
NE SARE PDP Webinar
February 3, 2015
Weed Management in Hay and Pasture
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New England Forage & Weed ID and Management Training Project

Title slide

Weeds in Hay and Pasture

- Reduce yield
  - Competition for light, nutrients, moisture, and space
- Reduce quality
  - Lower feed value?
- Reduce forage intake or can be toxic
  - Poisonous or mouth irritant

Weeds in pasture can have a number of impacts. As with any crop, they can reduce yield by competing for light, nutrients, moisture and space; they can reduce the quality of the forage; and they can reduce forage intake due to taste or smell or can have properties which may cause discomfort, illness or even death.

Hay and Pasture Invading Species Assessment

- Yield and quality – relative to desirable forage species
  - What's the goal?
- Competitive ability - potential to reduce desirable forage species
- Invasiveness – potential to multiply and spread
- Ability to control – cultural, mechanical, chemical, and biological

In dealing with weed management in pasture, an assessment of four key areas can be helpful. First how do the weeds affect forage yield and quality relative to the desirable species? The goal of the operation should be an important component of this decision. Second, how competitive are the weeds – what's their potential to reduce the desirable forage species? Third, how invasive are they – What's their potential to multiply and spread; Fourth, how hard are they to control using available tools? – cultural, mechanical, chemical, or even biological tactics. Let's discuss each of these factors.

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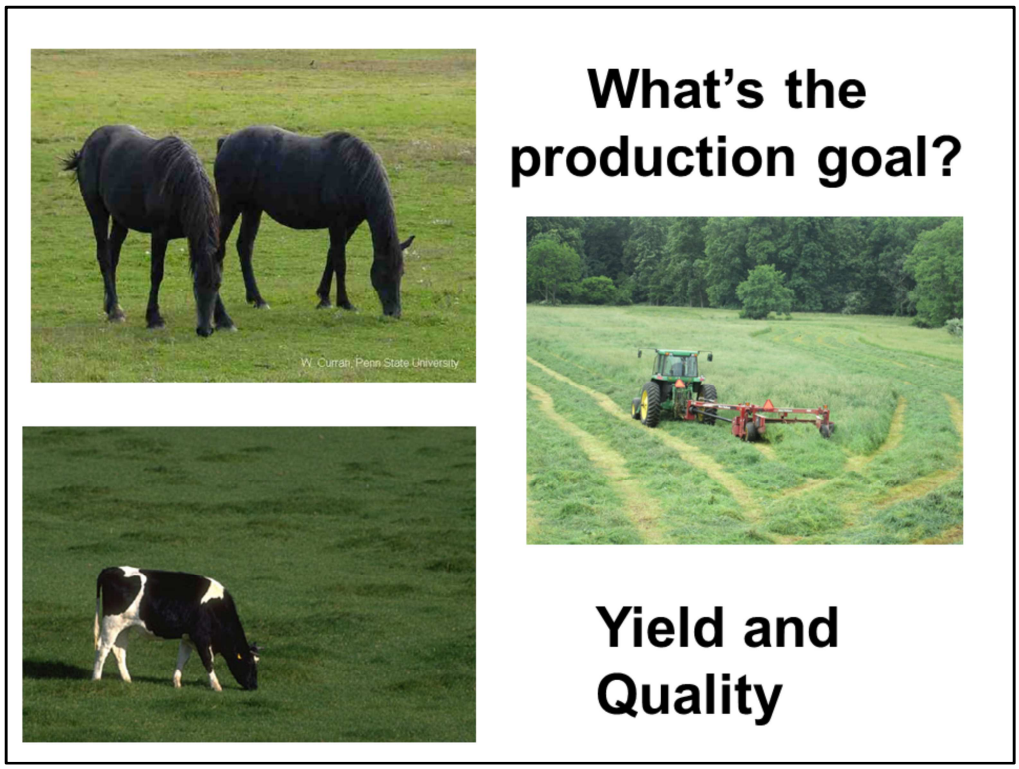
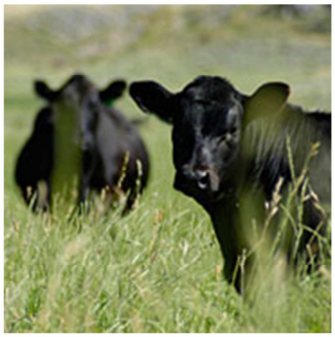
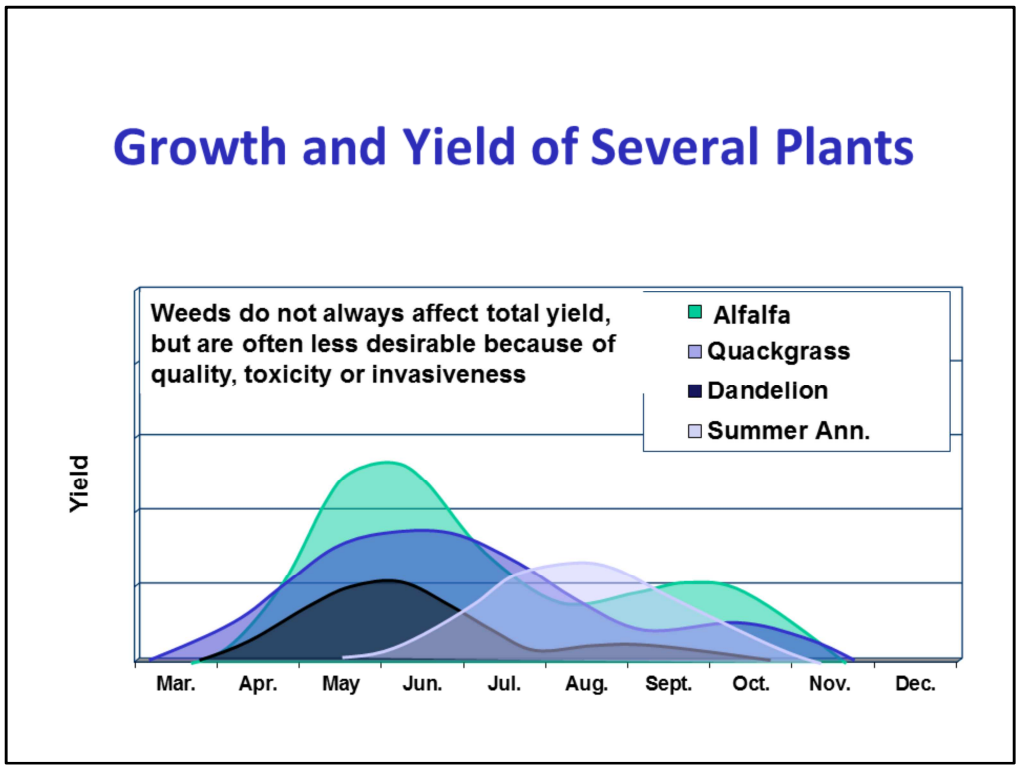
First how do the weeds affect forage yield and quality relative to the desirable species?



The question that needs be asked is "what's the goal of the operation"? (click) Is it dairy cattle requiring high quality intensively managed forage? (click) Is it for draft horses requiring lots of energy? (click) Is the pasture used to exercise and perhaps supplement hog feed? Or is it intended for some other use?



In discussing yield, keep in mind that with pasture and most certainly hay, yield may occur by harvesting both the intended forage crop plus whatever weeds are consumed or harvested. The first question is: how do the weeds yield over the growing season compared to the crop?



First, it's important to remember that most weed species have not been selected by humans for forage production. Although they may have adapted over time to be successful plants under animal grazing regimes, the goal for most weedy plants is reproduction – not maximizing vegetative growth. This chart compares yield over the growing season for some common forage and weed species. (click) The first line represents the theoretical forage yield for an improved bluegrass/white clover pasture over the growing season. The greatest yield occurs during the late spring and early summer with the lowest yield in mid-summer with some rebound in late summer and fall. (click) If we compare quackgrass, a common cool season grass – growth peaks in early summer, drops off during the heat of the summer and then rebounds only slightly in the fall. (click) Dandelion, a simple perennial has really just one major growth period during late Spring and early Summer. Dandelion doesn't't provide much forage from mid-summer on. (click) Finally, if we examine a typical Summer annual weed like common lambsquarters or pigweed, growth begins in late spring and doesn't't peak until August, with little regrowth in the fall. (click) So, depending on the goal, many weeds can provide forage at different times during the growing season. However, remember that quality, toxicity, and invasiveness should also be considered.

What About Quality?

