Weed Management in Hay and Pasture

Presented by:
Bill Curran
PennState

NORTHEAST SARE Sustainable Agriculture Research & Education Professional Development Program

New England Forage & Weed ID and Management Training Project

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

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

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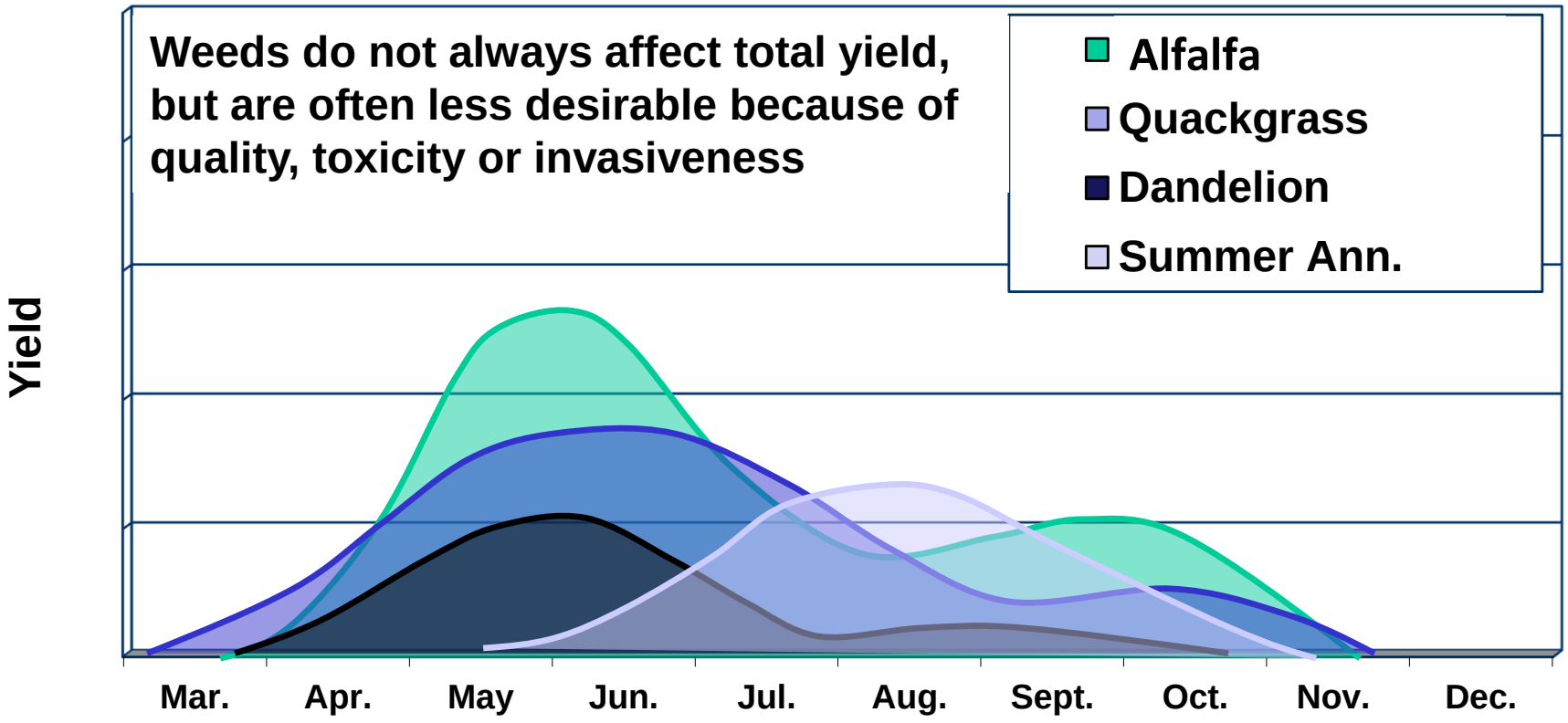
What's the production goal?

