sethoxydim* or *clethodim.*

Table 5. Shattercane is a warm-season annual grass and reproduces only by seed. Control measures need to prevent seed set and encourage development of an intact desirable groundcover to limit shattercane germination in future seasons.

treatment	details
mechanical	Shattercane is a fibrous-rooted annual. Small numbers of plants can be pulled.
mowing	Mowing will prevent seed set, but regrowth will occur if the crown is intact. Mowing tall-growing infestations and treating the regrowth makes it easier to spot-treat with postemergence herbicides.
postemergence herbicide	Spot treatment with *glyphosate* is effective any time, but needs to be done prior to seed set. Treating plants when they are small will limit the damage to adjacent non-target plants from overspray. The grass herbicides *sethoxydim* or *clethodim* provide selective control where shattercane is growing in desirable forbs
preemergence herbicide	This option would be useful in tree plantings. The herbicide *pendimethalin* can be tank-mixed with *glyphosate* to prevent germination of annual weeds and provide a weed-free zone around the planted trees.

Shattercane

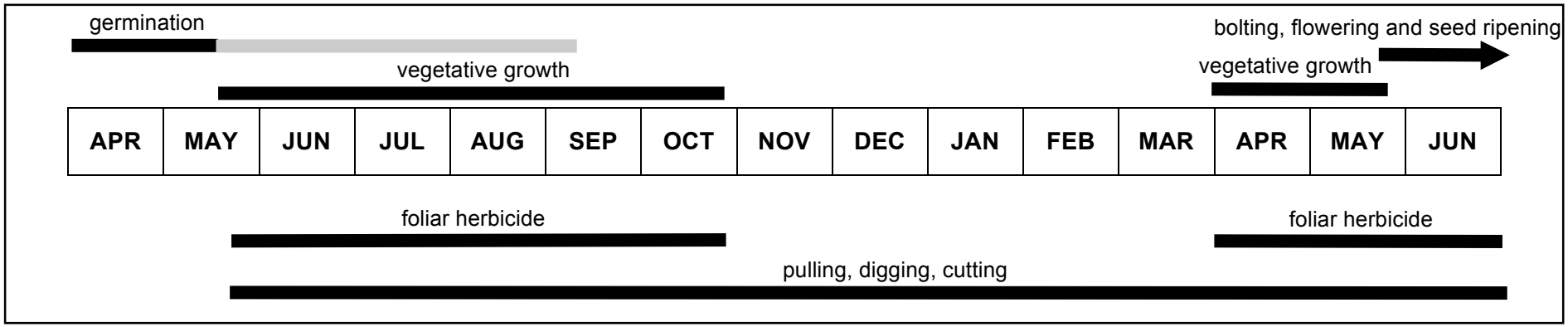
Sorghum bicolor

Control:

Hand pull or mow young plants before flowering. Targeted treatments of systemic herbicides such as *glyphosate* work best when plants are 12 to 18 inches tall and actively growing..

musk thistle (*Carduus nutans)*

biennial forb



Characteristics and Management

Musk thistle, also known as nodding thistle, is a biennial forb native to Europe. It is common along roadsides, non-maintained areas, and pastures. Musk thistle typically germinates in the spring, but it will germinate throughout the growing season in response to disturbance. As a true biennial, it must overwinter to flower. It spends its first growing season and the early stages of the second growing season as a rosette - a low-growing plant form where the stem has not elongated. After overwintering, the stem elongates, or 'bolts' in the spring, then flowers, sets seed, and dies. Musk thistle can grow up to 8 feet tall.

Musk thistle is taprooted, and isolated plants can be controlled by taking a shovel and severing the root below the crown. Unlike dandelion, biennial thistles will not continue to make new crowns from the remaining root.

Mowing can effectively control biennial thistles if done repeatedly after bolting. Mowing during the rosette stage is not useful because you will remove little of the plant, if any. Mowing during bolting or flowering will result in regrowth. The plant will be much smaller, but it will continue to use the energy it has to try to flower and set seed. If you mow after pollination, the seeds may still ripen in the severed flower heads. This is why it is important to mow prior to flowering or at early bloom. Mowing after seed set may make you feel better, but the damage is done.

The most practical herbicide applications are postemergence. Even though the biennials reproduce only by seed and would be susceptible to many preemergence herbicides, their ability to germinate throughout the season limits the utility of preemergence herbicides. It is more practical to treat the plants after they have emerged and are easily detected.

The best time to make herbicide applications is during the rosette stage, and the smaller the better. Biennials do not go dormant, so you can treat well into the fall, and fairly early in the spring. Unless stand density is really high, thistle rosettes lend themselves well to true spot treatment. Therefore, you could use *glyphosate* and cause little damage to adjacent non-target vegetation. If the thistle rosettes are growing in desirable grasses, you can use broadleaf herbicides such as *dicamba* , *triclopyr*, or combinations of these ingredients with *2,4-D*.

You can treat musk thistle up to early bloom stage, but it is easier to treat selectively at rosette stage, plus you won't have tall, spiny skeletons left if you treat at rosette stage.

Table 6. The biennial thistles reproduce only by seed. Controlling them during the rosette stage reduces their impact, and prevents them from going to seed.

treatment	details
mechanical	Biennial thistles are taprooted. You can sever the root below the crown with a shovel or similar tool to kill individual plants.
mowing	Repeated mowing after bolting has begun will exhaust the root and prevent seed set. If you mow after fertilization, the seed may still ripen in the severed flower head.
postemergence herbicide	The most effective approach is to treat at the rosette stage - the earlier (or smaller) the better. Rosettes are fairly easy to selectively spot treat, so you can use *glyphosate*. If the rosettes are in desirable grasses, broadleaf herbicides such as *dicamba* ('Clarity', 'Banvel'), *triclopyr* ('Garlon 3A'), or products containing *2,4-D* in combination with *dicamba* ('Weedmaster') or *triclopyr* ('Crossbow') will provide control without injuring grasses. These products will work up to early bloom stage, but you will use less product and find it much easier to treat rosettes.