- Weeds may be consumed by livestock or remain to reduce forage growth and yield
- More of an issue with high production milk or meat – less with horses/recreation
  - More purchased feed or forage
- Quality may involve lower protein, reduced digestibility, or reduced intake
  - taste, smell, or toxicity may be factors
- Weed quality can range from 50 to 100% of forage quality (alfalfa)
- Species and stage of growth determine quality

Let's talk quality. Weeds in pasture are either consumed by livestock or remain in the field potentially reducing forage growth and yield. This may be more of issue with more intensive types of livestock production such as dairy or meat production. So again, the production goal is very important. Quality can involve lower protein, reduced digestibility, or reduced intake. Certain weeds may be toxic, or simply taste and smell may reduce intake. In general, weed quality ranges from 50 to 100% of forage quality based on alfalfa. Weed species differ in their quality and just like forage species, quality changes with maturity.

Weed Forage Quality (cont.)

- Some weeds have excellent nutritive quality
- Young vegetative weeds better quality than mature weeds
- Livestock may avoid certain plants because of taste, smell, or toxicity
- Certain plants are poisonous and should be removed

So, some weeds have excellent nutritive quality depending on species and stage of growth. In general, young vegetative weeds have lower fiber and higher protein than more mature weeds. Regardless of quality however, some livestock will not eat certain species because of taste, smell, or toxicity. Toxic plants should be removed from pasture to avoid livestock poisoning.

Forage quality of several weeds/forages (ranges = vegetative to flowering)

Plant	% Crude protein	% IVDMD
Curly dock	30 - 16	73 - 51
Redroot pigweed	24 - 11	73 - 64
Yellow foxtail	17 - 14	73 - 57
Large crabgrass	14 - 6	79 - 63
White clover	27 - 23	81 - 83
Tall fescue	22 - 12	78 - 67

Adapted from Bosworth et. al, 1980, 1985.

This table shows some examples of forage quality for several weed and forage species. The values in column two and three show % crude protein and % invitro dry matter digestibility (IVDMD) for plants ranging from the vegetative stage to flowering. As you can see for all species, crude protein decreases with maturity as digestibility or fiber increases. You can also see from this table that several weed species are fairly comparable in terms of quality to either white clover or tall fescue, the two forage species in this table. Other weeds such as large crabgrass simply don't have the necessary quality parameters to provide much forage benefit.

Poisonous Plants

- Most poisonous plants must be consumed in large enough quantities to cause animal death
  - Many have undesirable taste and animals typically won't consume enough, *UNLESS…*
  - Forages are limited or unavailable
  - Especially during times of overgrazing, drought, or long winter seasons

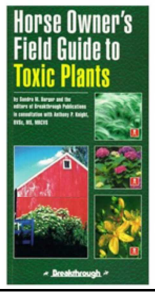


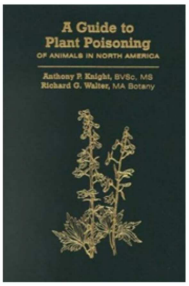
Info on Poisonous Plants

- Numerous books, fact sheets, and websites on toxic plants
  - Trust university or science-based publications
- *Consult with veterinary scientist if you have concerns*

Penn Veterinary Medicine Computer Aided Learning

http://research.vet.upenn.edu/poisonousplants/Home/tabid/5034/Default.aspx





Hay and Pasture Invading Species Assessment

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Secondly, how competitive are the weeds – what's their potential to reduce the desirable forage species?

Weed Competition in Hay and Pasture

- More complex than annual cropping systems
- Not thoroughly investigated
- Decisions based largely on visual thresholds and intuition
- Biennial and perennial weeds are biggest threat – most competitive
- Seeding year and established stands require different management
  - Competition more of a factor during establishment

Weed competition in pasture is more complex than for annual cropping systems. Because of this complexity and the general lack of weed scientists working in pasture systems, it has not been thoroughly investigated. Weed management decisions in pasture are largely based on visual thresholds and intuition – not economic thresholds based on scientific experimentation. In general, large, aggressive, persistent, competitive weed species which generally are biennial and perennials are the biggest threat. In addition, the threat of weed competition is greatest during the seeding year, rather than for established stands. However, weed competition can also be a factor for established pastures.

General rules about weed competition

- Maximize crop competition and minimize weed competition
- Weeds emerging with a new seeding are most destructive
- Control weeds for the first 60 days after establishment
- Weeds that emerge beyond 60 days will generally not influence that year's forage yield
- Winter annuals most damaging to early spring forage yield

Some general rules about weed competition in pasture. The basic goal with any crop is to maximize crop competition and minimize weed competition. Weeds emerging with a new seeding are most destructive because they more readily kill young seedlings. Control or manage weeds for the first sixty days after seeding – this is when new seedings are most susceptible. Weeds that emerge beyond 60 days (after tiller formation for grasses) will generally be less destructive. During the year of establishment, winter annual weeds are often most damaging to early spring forage growth.

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Our Third factor, how invasive are they – What's their potential to multiply and spread?

Invasiveness

- Ability to spread and multiply
  - Prolific seed production
  - Creeping vegetative structures
  - Spread by wind, manure, or livestock
    - Weed seed resistant to decay
  - Persistent, long lived and difficult to kill
  - Examples: quackgrass, multiflora rose, Canada thistle, tall ironweed, and Japanese stiltgrass.

Tall ironweed

Japanese stiltgrass

Invasiveness means the ability of a plant species to spread and multiply where it's not wanted. Weeds are generally considered invasive for several reasons including prolific seed production, creeping vegetative structures as in the case of perennials, seed or vegetative structures are spread by wind, manure, or by livestock. It's important to remember that weed seed in particular is extremely resistant to decay and can pass readily through most types of livestock. Invasiveness may be due to the persistent, long lived, and difficult to kill traits often associated with weeds. Some examples of invasive pasture species include quackgrass, multiflora rose, Canada thistle, johnsongrass, and spiny amaranth.

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Our fourth factor, how hard are they to control using available tools? – cultural, mechanical, chemical, and biological tactics. Let's discuss each of these factors.

Ability to Control

- Understand weed biology
- Cultural
- Mowing and hand removal
- Herbicides
- Biological

The final assessment factor – the ability to control. In determining this, understanding the biology of the weed is important as well as how different management tactics will influence control. Management factors include cultural, mowing and hand removal, the use of herbicides, and biological control tools.

Weed Biology and Ecology

- Lifecycle
- Reproduction
- Population dynamics
- Vegetative reproduction
- Plant physiology
- Genetics
- Seed dissemination
- Preferred habitat
- Emergence patterns
- Competitiveness

Lifecycle

- Annual
- Biennial
- Perennial

Annual weeds

- Completes lifecycle in <1 year
  - Winter annual – germinates in the fall or early spring
    - common chickweed, henbit, shepherdspurse, downy brome, yellow rocket, horseweed, garlic mustard, et
  - Summer annual – germinates in late spring or early summer
    - lambsquarters, pigweed, foxtail, crabgrass, ragweed, etc.

Before looking at specific weeds, the following drawings review weed lifecycles. There are two kinds of annuals - winter and summer. Each kind completes their lifecycle within one year. Winter annual examples include chickweed, henbit and downy brome, while summer annuals are lambsquarters, pigweed, velvetleaf and foxtail. (click on the thumbnails.)

Biennial weeds

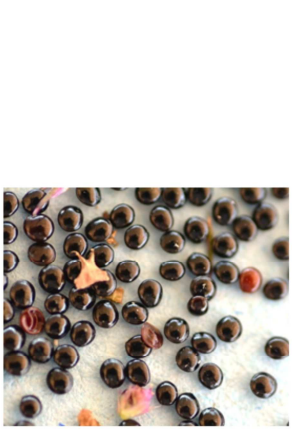
- Completes lifecycle in <2 years
  - Emerges from seed in early to late summer
  - Overwinters as a rosette then bolts (grows a seed stalk), and sets seed next year

    - common burdock, bull thistle, musk thistle, wild carrot, poison hemlock, common mullein, common evening primrose

Biennials complete their lifecycle within two years. Some examples include bull thistle and wild carrot. (click on the thumbnail.)