Yield and Quality


W. Curran, Penn State University

Forage Yield =
Forage Crop + Weeds

Growth and Yield of Several Plants



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

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

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.

Poisonous Plants

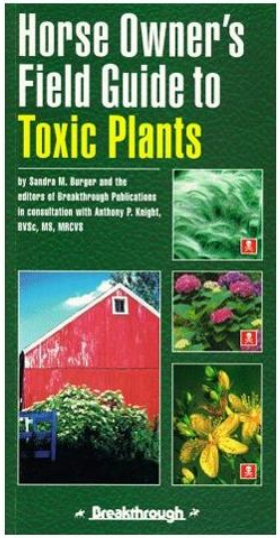
- Most poisonous plants must be consumed in large enough quantities to cause animal death
  - Many have undesirable taste and animals typically won't consume enough, *UNLESS…*
  - Forages are limited or unavailable
  - Especially during times of overgrazing, drought, or long winter seasons

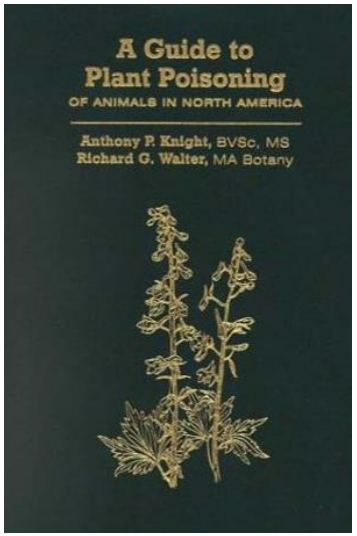
Info on Poisonous Plants

- 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





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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

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

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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

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Ability to Control

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

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.