Musk or Nodding Thistle

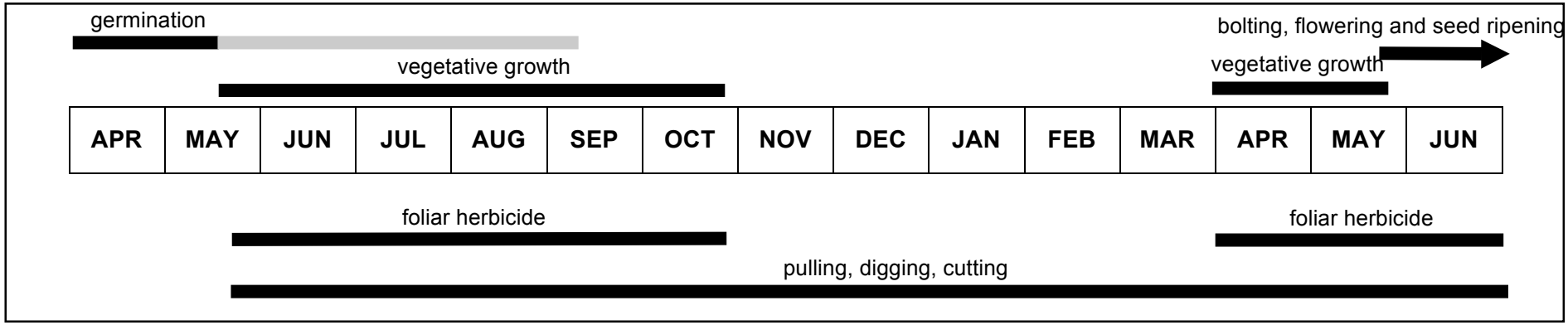
Carduus nutans

Control:

Cut before seed sets. Repeated cutting will eventually weaken and kill the root system.. Herbicide applications are most effective when applied before flowering.

bull thistle (*Cirsium vulgare)*

biennial forb



Characteristics and Management

Bull thistle, also known as spear thistle, is a biennial forb native to Eurasia. It is common along roadsides, non-maintained areas, and pastures. Bull thistle typically emerges in the spring, but it will germinate throughout the growing season in response to disturbance. As a true biennial, it must overwinter to flower. It spends its first growing season and the early stages of the second growing season as a rosette - a low-growing plant form where the stem has not elongated. After overwintering, the stem elongates, or 'bolts' in the spring, then flowers, sets seed, and dies. Bull thistle can grow up to 8 feet tall.

Bull thistle is taprooted, and isolated plants can be controlled by taking a shovel and severing the root below the crown. Unlike dandelion, biennial thistles will not continue to make new crowns from the remaining root.

Mowing can effectively control biennial thistles if done repeatedly after bolting. Mowing during the rosette stage is not useful because you will remove little of the plant, if any. Mowing during bolting or flowering will result in regrowth. The plant will be much smaller, but it will continue to use the energy it has to try to flower and set seed. If you mow after pollination, the seeds may still ripen in the severed flower heads. This is why it is important to mow prior to flowering or at early bloom. Mowing after seed set may make you feel better, but the damage is done.

The most practical herbicide applications are postemergence. Even though the biennials reproduce only by seed and would be susceptible to many preemergence herbicides, their ability to germinate throughout the season limits the utility of preemergence herbicides. It is more practical to treat the plants after they have emerged and are easily detected.

The best time to make herbicide applications is during the rosette stage, and the smaller the better. Biennials do not go dormant, so you can treat well into the fall, and fairly early in the spring. Unless stand density is really high, thistle rosettes lend themselves well to true spot treatment. Therefore, you could use *glyphosate* and cause little damage to adjacent non-target vegetation. If the thistle rosettes are growing in desirable grasses, you can use broadleaf herbicides such as *dicamba*, *triclopyr*, or combinations of these ingredients with *2,4-D*.

You can treat bull thistle up to early bloom stage, but it is easier to treat selectively at rosette stage, plus you won't have tall, spiny skeletons left if you treat at rosette stage.

Table 7. The biennial thistles reproduce only by seed. Controlling them during the rosette stage reduces their impact, and prevents them from going to seed.

treatment	details
mechanical	Biennial thistles are taprooted. You can sever the root below the crown with a shovel or similar tool to kill individual plants.
mowing	Repeated mowing after bolting has begun will exhaust the root and prevent seed set. If you mow after fertilization, the seed may still ripen in the severed flower head.
postemergence herbicide	The most effective approach is to treat at the rosette stage - the earlier (or smaller) the better. Rosettes are fairly easy to selectively spot treat, so you can use *glyphosate*. If the rosettes are in desirable grasses, broadleaf herbicides such as *dicamba* ('Clarity', 'Banvel'), *triclopyr* ('Garlon 3A'), or products containing *2,4-D* in combination with *dicamba* ('Weedmaster') or *triclopyr* ('Crossbow') will provide control without injuring grasses. These products will work up to early bloom stage, but you will use less product and find it much easier to treat rosettes.

Bull or Spear Thistle

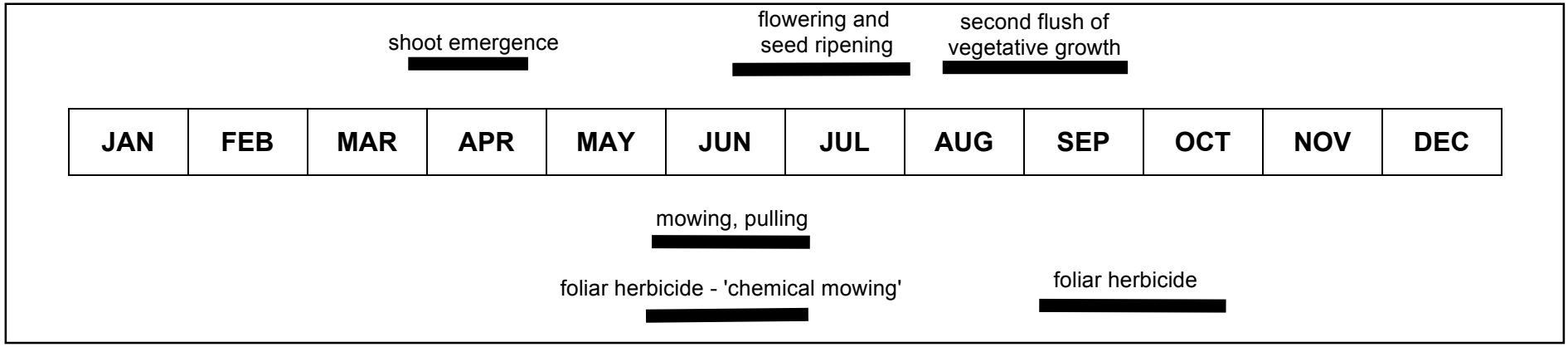
Cirsium vulgare

Control:

Cut before seed sets. Repeated cutting will eventually weaken and kill the root system. Herbicide applications are most effective when applied before flowering.