Weed Seed - "their" key to success

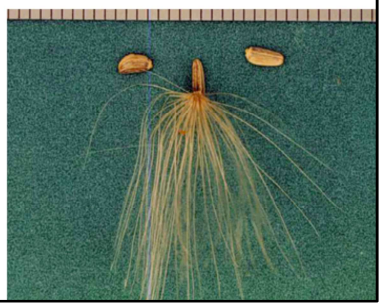
- Weeds can produce large numbers of seeds
- Weeds produce viable seed under adverse conditions
- Weeds seeds survive adversity – resist freezing, drought, fire, animal digestion, etc.
- Weed seeds exhibit periods of dormancy
- Weed seeds buried in the soil remain viable for years
- Weed seeds can be difficult to detect in or remove from crop seed
- Many weed seeds and fruits have adaptations that aid in dispersal



Pigweed

Burdock

Bull thistle

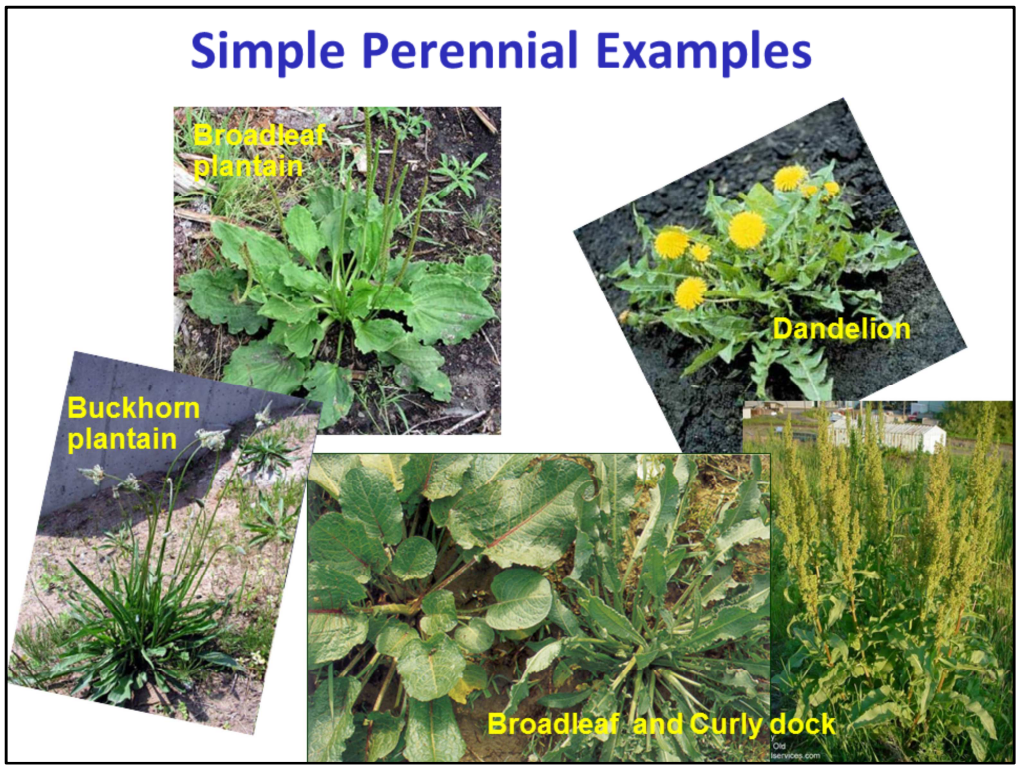


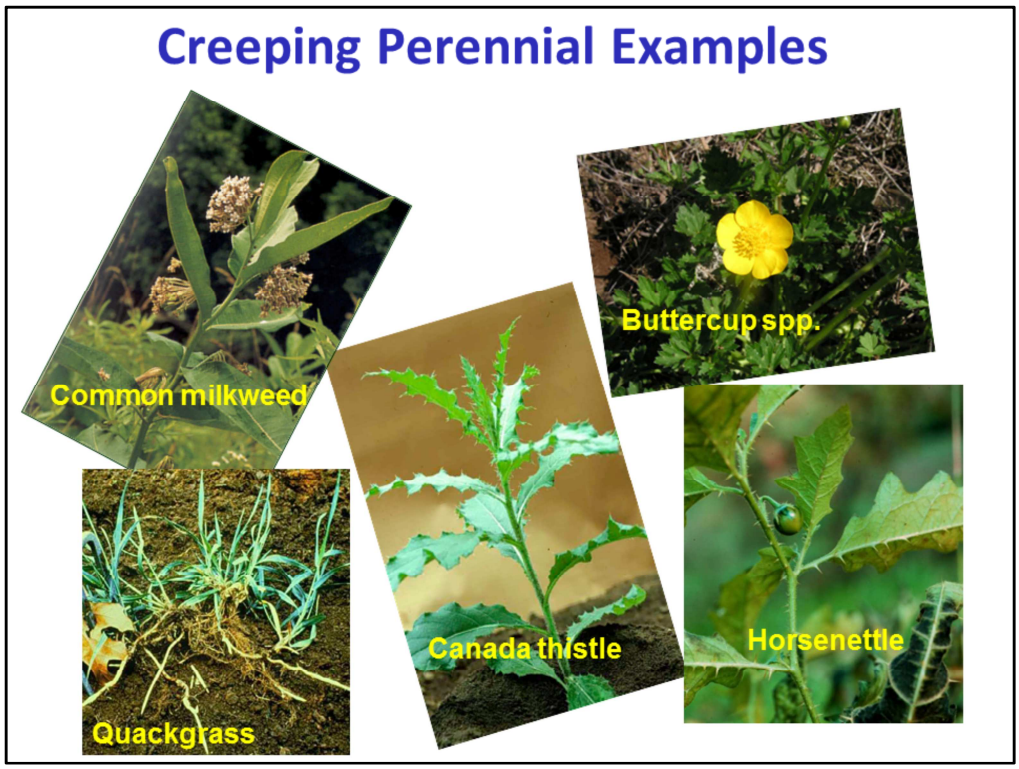

Weed Seed Production

Perennial weeds

- Completes lifecycle in >2 years
  - Simple perennial – spreads primarily by seed and has a taproot
    - dandelion, plantains, curly dock, pokeweed
  - Creeping perennial – spreads by vegetative means as well as seed. May be herbaceous or woody.
    - Herbaceous: quackgrass, Canada thistle, hemp dogbane, purple loosestrife, Johnsongrass, ground ivy, yellow nutsedge
    - Woody: multiflora rose, Japanese knotweed, Japanese honeysuckle, poison ivy, tree-of-heaven

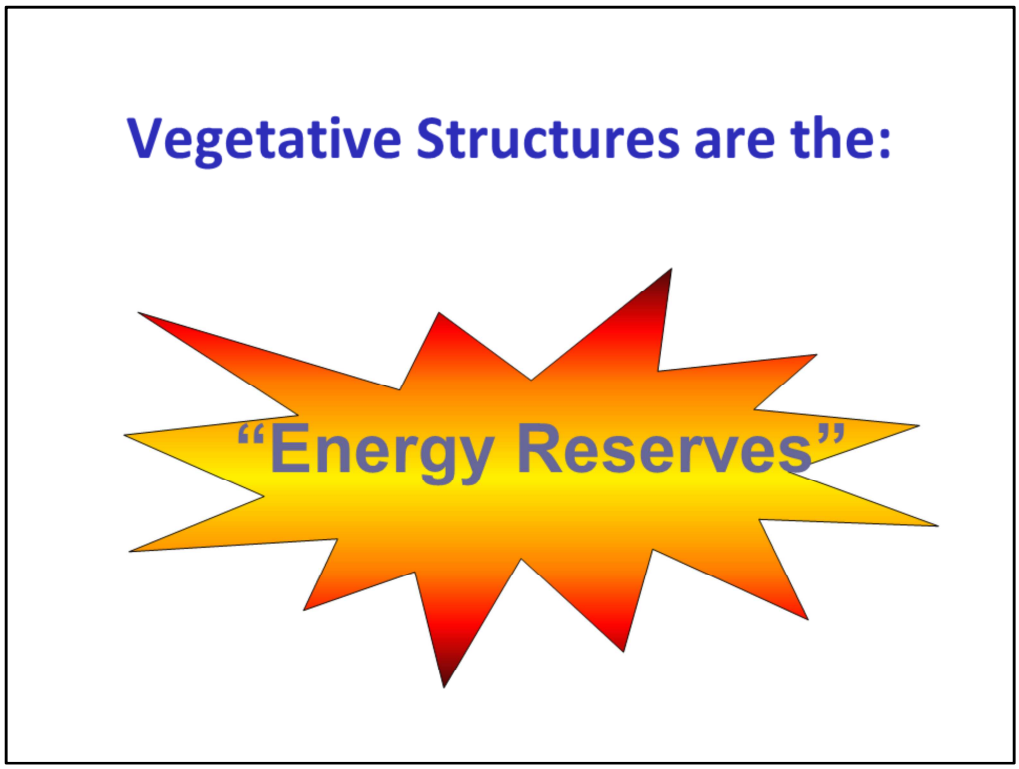
Perennials live more than two years. They are classified as either creeping or simple. An example of a simple perennial would be dandelion while a creeping perennial would be Canada thistle. (click on the thumbnails.)