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

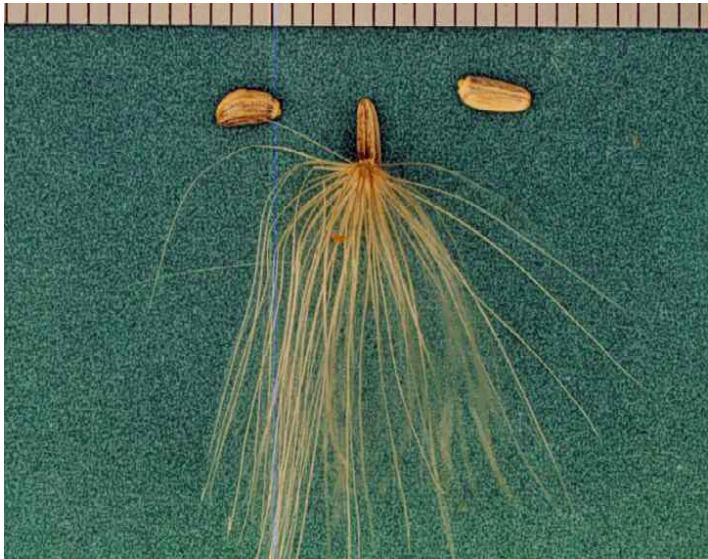
Weed Seed - “their” key to success

- 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

Burdock

Pigweed

Bull thistle

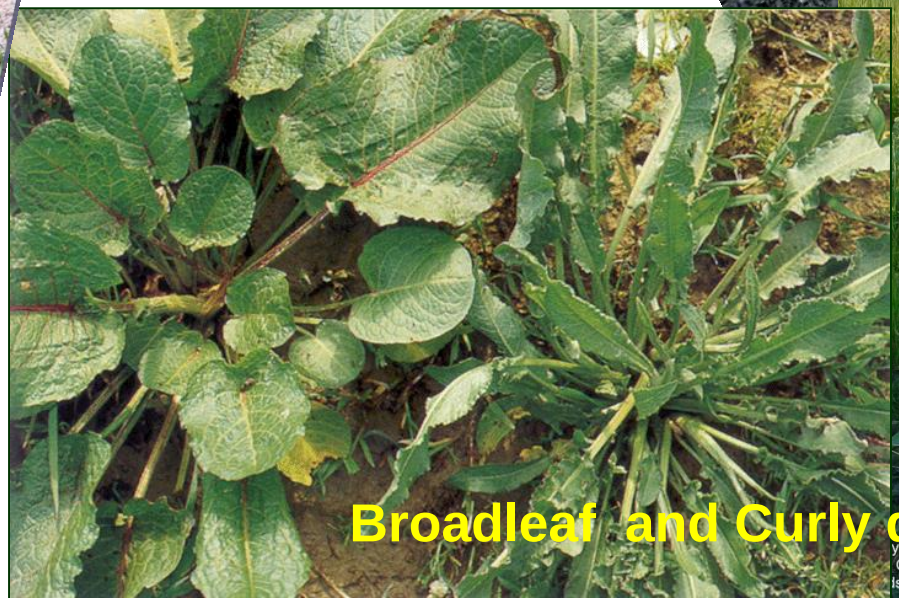



Weed Seed Production

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

Simple Perennial Examples

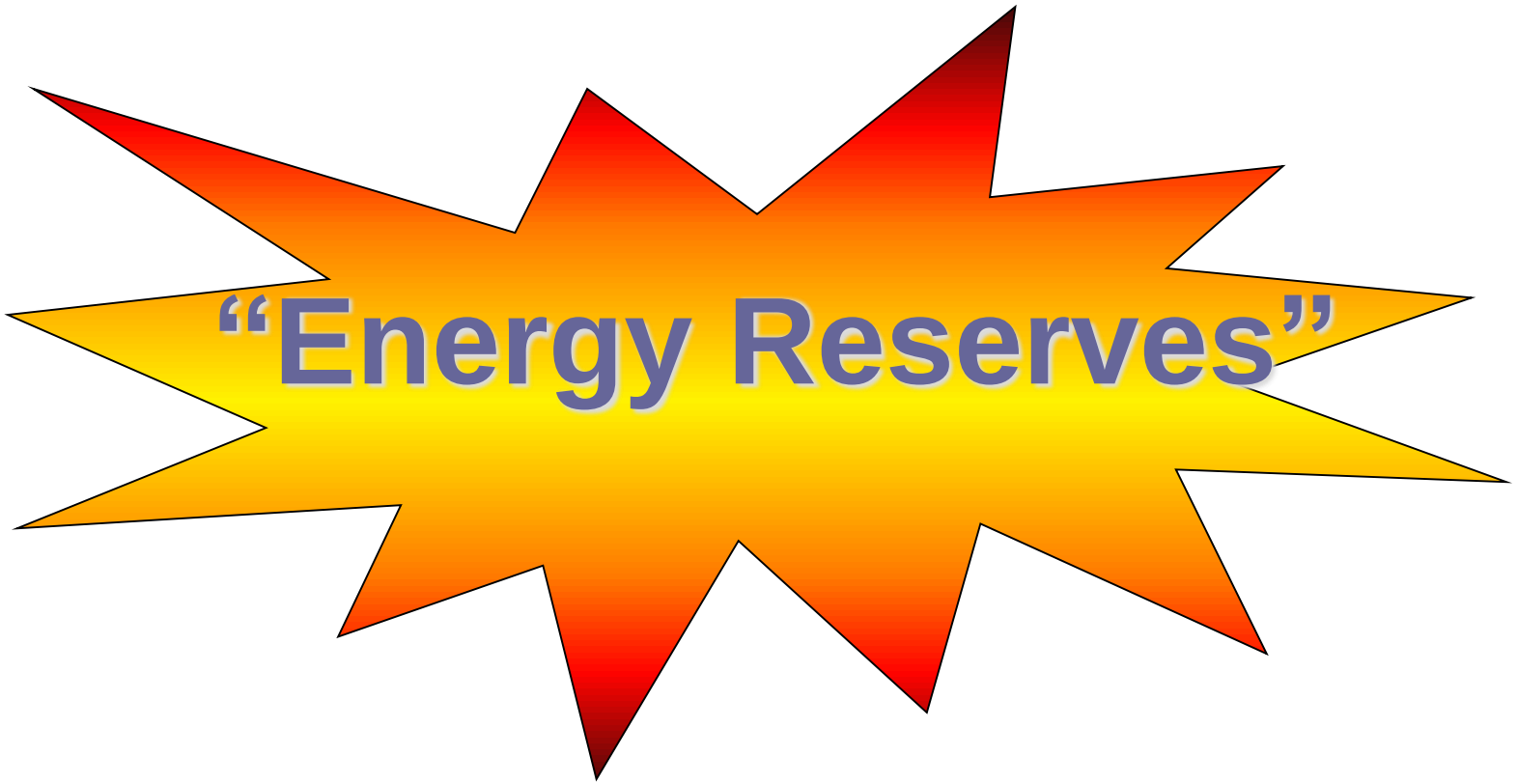


Creeping Perennial Examples

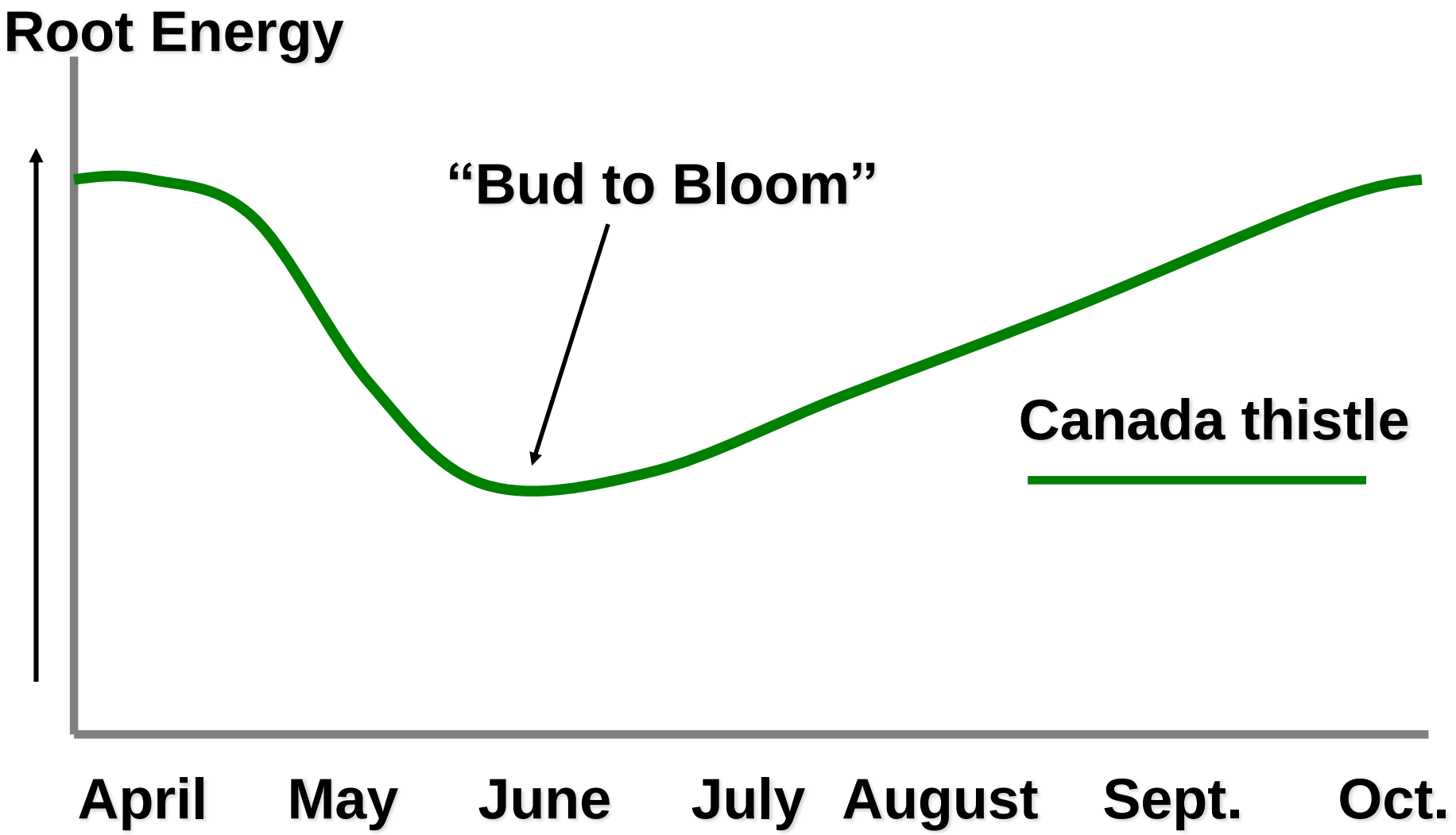
Perennial structures

- 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 are the:



Perennial Broadleaf Root Reserves



But, don’t forget about seeds

Multiflora rose

Curly dock

Canada thistle

Ability to Control

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

Cultural weed control

Seeding year

- Weed-free soil preparation
- Optimum planting date and seeding rate
- High quality seed
- Adapted species/varieties
- Soil test and fertilize
- Don't import weeds

Established

- Maximize crop competition
- Timely mowing
- Overseed thin areas