Canada thistle (*Cirsium arvense*)

perennial forb



Characteristics and Management

Canada thistle is a perennial that has plagued farmers in America since European settlement. It is adapted to a wide range of soil conditions, and spreads vigorously by wind-borne seeds and by way of its extensive, creeping root system. Canada thistle shoots emerge in the early spring, go through a brief 'rosette' phase, and then increase in height until mid-May to early June when the flower buds appear. After flowering and seed set, there is a second flush of growth from the axils of surviving stems and from new shoots.

To eliminate Canada thistle you must injure and exhaust its root system. A successful management program requires multiple treatments within a season and at least two seasons of treatment.

Fall is the ideal time to maximize injury to the thistle's root system because systemic herbicides move through plants with the sugars being sent to the roots. As the thistle is stocking up its root reserves for the winter, it will send fall-applied herbicides to where they can do the most damage.

Late spring, at the bud-to-early-bloom stage is the second important opportunity for control. Much of the energy to produce the spring flush of growth comes from stored reserves in the root system, causing a seasonal-low of stored energy at bloom stage. This is an ideal time to eliminate the top growth by mowing or an herbicide application to force the plant to use its scarce reserves to regrow.

In grassland plantings, there are many inexpensive herbicide products that will selectively eliminate the aboveground thistle growth and leave grasses intact. These products will contain *2,4-D*, and usually contain a second active ingredient as well (e.g. *dicamba*, *triclopyr, aminopyralid*). In tree plantings, spot treatments using *glyphosate* reduce the risk of injuring the trees with broadleaf herbicides through root absorption.

Table 8. Canada thistle is a difficult-to-control perennial that requires multiple operations for effective suppression. Emphasize the fall timing for best results.

treatment	details
fall herbicide application following late spring mowing or treatment	An application from mid-September to mid-October provides maximum injury to the root system. Recommended herbicides include *aminopyralid* ("Milestone' at 5 to 7 o/ac, or 'Forefront R&P' at 32 oz/ac), or *clopyralid* ('Stinger' at 8 oz/ac). *Glyphosate* ('Roundup Pro' or equivalent at 4 quarts/ac) is useful near desirable trees, which could potentially be injured through root absorption of *aminopyralid* or *clopyralid*.
late spring mowing	Mowing Canada thistle at the late flower-bud to early bloom stage prevents seed set, and forces the plant to produce a new canopy when its stored energy is at the lowest point.
late spring herbicide application	Treating Canada thistle during the flower-bud to early bloom stage prevents seed set, and serves as a 'chemical mowing'. The top growth can be eliminated, but the roots will be injured less compared to a fall application. Therefore, you can use less expensive products that contain *2,4-D* (e.g. 'Weedmaster', which is *2,4-D* plus *dicamba*). Expect regrowth, and treat it in the fall (see above).

Canada thistle

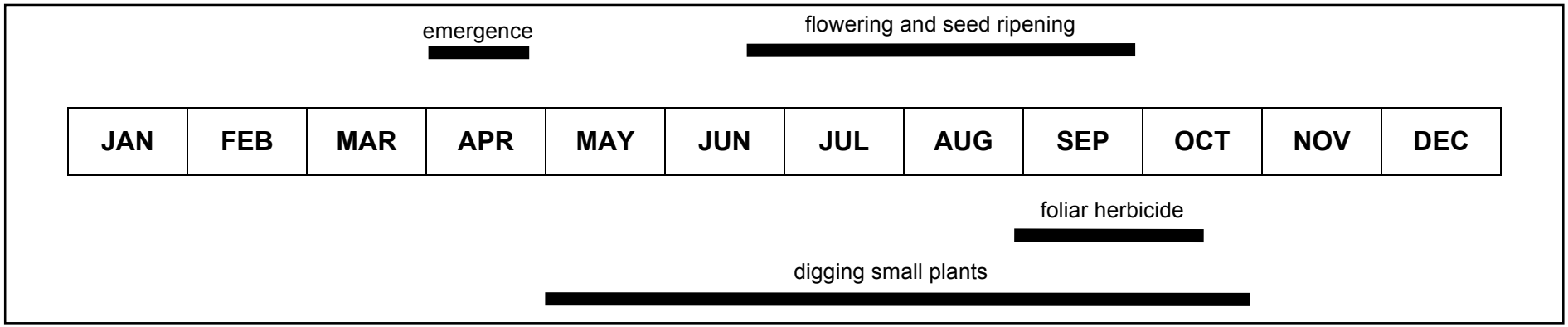
Cirsium arvense

Control:

The extensive, creeping root system makes control difficult. Multiple treatments each growing season are required for effective control. Cutting before seed set followed by an October treatment with a systemic herbicide such as *aminopyralid* will greatly reduce the stand.

goatsrue (*Galega officinalis*)

perennial forb



Characteristics and Management

Goatsrue is a perennial member of the Legume family (*Fabaceae*) native to Eurasia. It looks somewhat like an erect-growing form of crownvetch, though its root system would be more similar to the taprooted perennial alfalfa. It can reach heights of 6 feet, has pinnately compound leaves like crownvetch, and produces white to pink-lilac colored flowers. Unlike the globe-like clusters of flowers crownvetch produces, goatsrue flowers are arranged in an erect spike-like cluster.

It was imported to the western U.S. in the late 1800's as a potential forage crop, although subsequent investigations revealed it was actually toxic to livestock (!). The initial plantings eventually led to an infestation of approximately 35,000 acres in Utah. In 1980, goatsrue was designated as a Federal Noxious Weed, and it was added to the Pennsylvania Noxious Weed list in 2000.

Goatsrue has a long history of medicinal use in Asia, particularly for treatment of diabetes. Despite the fact it is expressly illegal (due to its Noxious status), you can purchase goatsrue from online vendors specializing in medicinal plants as well as gardening companion plants.