Simple Perennial Examples
Broadleaf plantain
Dandelion
Buckhorn plantain
Broadleaf and Curly dock

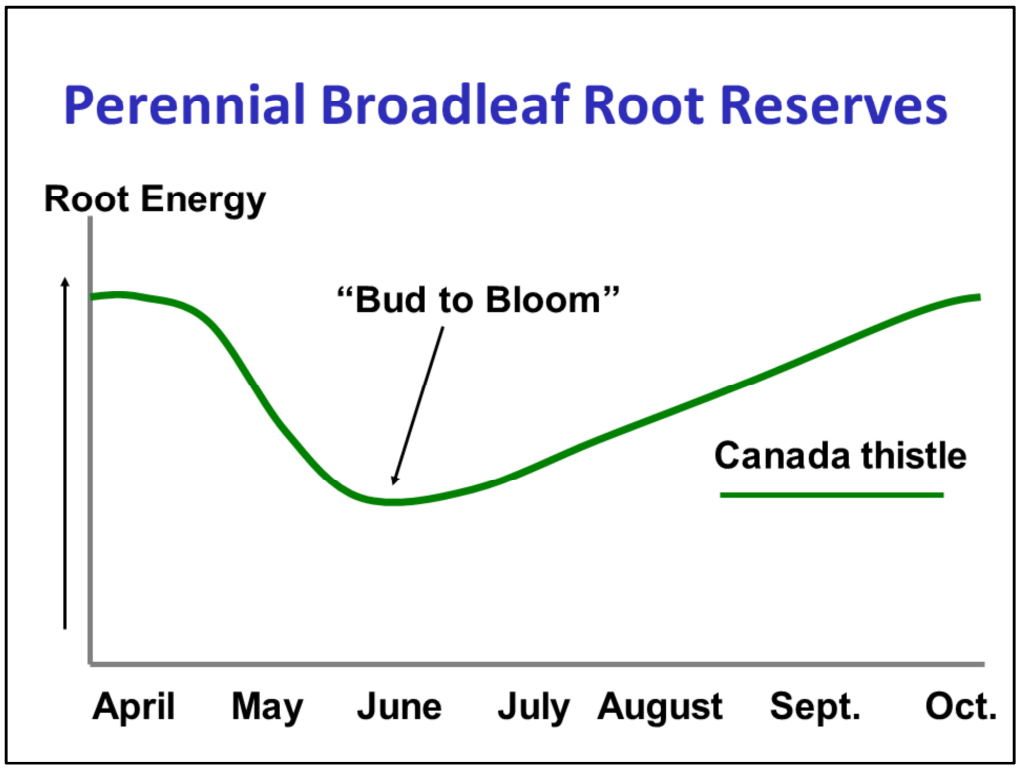

Creeping Perennial Examples
Common milkweed
Buttercup spp.
Canada thistle
Horsenettle
Quackgrass

Perennial structures

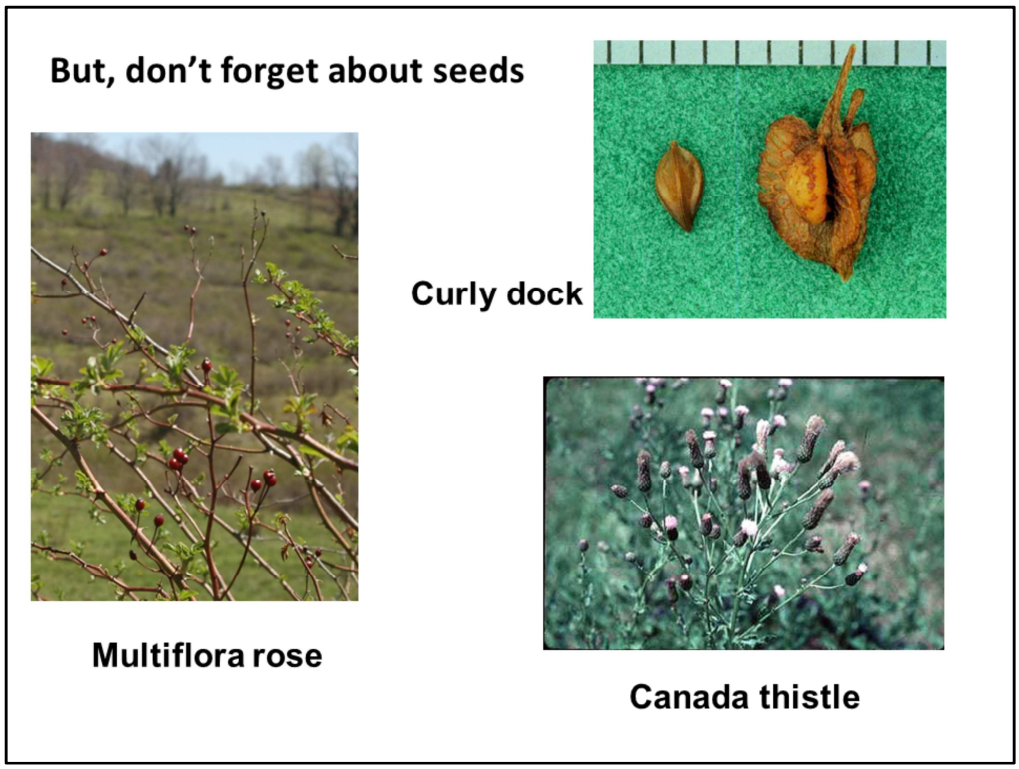
- Stolon's are above ground horizontal stems that root at the nodes to spread the weed.
- Rhizomes are below-ground thickened stems that grow horizontally in the upper soil layers.
- Tuber's are enlarged rhizomes with compressed internodes located at the ends of rhizomes.
- Budding roots are modified roots that can store carbohydrates and grow both vertically and horizontally.
- Bulbs are leaf tissues modified for carbohydrate storage, located at the base of the stem, at or below the soil line.



Vegetative structures store carbohydrates as energy. These energy reserves make most perennials very difficult to control using the same tactics that we employ for annual weeds.



(This slide contains animation, click to advance) This graph represents the change in perennial broadleaf root reserves over a growing season.(click) The yellow line represents a cool season perennial like Canada thistle. (click) The blue line is more representative of a perennial that emerges from the soil in early May like hemp dogbane. In spring, as the weeds break dormancy and emerge from the soil, root energy or carbohydrate levels are relatively high. As the plant mobilizes these carbohydrates and uses them for root and shoot growth, root reserves are depleted. Root energy reserves are at their lowest when the plants begin to form flower buds through early flowering. Once flowering and seed set are complete, the plants again begin to store carbohydrates in preparation for the winter dormancy period and the following spring. The cycle of Canada thistle, the cool season perennial is slightly advanced compared with other broadleaf perennials like hemp dogbane or horsenettle.

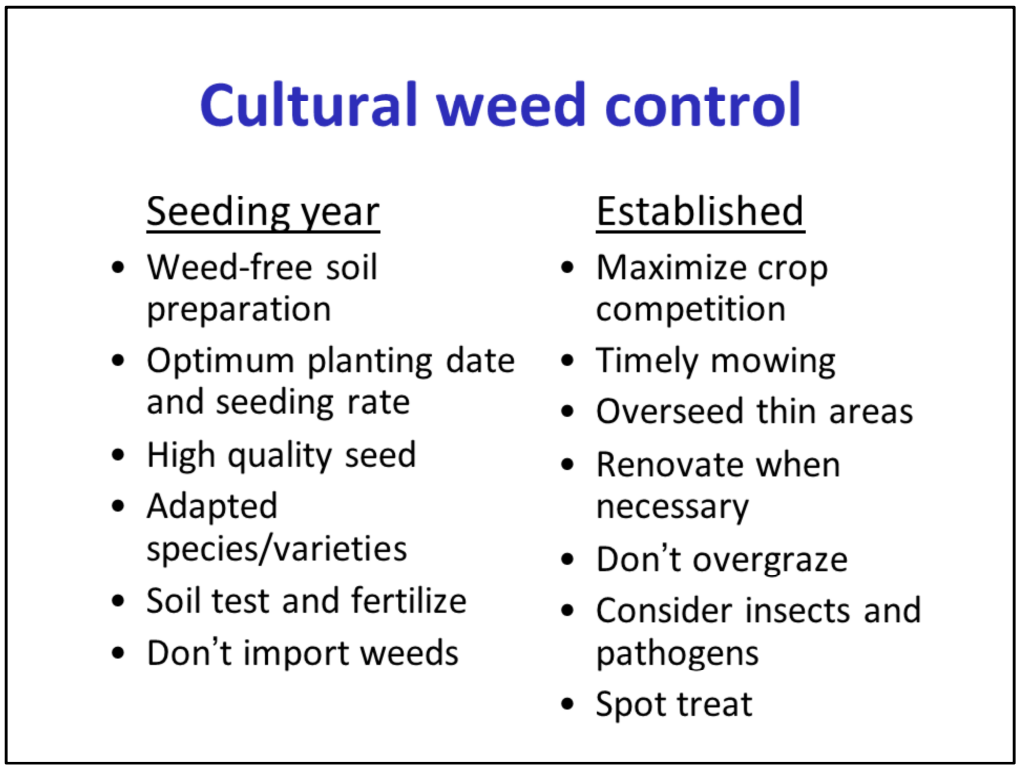


In addition to vegetative reproduction, most perennials also produce seed. In some perennials seed production is less important for survival and spread, while in others, it is critical for success.