The first reports of goatsrue in Pennsylvania were in the 1960's when it was discovered on the grounds of the Morris Arboretum. It subsequently discovered that a neighboring property owner had been collecting and planting goatsrue seed in an effort to naturalize it. This original infestation has been greatly reduced.

Infestations have also been identified in McKean County. It is speculated these plants were contaminants in crownvetch seed used after road construction.

Because of its Federal status and limited extent, the PA Department of Agriculture (PDA) is actively trying to eradicate known populations of goatsrue. If you believe you have identified a population of goatsrue, contact your regional PDA office so that the identification can be verified and control efforts initiated.

Due to its limited extent, little comparative research has been conducted to determine the most effective control treatments. A small number of plants could be dug as long as the roots are completely excavated. Herbicide treatments would include chemicals that are reliable against perennial legumes, such as *glyphosate, dicamba, clopyralid,* or *aminopyralid.* These systemic herbicides should be applied late in the growing season for best effect.

Table 9. Goatsrue is a perennial legume limited to a few scattered locations in PA. Little comparative control research has been conducted, so current recommendations would be similar to treatments to eliminate alfalfa or crownvetch.

treatment	details
mechanical	A small infestation could be eliminated by digging up the root system.
postemergence herbicide	In the absence of comparative data, the recommended herbicides would be late-season, higher-rate applications of *glyphosate, dicamba. clopyralid, or aminopyralid.* You should expect to retreat surviving plants or new seedlings the following season.

Goatsrue

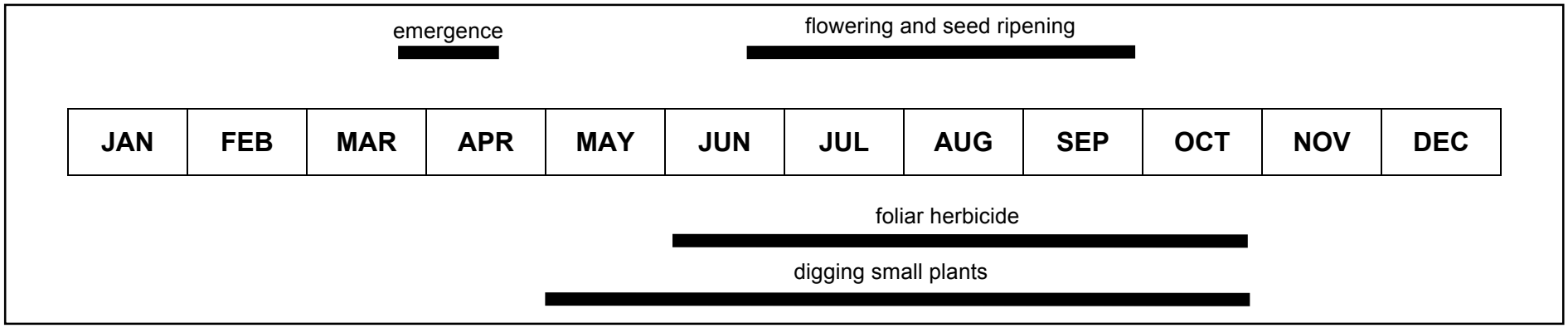
Galega officinalis

Control:

Mowing, clipping and cultivation are poor controls for this plant because seed is produced even when plants are small. The most effective control is treatment with selective herbicides such as 2,4-D. Two applications during the growing season for two consecutive years.

giant hogweed (*Heracleum mantegazzianum*)

perennial forb



Characteristics and Management

Giant hogweed is a perennial member of the same botanical family (*Apiaceae*) as familiar plants such as carrot, parsley, parsnip, celery, and many others. What distinguishes giant hogweed is its tendency towards extremes. Hogweed is arguably the largest-known herbaceous plant, reaching heights of 15 feet with stem diameters of 4 inches, and flower heads with a diameter of 30 inches. Additionally, the *Apiaceae* are known to produce a variety of harmful chemicals. Giant hogweed sap contains quantities of chemicals called *furanocoumarins* that cause severe skin blistering and burns when exposed to sunlight. The hazard that hogweed poses to humans has earned it a place on the Federal and Pennsylvania Noxious Weed lists.

The PA Department of Agriculture (PDA) is engaged in an eradication program, and is tracking and treating every known site. Giant hogweed occurs most frequently in the northwest corner of PA, but new sites continue to be discovered throughout the state.

If you believe you have seen giant hogweed, call 1-877-HOGWEED (877-464-9333), and PDA will verify the identity of the plant, and initiate control measures if it is giant hogweed. Hogweed resembles its close kin cow parsnip (*Heracleum lanatum*), and angelica (*Angelica atropurpurea*) is sometimes confused for hogweed.

Hogweed is described as a monocarpic perennial, which means it flowers only once, regardless of how old it is. Flowering usually occurs in years 3 to 5, but has been observed as early as year 2 or as late as 10 years. Where many plants are growing together, it can appear that root system has survived to produce another year of flowering. Once a patch has seeded, seedling may emerge for years after the existing plants have been controlled due to variable dormancy of the seed.

Young plants can be effectively controlled through digging. This is easier during the growing season when you can readily find the plants. Older plants will produce huge persistent stems, but young plants will be harder to locate after the foliage dies back.

The herbicides commonly employed by regulatory agencies are *glyphosate* or a combination of *triclopyr* and *clopyralid*.

Table 10. Giant hogweed is a Federal Noxious Weed, and all locations should be reported to PA Dept. of Agriculture at 1-877-HOGWEED. Sap of giant hogweed that comes in contact with skin and exposed to sunlight can cause severe burns. Chemical resistant gloves should be worn when handling any part of the plant, including the seed.

treatment	details
mechanical	Small, young plants can be dug up and destroyed. Efforts to dig older (larger) plants will usually result in viable root pieces being left behind.
mowing/cutting	Cutting will slow the growth of the plant and delay flowering. Flowers can be cut off at early bloom stage to prevent seed set. Avoid mowing other practices that will throw shredded tissue as all of these small pieces of hogweed can cause burns to the skin. Hand-held cutting tools should be cleaned with alcohol to remove the oil-soluble constituents of the sap.
postemergence herbicide	*Glyphosate* or a combination of the broadleaf herbicides *triclopyr* ('Garlon 3A') and *clopyralid* ('Stinger') have been used to treat pre-flowering hogweed.