Ability to Control

- Understand weed biology
- Cultural
- Mowing and hand removal
- Herbicides
- Biological

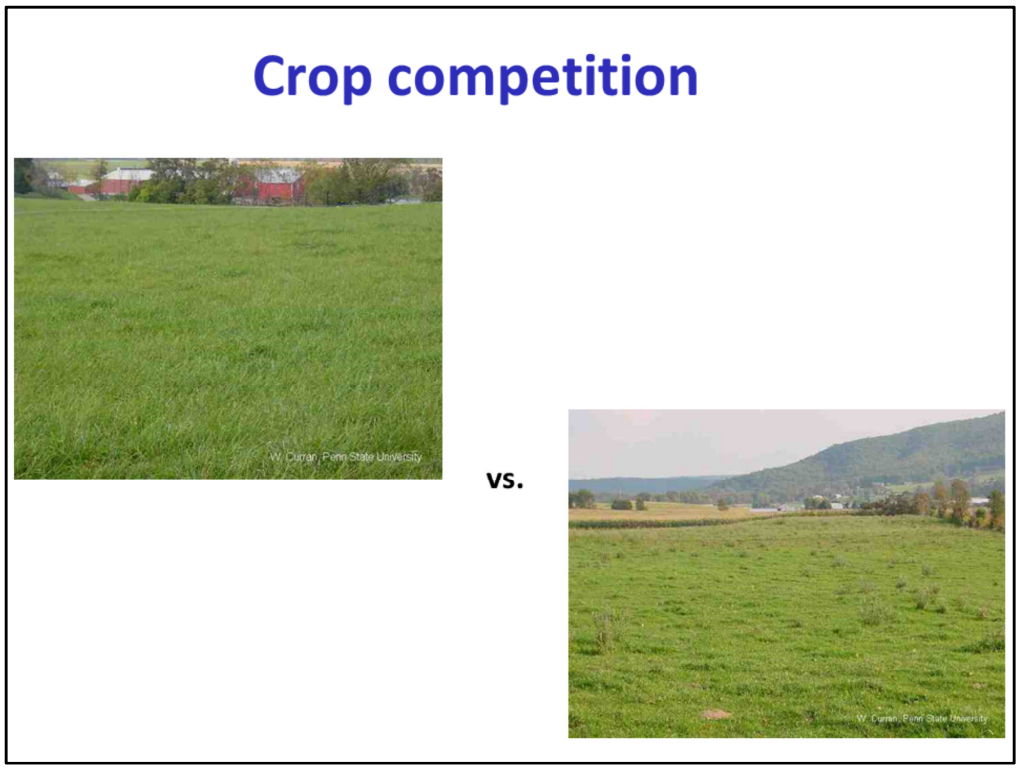
The final assessment factor – the ability to control. In determining this, understanding the biology of the weed is important as well as how different management tactics will influence control. Management factors include cultural, mowing and hand removal, the use of herbicides, and biological control tools.



Cultural weed control includes many practices that make the crop more competitive and weeds less. In perennial forage systems, cultural practices are often divided into those conducted during the seeding year and those conducted during established stands.(click)

During the seeding year, cultural controls include starting weed-free at planting time using herbicide or tillage, planting when the forage will be most competitive and the weeds least, using high quality seed, planting adapted species and varieties, testing soil and amending when necessary, selecting the correct crop seeding rate, not spreading additional weeds either with crop seed, tillage equipment, or during some other practice (click).

In established stands one of the goals it to maximize crop competition. You can do this by over seeding thin areas and renovating when necessary. Avoid overgrazing, control insects and pathogens if possible that can reduce or thin stands, and spot treat either mechanically or with herbicide to keep weeds at bay.



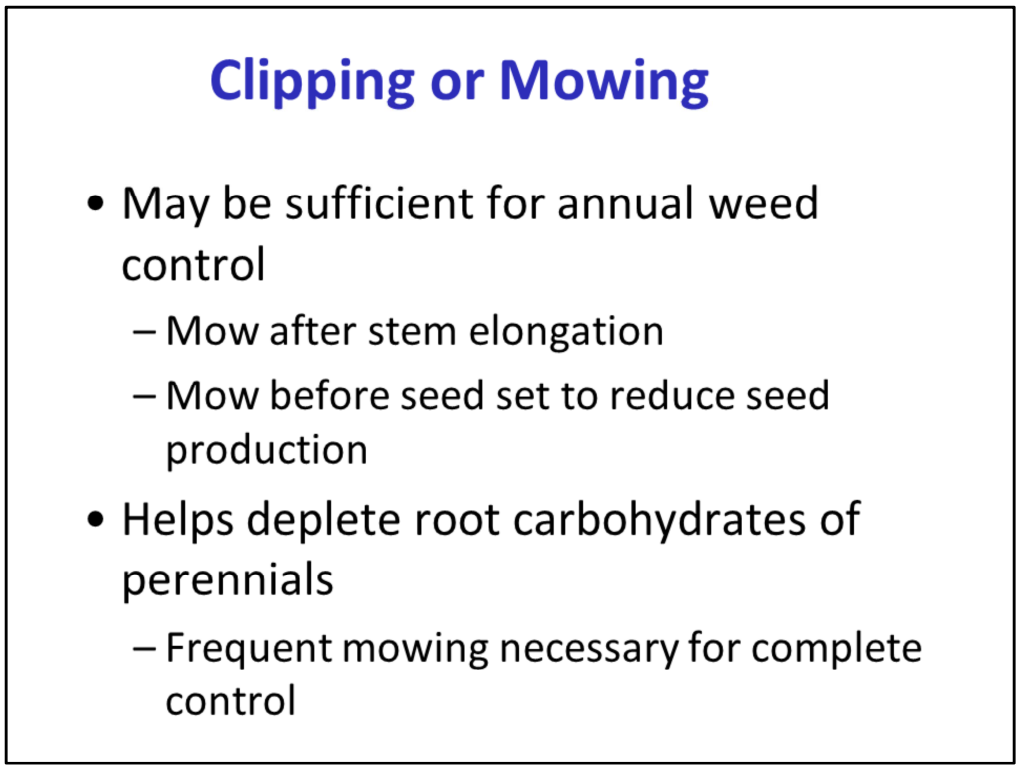
This photo shows an excellent stand of tall fescue that is managed through rotational grazing. Notice the uniformity of stand and lack of weed pressure. (click) this pasture is grazed more frequently and not managed to maximize crop competition. It is infested with biennial thistles which are not been eaten by the cattle and become more of a problem with the frequent low grazing.

Mowing and Hand Removal

- Repeated mowing (2 to 4 times/year) reduces weed competition, helps deplete root/vegetative reserves, prevents seed production

- Particularly important during establishment year – mow when weeds are 8 to 10 inches tall
- For new or scattered weeds, dig, pull, or remove seedheads to prevent spread

Mowing and hand removal are key ways to manage weeds in pasture. Repeated mowing at 2 to 4 times per year greatly reduces weed competition. Mowing reduces carbohydrate reserves of both annuals and perennials as well as prevents seed production. Mowing is particularly important during the establishment year. In general mow the forage when weeds are 8 to 10 inches tall to reduce weed competition. Pull or dig new or scattered weeds before they become a problem.



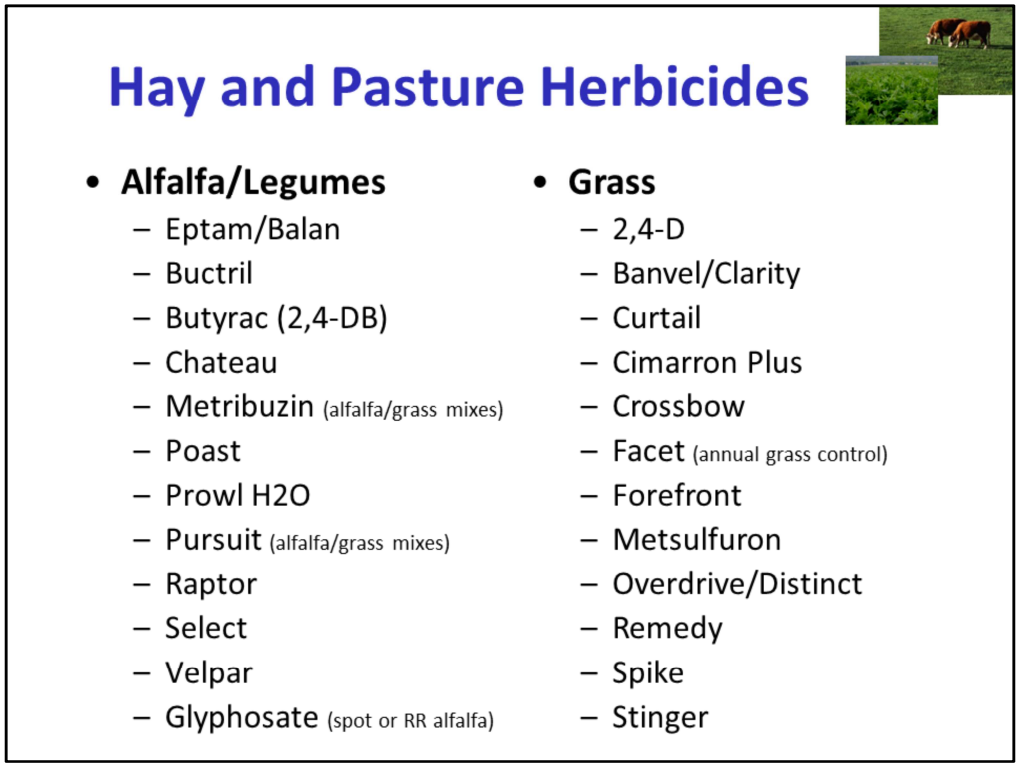
Clipping or mowing may be sufficient for annual weed control in many pasture systems. Mow the weeds after stem elongation and before seed set. Again, mowing helps to deplete vegetative carbohydrates which can help manage perennials.

Herbicides for Hay and Pasture Weeds

- Can provide convenient, economical, effective weed control
- Without herbicides, cultural and mechanical control options more important
- Thin or irregular stands may require overseeding or renovation following herbicide application
- Spot spray scattered infestations
- Watch harvesting, feeding, and grazing restrictions

Visit your local extension service for specific recommendations

Herbicides are also available for weed management in pastures. Herbicides can provide a convenient, economical, and effective option for controlling weeds. Without herbicides, cultural and mowing tactics become more important tools for pasture management. Remember, thin or irregular stands will not thicken alone – they may require over seeding or renovation. Spot spray scattered weeds and be sure to pay attention of harvest, feeding, and grazing restrictions.



There are no new herbicides to discuss in forages. But, as a reminder here is a listing of herbicides that can be used in alfalfa or grass forages.

Typical herbicides used in pure-stand alfalfa include Butyrac (or 2,4-DB), Pursuit, Raptor, and Velpar. Poast and Select will control grassy weeds in alfalfa. Prowl H2O can now be used in alfalfa but must be applied before weed emergence. Only Pursuit and metribuzin are labeled for use in alfalfa/grass mixtures.

The list on the right includes products that can be used in grass pastures or hay settings. The typical herbicides used to control broadleaves in grass forages include 2,4-D, Clarity, Cimarron (or metsulfuron), Crossbow, and Remedy. Recently, much attention has been given to Milestone and ForeFront due to its effective weed control but some problems have occurred from improper use of manure from animals that have consumed forages that were treated with these herbicides. Please read the label carefully and abide by all the precautions for crop rotation and manure handling.

Also, most of these herbicides in the right column can also be used in CREP settings.

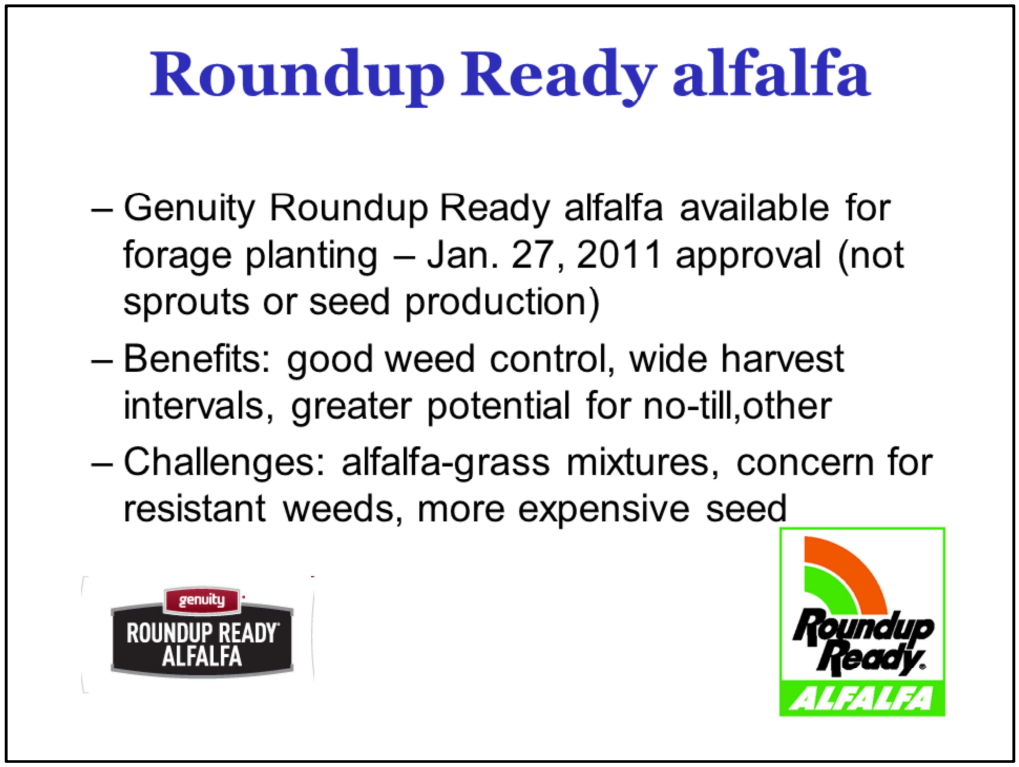
Keep in mind that herbicides used to control broadleaf weeds in grass pasture or hay will also kill or injure any legumes such as clovers, trefoil, and alfalfa that are in the stand.

Apply to actively growing alfalfa and weeds

- **Butyrac 200 2E** – 2,4-DB (several) – mustards, lambsquarters, pigweed, ragweed, etc. ($14/A)
- **Pursuit 2S/70DG** – imazethapyr (BASF) –Thunder – chickweed, mustards, pigweed, small annual grasses, etc. ($13/A)
- **Raptor 1S** – imazamox (BASF) - chickweed, mustards, lambsquarters, pigweed, medium size annual grasses, etc. ($20/A)
- **Select** – clethodim (Valent) – Arrow, Intensity, Section, Shadow, Volunteer, etc. – annual and perennial grasses ($6.25/A)

Apply to dormant alfalfa and weeds

- **Chateau 51WDG** – flumioxazin (Valent) – chickweed, henbit, etc. ($14/A)
- **Gramoxone 2S** – paraquat (Syngenta) – Firestorm, Parazone, Quik-Quat, etc. – winter annuals ($8/A)
- **Metribuzin 75DF/4L** – metribuzin (several) – Dimetric, Glory, Metri, TriCor, etc. – winter annuals ($6.50/A)
- **Prowl H2O 3.8CS** – pendimethalin (BASF) – winter and summer annuals ($15/A)
- **Velpar 2L/90DF** – hexazinone (Dupont) – winter annuals and dandelion ($27/A)



Optimum GAT corn and soybean introduction has been delayed. Optimum GAT confers resistance to glyphosate and ALS-inhibitor herbicides. DuPont and Pioneer have been working on this technology for the past several years, but no revised release date has been set.