Giant Hogweed

Heracleum mantegazzianum

Report all sightings.

Giant Hogweed Hotline:

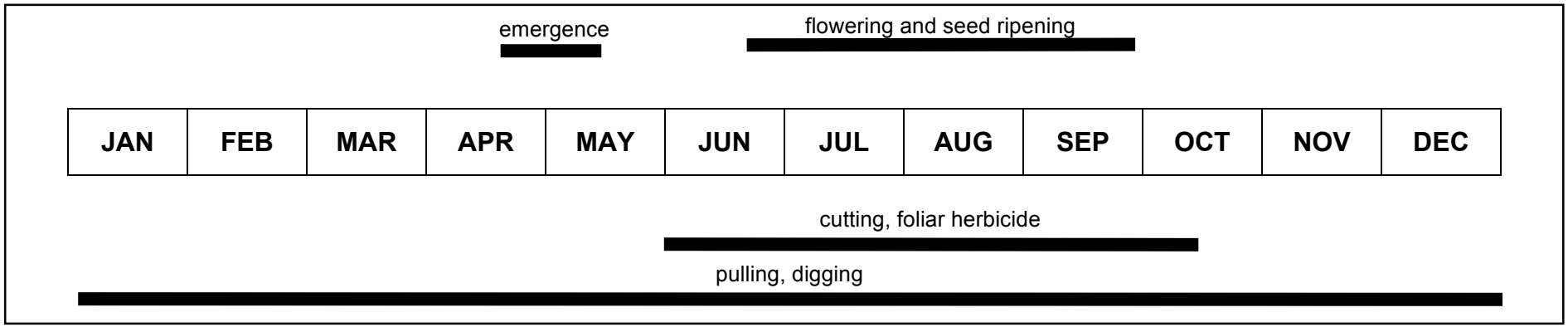
1-877-464-9333

Control:

Hand pulling or cutting are not recommended in controlling this plant. Plants exude a clear watery sap which sensitizes the skin to ultraviolet radiation. This can result in severe burns, blistering and painful dermatitis. These blisters can develop into purplish or brownish scars. Repeated targeted treatments of a systemic herbicides such as glyphosate are the most effective. Always wear protective clothing and avoid getting the sap on your skin.

purple loosestrife (*Lythrum salicaria)*

perennial forb



Characteristics and Management

Purple loosestrife is an herbaceous perennial that thrives as an emergent or near-aquatic plant along shorelines and in ditches.

Purple loosestrife spreads readily. The tiny, buoyant seeds can be distributed over great distances by water. The crown atop the branched taproot continues to expand, producing more stems each growing season. The aggressive spread of loosestrife into wetlands reduces plant diversity and habitat value.

Small infestations can be dealt with by hand pulling or digging. You would only want to attempt this on a small number of plants in saturated soil, as loosestrife is well rooted. It is imperative to remove as much of the root system as possible, as large root pieces are capable of generating new shoots. The stems are fairly persistent, and you can at least find plants by the stems in the dormant season, if not use them to pull the plant.

Mowing or cutting the above ground portions of the plant can prevent flowering and seed set. If you are going to cut once, wait until flowering begins and cut to the ground. This will not significantly injure the established plant, but if you can prevent additional seed, you can begin to limit the expansion of the infestation.

Biological control attempts have been undertaken by the PA Department of Agriculture and USDA-APHIS, who are releasing the *Galerucella* beetle in selected sites to control loosestrife. Biological control is an appropriate approach for larger scale infestations, but not practical at the individual landowner level. The beetles are expensive, the results are variable, and the potential effect is not as quick as more direct approaches.

To apply herbicides to loosestrife in standing water or saturated soil (these constitute 'waters of the Commonwealth') you must apply for a permit from the PA Fish and Boat Commission. If the site is not saturated at the time of application, no permit is required. Therefore, time your application to drier periods.

Purple loosestrife can be controlled with aquatic-labeled herbicides containing *glyphosate* ('Rodeo' or equivalent - there are many) or *triclopyr* ('Garlon 3A'). These herbicides can be used in wetland areas that are currently dry. Either must be applied to the foliage of plants. Ideally the treatment is performed at or before bud-to-early-bloom stage. This will prevent seed development.

Table 11. Purple loosestrife is a perennial forb that grows in or near water, producing thousands of tiny, buoyant seeds.

treatment	details
mechanical	Small numbers of small plants can be pulled or dug. This is much easier when the soil is saturated.
mowing/cutting	Mowing or cutting will prevent seed set. If flowering has already occurred, seedheads can be clipped, collected, and destroyed; and the remainder of the plant can be cut to the ground. This won't injure the plant, but it will reduce its expansion the following season.
postemergence herbicide	Spot treatment with aquatic-labeled *glyphosate* or *triclopyr* products is effective as loosestrife approaches flowering stage. *Glyphosate* is non-selective and will injure all plants contacted by the spray. *Triclopyr* will only injure forbs, leaving grasses, sedges, and other grass-like plants largely uninjured.
biological	Extensive infestations can be treated with the release of the *Galerucella* beetle. Contact PA Dept. of Agriculture for sources of the beetle.

Purple Loosestrife

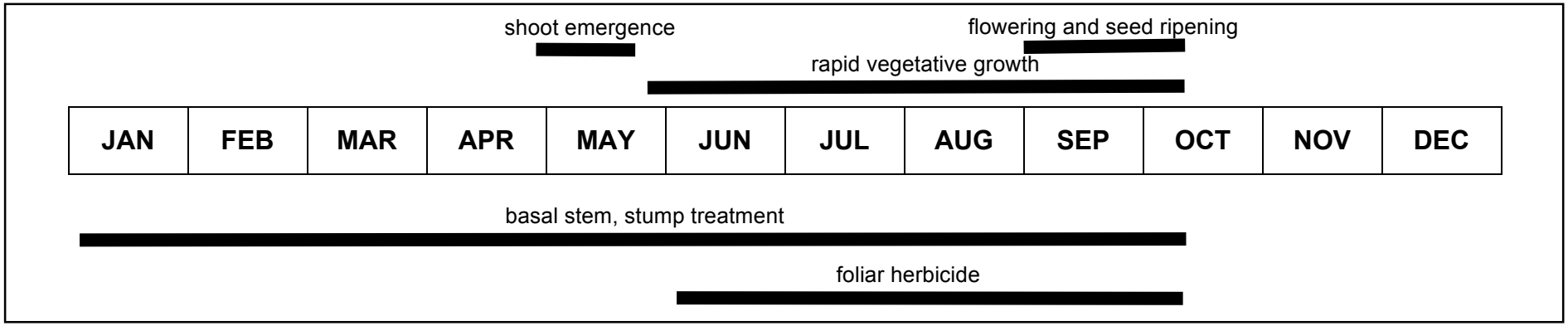
Lythrum species

Control:

Hand pull small infestations before seed set. Targeted applications of systemic herbicides such as *glyphosate* or *triclopyr* are most effective in controlling older plants. Herbicide applications are most effective when applied late in the growing season, but before seed set. Biological control for large infestations has also been approved by USDA. For information contact PA Department of Ag @ 717-772-5209.

kudzu (*Pueraria lobata*)

woody vine



Characteristics and Management

Kudzu is a woody vine in the legume family originally imported from Japan as a curiosity in 1876, but eventually was adopted by resource agencies as a conservation plant material in the 1930's. Once it became apparent that kudzu was entirely too aggressive and fast growing, its status changed from friend to foe.

What makes kudzu so difficult to manage is the remarkable linear growth it produces each year. Some publications state it will increase its length up to 100 feet in a year. The task of taming a well-established infestation is daunting as the crowns will be buried under a thick spaghetti-like mat of accumulated stems and the vines will have extended to the tops of nearby trees or utility poles. Kudzu devotes much more energy to length than stem diameter, which is why we often 'forget' that it is a woody stem - 15-year old stems may only be 2 inches in diameter, but reach 80 feet into adjacent trees. Kudzu is often described as 'semi-woody' because it may die back some distance from the terminal end of last year's growth. This is probably a function of kudzu growing rampantly up to killing frost, and the tender new growth has not yet set mature buds and 'hardened' for the winter.

Kudzu grows from large tuber-like roots, or crowns that may be 3 feet long and 8 inches thick. New crowns are formed when the stems creep along the ground and take root at the nodes.

Initial efforts to control kudzu should focus on reducing the aerial (climbing) biomass. One approach is locate the base of the climbing vines early in the spring before new growth leafs out. The vines can be cut and the stumps treated, or left intact and treated with a basal stem treatment. This approach will not prevent regrowth from the crowns later in the season, but it will make subsequent work much easier to do.

Foliar treatments can be used on kudzu that is growing along the ground, or on regrowth from cutting or stem treatments. Foliar treatments should be avoided when kudzu is climbing on desirable trees.

Table 12. Kudzu is a rampant, woody vine. Control of established infestations will take multiple applications and at least two to three seasons to completely suppress. Cutting or stem treatment of the aerial growth will allow you to use foliar applications to complete the follow-up treatments.

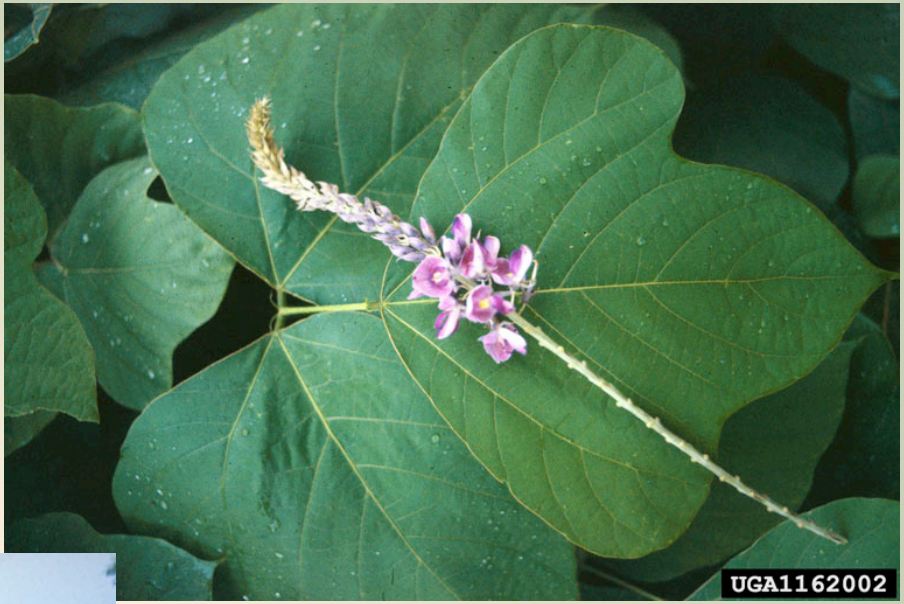
treatment	details
basal stem	Applications of *triclopyr* ('Pathfinder II') to the base of aerial vines and exposed stems growing along the ground will kill the top growth of treated stems. Injury to the root system is increased if this is done in the fall prior to killing frost. However, it's much easier to make this treatment in the early spring prior to leaf-out. This is a 'first step' treatment as you will miss some stems and regrowth will occur.
stump treatment	Aerial vines can be cut in the early spring and the remaining stump treated to prevent resprouting. *Triclopyr* ('Pathfinder II') is an oil-based RTU formulation. *Clopyralid* ('Stinger') can be applied as a 1:1 mix with water. Like the basal stem treatment (above), this is a 'first step' treatment.
postemergence herbicide	This treatment is useful for treating regrowth after spring cutting/stump treatment or basal stem treatment, when the growth is still low to the ground. Once kudzu has begun climbing desirable vegetation, it should be cut or stem-treated rather than foliar treated to prevent injury to desirable vegetation. *Clopyralid* ('Stinger') is quite active against kudzu.