Roundup Ready alfalfa varieties are once again available allowing over-the-top applications of glyphosate for weed control in alfalfa. Penn State research has shown that glyphosate is a very effective herbicide for control of weeds in Roundup Ready alfalfa. It has a wide harvest interval following application and good crop safety. It may also provide more opportunities for no-till alfalfa production. Penn State and other research suggests that RR alfalfa has the best fit in historically weedy fields with heavy grass pressure, late emerging weeds, heavy winter annual pressure, and problems with perennial weeds. In addition, it offers a number of convenience factors including the potential for fewer mistakes by spraying all the glyphosate resistant crops at the same time, potentially fewer trips over fields, greater opportunity for spot treatment without injury, and the ability to spray uniformly crop field edges that border other RR crops which could be a better deterrent for the evolution of herbicide resistant weeds. On the negative side, this technology makes less sense in fields with low weed populations where herbicides aren't often necessary, in fields consistently planted to other Roundup Ready crops that are repeatedly treated with glyphosate (since too much dependence on glyphosate can lead to resistant weeds), and in alfalfa-grass mixtures. Also it is reported that seed costs and tech fees are rather expensive compared to standard varieties.

Herbicides labeled for grass hay and pasture

- Older
  - Glyphosate - nonselective spot treatment
  - Crossbow (triclopyr + 2,4-D) - annual and perennial broadleaves
  - Banvel (dicamba) - annual and perennial broadleaves
  - Stinger (clopyralid) - annual and perennial broadleaves
  - 2,4-D - annual and perennial broadleaves
- Less Old
  - Cimmaron/Ally (metsulfuron) - annual and perennial broadleaves
  - Curtail (clopyralid+2,4-D) – annual and perennial broadleaves
  - Overdrive (dicamba) - same as Distinct
- Latest
  - Forefront HL (Milestone+2,4-D): broadleaves **(Watch hay/manure restrictions)**
  - Facet – some grass control

All products can kill legumes!

Common Herbicides for Grass Hay/Pastures

	Avg. herbicide cost/acre
• 2,4-D	<$5
• Banvel/Clarity (dicamba)	<$10
• Cimarron Plus (metsulfuron + chlorsulfuron)	$15
• Crossbow (triclopyr + 2,4-D)	$20-30
• ForeFront HL (aminopyralid + 2,4-D)	$15
• Roundup/glyphosate products	$5-10
– Spot treatments or renovation	
• Facet (quinclorac)	≈$25 (25 fl oz)

***The avg. cost does not represent the use of spray additives or application costs**
****Generic alternatives are available for some of these herbicides**

Selected Generic alternatives for grass hay/pasture

Active ingredient(s)	Tradename	Manufacturer	Alternative to:
Clopyralid	Clopyr AG Spur Pyramid	UPI Albaugh/Agri-Star Albaugh/Agri-Star	Stinger
Metsulfuron-methyl	Accurate Ciramet Metsulfuron-methyl Metsulfuron 60EG AG Plotter	Cheminova AgSurf FarmSaver.com Arysta LifeScience Rotam North Amer.	Cimarron 60DF (DuPont no longer sells the single ai product for pastures)
Metsulfuron-methyl + chlorsulfuron	Chisum	Cheminova	Cimarron Plus
Triclopyr + 2,4-D	Candor Crossroad	NuFarm Albaugh/Agri-Star	Crossbow

Effect of Herbicides on Selected Pasture Weeds

Weed	2,4-D	Clarity (dicamba)	2,4-D + Clarity	Cimarron Plus	Crossbow	ForeFront	Roundup (spot)
Milkweed	6	8	**8+**	N	7+	6	7+
Poison hemlock	7	8	**9**	N	**9**	7	**9**
Pokeweed	7	7	7		**9**	8	8
E. Black nightshade	7+	**8+**	8	8	**8+**	**9**	**9**
Horsenettle	7	8	**8+**	6	**8+**	**9**	8
Jimsonweed	8	**9+**	**9+**	**9+**	**9**	8	**9**
Buttercup	**8+**	8	**9**	**9+**	**9**	**9**	**9**
Lambsquarters	**9**	**9+**	**9+**	**9+**	**9+**	**9**	**9**
Pigweed	**9**	**9**	**9+**	**9+**	**9**	8	**9**
Ragweed	**9**	**9**	**9+**	7	**9+**	**9**	**9+**
White snakeroot	8	**9**	**9**	N	**9**	8	8
Plantain species	**9**	8	**9+**	**9**	**9**	7+	**9**
Smooth bedstraw	7	N	7	N	**8+**	**9**	**9**
Canada thistle	8	8	**8+**	**8+**	8	**9+**	8
Multiflora rose	6	6	7+	**8+**	**8+**	7+	8

***Weed control ratings: 10 = 95-100%, 9 = 85-95%, 8 = 75-85%, 7 = 65-75, 6 = 55-65%, N = no control**

Effect of Herbicides on Selected Pasture Weeds

Weed	2,4-D	Clarity (dicamba)	2,4-D + Clarity	Cimarron Plus	Crossbow	ForeFront	Roundup (spot)
Milkweed	6	8	**8+**	N	7+	6	7+
Poison hemlock	7	8	**9**	N	**9**	7	**9**
Pokeweed	7	7	7		**9**	8	8
E. Black nightshade	7+	**8+**	8	8	**8+**	**9**	**9**
Horsenettle	7	8	**8+**	6	**8+**	**9**	8
Jimsonweed	8	**9+**	**9+**	**9+**	**9**	8	**9**
Buttercup	**8+**	8	**9**	**9+**	**9**	**9**	**9**
Lambsquarters	**9**	**9+**	**9+**	**9+**	**9+**	**9**	**9**
Pigweed	**9**	**9**	**9+**	**9+**	**9**	8	**9**
Ragweed	**9**	**9**	**9+**	7	**9+**	**9**	**9+**
White snakeroot	8	**9**	**9**	N	**9**	8	8
Plantain species	**9**	8	**9+**	**9**	**9**	7+	**9**
Smooth bedstraw	7	N	7	N	**8+**	**9**	**9**
Canada thistle	8	8	**8+**	**8+**	8	**9+**	8
Multiflora rose	6	6	7+	**8+**	**8+**	7+	8

***Weed control ratings: 10 = 95-100%, 9 = 85-95%, 8 = 75-85%, 7 = 65-75, 6 = 55-65%, N = no control**

Follow Herbicide Grazing and Haying Restrictions

(taken from PSU Agronomy Guide)

Table 2.6-9. Grazing and haying restrictions for grass forage and pasture herbicides.

Herbicide	*Type of Animal*	*Interval Between Application and Grazing*	*Interval Between Application and Haying*	*Comments*
2,4-D amine	Lactating dairy	7 days	30 days	Remove meat animals from treated area 3 days before slaughter. 2,4-D labels vary. See specific label of product used.
2,4-D LVE	Lactating dairy	7 days	30 days	Remove meat animals from treated area 3 days before slaughter. 2,4-D labels vary. See specific label of product used.
Cimarron Plus (metsulfuron + chlorsulfuron)	All	None	None	Be cautious of crop rotation restrictions. See label for details.
Clarity/Banvel (dicamba)	Lactating dairy	7 days if < 1 pt 21 days if 1–2 pt 40 days if 2–4 pt	37 days if < 1 pt 51 days if 1–2 pt 70 days if 2–4 pt	No waiting period between treatment and grazing for nonlactating animals. Remove meat animals from treated areas 30 days prior to slaughter.
Crossbow (2,4-D + triclopyr)	Lactating dairy Other livestock	Do not graze until next season None	14 days 14 days	Remove meat animals from treated areas or dried hay 3 days prior to slaughter.
ForeFront (aminopyralid + 2,4-D)	All	None	7 days	Do not transfer grazing animals for 3 days from treated areas to areas with Milestone sensitive-species. Do not spread manure to areas where sensitive-species are or will be grown.
Metsulfuron	All	None	None	Do not seed to other crops for 1 or more years. See label for restrictions.
Milestone (aminopyralid)	All	None	None	Do not transfer grazing animals for 3 days from treated areas to areas with Milestone-sensitive species. Do not spread manure to areas where sensitive-species are or will be grown.
Overdrive/Distinct (dicamba + diflufenzopyr)	All	None	None	Do not apply more than 8 oz/A per season.
Roundup/glyphosate	All	Spot—7 days Renovate—56 days	Spot—7 days Renovate—56 days	Use as spot treatment. Do not treat more than one-tenth of any acre. Leaves no soil residue.
Spike (tebuthiuron)	All	< 20 lb/A—none > 20 lb/A—one year	One year	Leaves soil residue up to 2 years.
Stinger (clopyralid)	All	None	None	Do not use hay or straw from treated areas for compost or mulch on susceptible broadleaved crops.