Kudzu-vine

Pueraria lobata

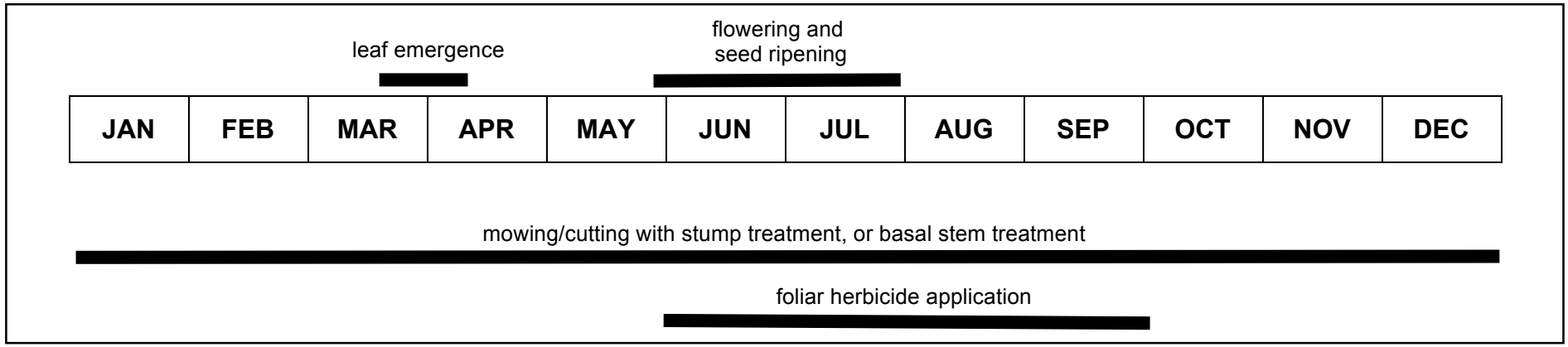
Control:

Complete control of this woody vine requires several years of repeated herbicide treatments. Climbing portions can be eliminated with stem treatments or cutting and stump treatment. Regrowth can be treated with foliar applications.



multiflora rose (*Rosa multiflora*)

shrub



Characteristics and Management

Multiflora rose is an invasive shrub that can develop into impenetrable, thorny thickets. This plant was introduced from Asia and widely promoted by resource agencies as a 'living fence' to provide erosion control and as a food and cover source for wildlife.

Individual plants can easily grow to more than 10 feet tall and 10 feet wide. When they grow singly, multiflora rose plants have a mounded form because of their arching stems. When the tips of the stems touch the ground, they can take root (called *layering*) and form a new crown. If near trees, the rose behaves almost like a vine, and can grow 20 feet into the tree.

Multiflora rose breaks bud early in the spring, quickly developing a full canopy of compound leaves that have seven to nine leaflets. Peak bloom is in early June. Birds and browsing animals eat the fleshy, bright red hips and the seeds pass through their digestive systems intact. These seeds can remain viable in the soil up to 20 years.

Brush-type mowers can be used to cut and pulverize the top growth of established plants. Mowing alone will not control multiflora rose, but it makes it easier to treat the plant with herbicides.

Herbicides can be applied to rose foliage or to the stems. The flowering stage is a good indicator of when the canopy is leafed out enough for foliar applications to be effective. Once fall color or leaf-drop begins to occur, foliar applications will be less effective.

Stump treatment is a very effective way to enhance a mowing treatment. 'Pathfinder II' is an oil-based product containing *triclopyr*, and can be applied after a mowing to prevent regrowth. The oil solution penetrates the bark of the rose stems and kills the tissue underneath, preventing sprouts. You can apply this treatment with a squirt bottle, but if you have a lot of crowns to treat, it's much easier to use a backpack sprayer.

When it's acceptable to leave the top growth of the rose in place, and you can actually access the base of the plant with a spray wand, you can control multiflora rose with a basal stem treatment. Apply 'Pathfinder II' to the lower 12 inches of all the stems, completely wetting each stem, but avoiding run-off.

Table 13. Multiflora rose is readily controlled with herbicides, but its thorny habit and tendency to grow in tangled thickets makes application difficult.

treatment	details
foliar herbicide application	Apply anytime from bloom stage to onset of fall color. In grasslands, selective herbicides such as *2,4-D* plus *triclopyr* ('Crossbow' at 1 percent by volume) will control rose without injuring grasses. *Glyphosate* ('Roundup Pro' or equivalent at 4 qts/100 gal, spray-to-wet) or *metsulfuron* ('Escort XP' at 1 oz/100 gal, spray-to-wet) are effective, but will injure non-target vegetation that is contacted.
mow and stump treat	Use when mowing is practical and the rose top growth should be removed. After cutting, apply *triclopyr* ('Pathfinder II' is a ready-to-use product) to the point of just wetting the remaining stubble. This treatment can be applied year-round.
basal stem treatment	This application is only feasible when you can access the base of the plant. Apply 'Pathfinder II' to completely wet the lower 12 inches of the stems, without causing run-off. This is *best* applied from January up to fall color, but as long as conditions permit you can apply year-round.

Multiflora Rose

Rosa multiflora

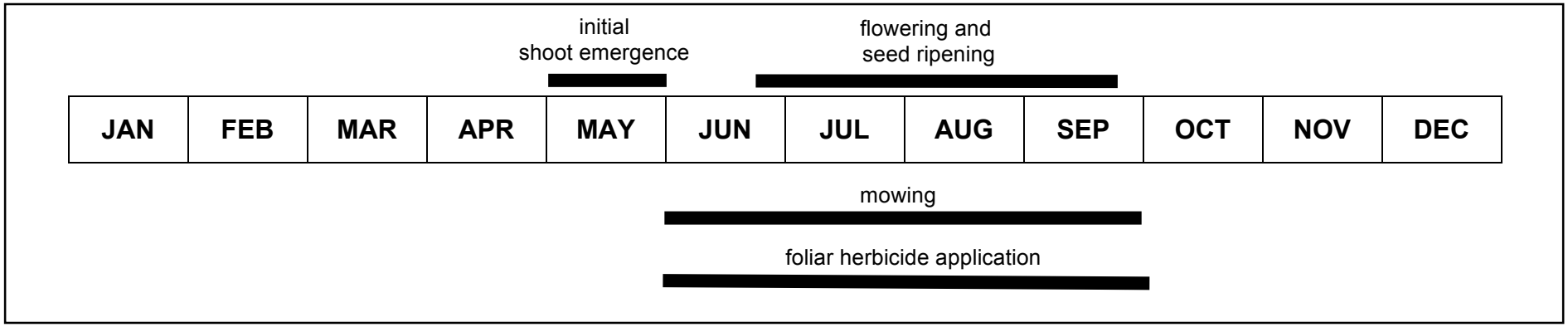
Control:

Hand pull young plants. Mow or cut larger plants to make further treatment easier and eliminate the thorny canopy. Treat the stumps or wait for the regrowth to make a late-season foliar treatment.