Top Choices

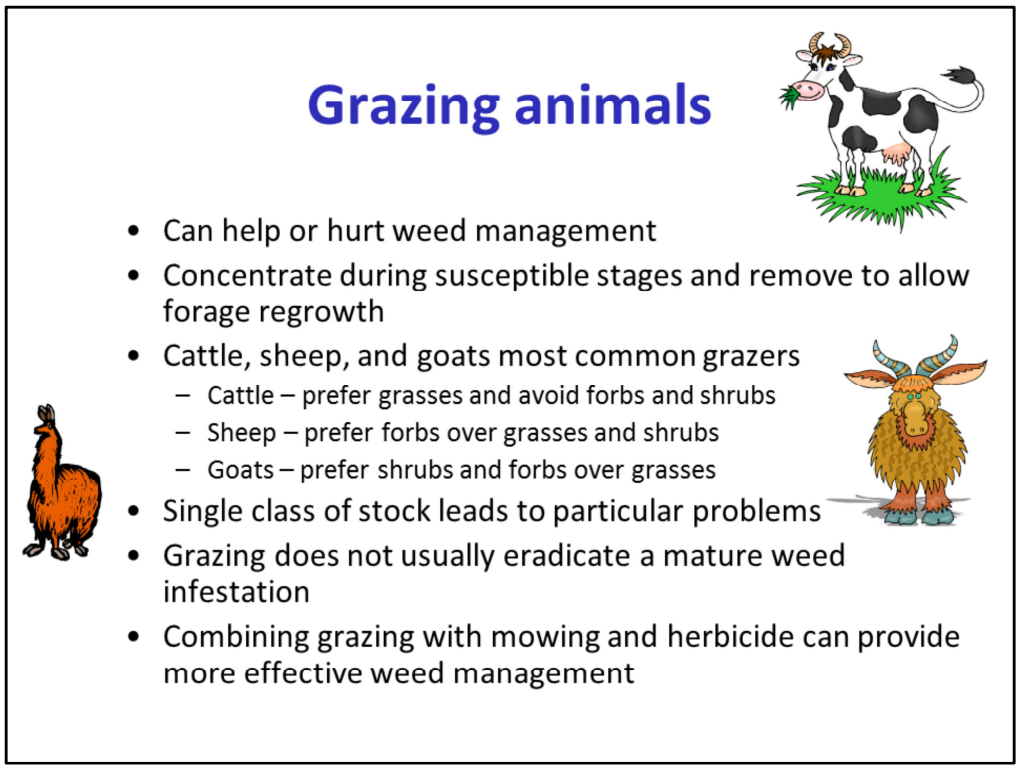
- Bedstraw – late June/early July
  - Forefront HL, Crossbow
- Biennial thistles – bull, musk, plumeless – late fall/early spring
  - Forefront HL, Stinger/clopyralid, 2,4-D+Banvel
- Canada thistle – bud to bloom or fall
  - Forefront HL, Stinger/clopyralid, 2,4-D+Banvel
- Horsenettle – bud to bloom
  - ForeFront HL, Crossbow, Banvel
- Multiflora rose – bloom or fall
  - Cimarron Plus, Crossbow
- Spiny pigweed - seedlings
  - Cimarron Plus or Metsulfuron
- Annual grasses
  - Facet

ForeFront HL: Watch hay/manure restrictions

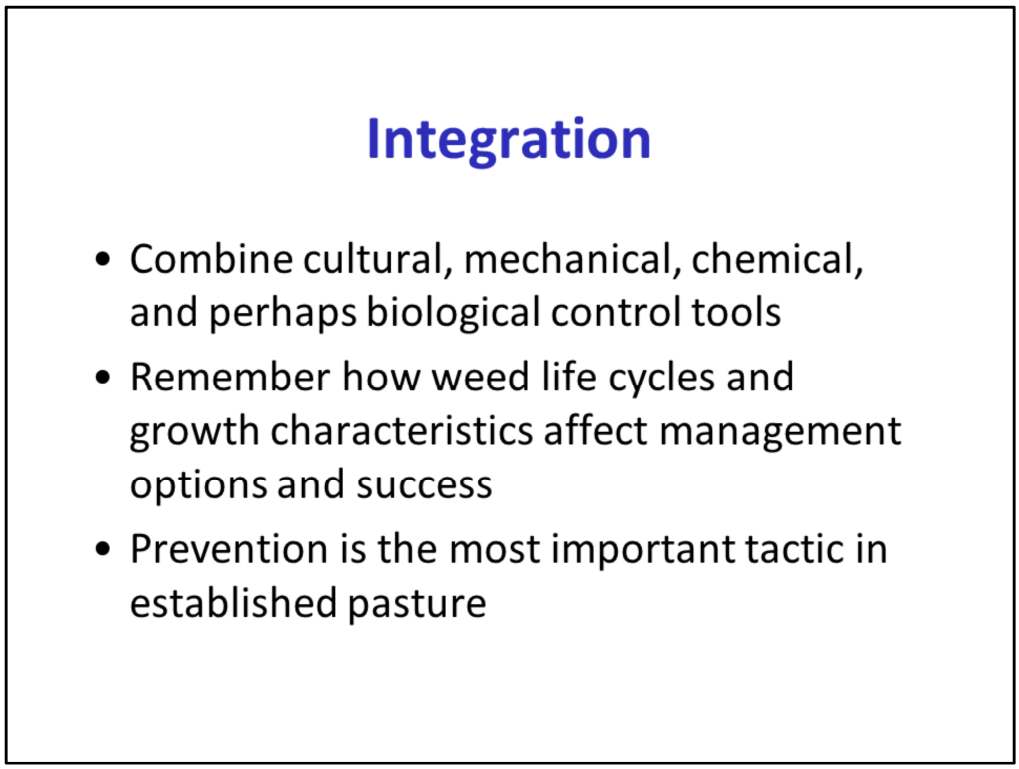
Biological Control

- Introduction or manipulation of a pest's natural enemies – suppress pest population
- Can include insects, mites, nematodes, pathogens, and grazing animals
- Can be cost effective, safe, self perpetuating, and well suited for IPM
- Long-term, slow, species specific, high rate of failure
- Best suited for perennial production systems

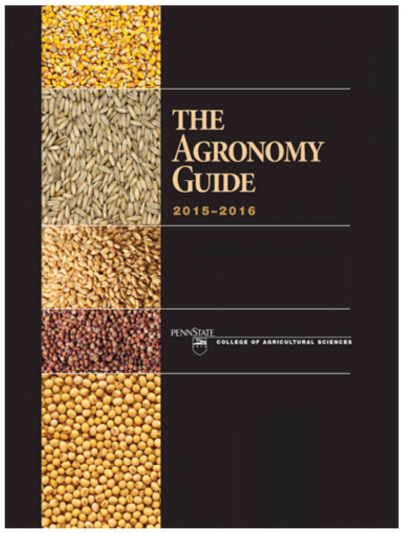
Biological control is defined as the manipulation of a pest's natural enemies to suppress or manage pest populations. Biological control of weeds has generally focused on the use of insects, mites, nematodes, plant pathogens or grazing animals. There are a number of advantages to adopting a successful biocontrol program include cost effectiveness, safety, self perpetuation at least in theory, and its well suited to integrated pest management where multiple tactics are employed. In general, biocontrol programs targeting weeds have been most successful in perennial production systems where the host or weed and the biocontrol tool (insect of pathogen) can coexist for longer periods of time with constant interruption (more than one year). In the Northeast, pasture systems are one of the better agroecosystems that could support a biocontrol approach.



Grazing animals could probably contribute more than they do to biosensor of weeds in pasture, but as with many things, it requires more time, money, and management. Grazing animals used correctly can help control weeds, but if overgrazing occurs, weeds can proliferate. If possible, concentrate livestock during susceptible stages of growth (seedling and prior to seed formation) and remove them in a timely fashion to allow for forage crop regrowth. Cattle, sheep, and goats are the most common grazing livestock in the Northeast. Each class of livestock has particular traits that can make it helpful or a in some cases detrimental. Cattle like to graze grass and tend to avoid forbs and shrubs, while sheep prefer the forbs and tend to leave the grasses and shrubs. Goats like shrubs and will tend to leave the forbs and grasses until last. As you can see from this information, a single class of livestock favors certain species and avoids others – this can lead to problems. Also, grazing is not a herbicide – it will not completely or quickly control a mature weed infestation. However, grazing with mixed stock combined with other weed management tools can provide an effective weed management program.



So, in closing, combine cultural, mechanical, chemical, and perhaps biological control tools to achieve integrated solutions. Remember how weed life cycles and growth characteristics affect management options and success and finally, prevention is probably the most important tactic in established pasture systems.



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