Multiflora can be distinguished from native look-alikes by the fringed bracts found at the base of each leaf stalk and upright stem.

Johnsongrass (*Sorghum halepense*)

perennial grass



Characteristics and Management

Johnsongrass is a warm-season perennial grass native to the Mediterranean region. It is in the same genus as cultivated sorghum (*Sorgum bicolor*), and will interbreed freely, reportedly producing viable hybrids. Johnsongrass was imported into South Carolina in 1830 for use as a forage grass, and into Alabama in 1840 by a farmer named Johnson - hence the common name. It escaped from cultivation quickly, and is a significant weed in the southern U.S., the west coast, southern plains, the Mid-Atlantic States, and into southern Ontario. Johnsongrass is a global weed, and considered one of the world's worst.

Johnsongrass can grow up to 10 feet tall, but will usually be 4 to 6 feet tall. It grows in patches due to its strongly rhizomatous growth, and will expand several feet in all directions each season if not managed. In PA, emergence will usually occur in late April or early May, and seedheads emerge about two months later. Flowering continues throughout the remainder of the growing season until the topgrowth is frost-killed.

Johnsongrass produces abundant seed that remains viable in the soil for several years, but spread of established plants is primarily through expansion of the rhizome system. Plants can grow in extensive patches with hundreds to thousands of stems, and can produce hundreds of feet of new rhizomes each season. Rhizomes begin to form on plants grown from seed as soon as the fifth-leaf stage.

Johnsongrass control is accomplished by injuring the rhizomes and depleting the soil seed bank.

For prescriptive information in crop settings, *Johnsongrass and Shattercane Control: An Integrated Approach* is available from Penn State at http://cropsoil.psu.edu/extension/facts/agfact4.pdf

Timing of management operations can be based on height, with 12 inches serving as a useful benchmark. Mowing Johnsongrass to prevent it from exceeding 12 inches will suppress rhizome growth and reduce energy reserves. Waiting to treat with *glyphosate* until its at least 12 inches tall will ensure that Johnsongrass is devoting energy to rhizome growth, and improve translocation and injury to the rhizomes.

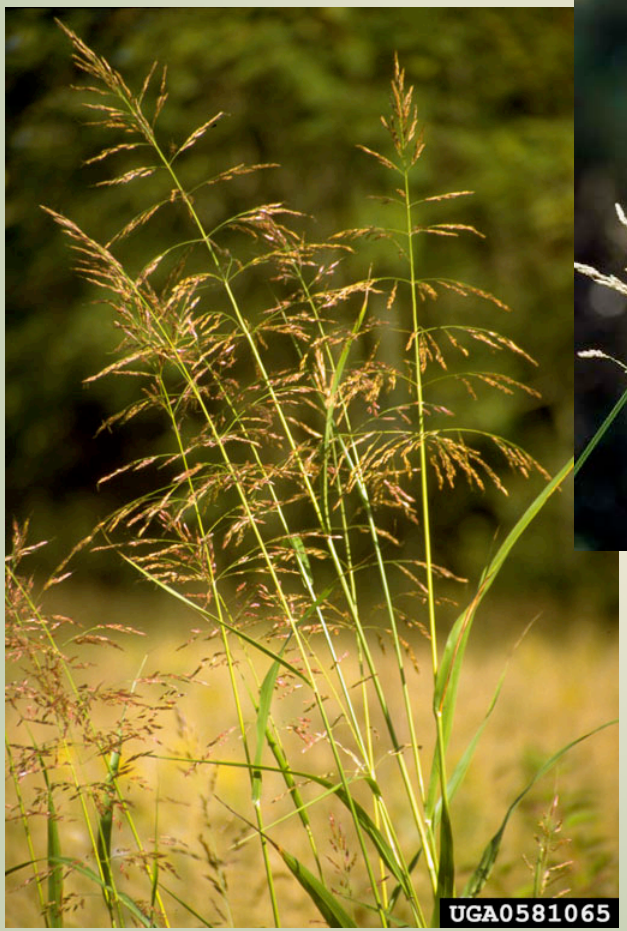
Severe infestations will require at least two seasons for complete control, and new plants from seed will need to be controlled each spring for several years.

Table 14. Johnsongrass is difficult to control due to its extensive rhizome system. A successful program weakens the rhizomes, and prevents additional seed set.

treatment	details
mowing	Mowing reduces rhizome growth and energy storage. Mowing prior to herbicide application weakens the plants and makes them more susceptible. Preventing Johnsongrass from exceeding 12 inches high greatly reduces rhizome growth.
foliar herbicide application	Use *glyphosate* at 1.5 to 3 lbs/ac when Johnsongrass is actively growing, and at least twelve inches tall. Treating Johnsongrass when it is shorter will provide control of the topgrowth but will likely reduce injury to the rhizomes. *Sethoxdim* or *clethodim* only injure grasses, and can be used to provide selective control where Johnsongrass is growing among desirable broadleaf plants. For most effective control of established Johnsongrass, it is recommended that *sethoxydim* be applied twice. The first application (1.5 pints/ac) should be when Johnsongrass is between 10 and 24 inches tall, and the second (1 pint/ac) when regrowth is 10 inches or less.

Johnsongrass

Sorghum halepense



Control:

Hand pull or mow young plants and follow with a targeted application of systemic herbicides such as *glyphosate* to kill rhizomes. Foliar herbicide treatments work best when plants are 12 to 18 inches tall and actively growing.

Partners in the CREP Weed Control/Wildlife Habitat initiative:

- Pocono Northeast Resource Conservation & Development Council (RC&D)
- USDA / Natural Resources Conservation Service (NRCS)
- USDA / Farm Services Agency (FSA)
- Pennsylvania Game Commission
- PA Department of Conservation and Natural Resources (DCNR)
- Endless Mountains RC&D
- Penn State College of Agricultural Sciences - Cooperative Extension
- The Chesapeake Bay Foundation
- PA Association of RC&D Councils
- PA Department of Environmental Protection (DEP)

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