- Renovate when necessary
- Don't overgraze
- Consider insects and pathogens
- Spot treat

Crop competition

vs.

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

Clipping or Mowing

- May be sufficient for annual weed control
  - Mow after stem elongation
  - Mow before seed set to reduce seed production
- Helps deplete root carbohydrates of perennials
  - Frequent mowing necessary for complete control

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

Hay and Pasture Herbicides

- **Alfalfa/Legumes**
  - Eptam/Balan
  - Buctril
  - Butyrac (2,4-DB)
  - Chateau
  - Metribuzin (alfalfa/grass mixes)
  - Poast
  - Prowl H2O
  - Pursuit (alfalfa/grass mixes)
  - Raptor
  - Select
  - Velpar
  - Glyphosate (spot or RR alfalfa)
- **Grass**
  - 2,4-D
  - Banvel/Clarity
  - Curtail
  - Cimarron Plus
  - Crossbow
  - Facet (annual grass control)
  - Forefront
  - Metsulfuron
  - Overdrive/Distinct
  - Remedy
  - Spike
  - Stinger

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)

Roundup Ready alfalfa

- Genuity Roundup Ready alfalfa available for forage planting – Jan. 27, 2011 approval (not sprouts or seed production)
- Benefits: good weed control, wide harvest intervals, greater potential for no-till,other
- Challenges: alfalfa-grass mixtures, concern for resistant weeds, more expensive seed

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**

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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.

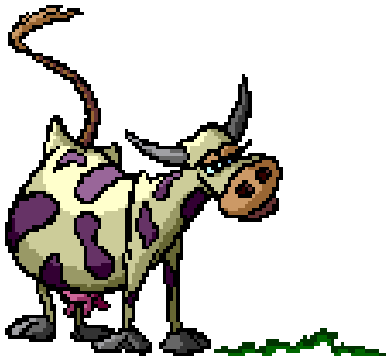
Herbicide	*Type of Animal*	*Interval Between Application and Grazing*	*Interval Between Application and Haying*	*Comments*
2,4-D amine	Lactating dairy	7 days	30 days	Remove meat animals from treated area 3 days before slaughter. 2,4-D labels vary. See specific label of product used.
2,4-D LVE	Lactating 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	Do not graze until next season	14 days	Remove meat animals from treated areas or dried hay 3 days prior to slaughter.
	Other livestock	None	14 days	
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

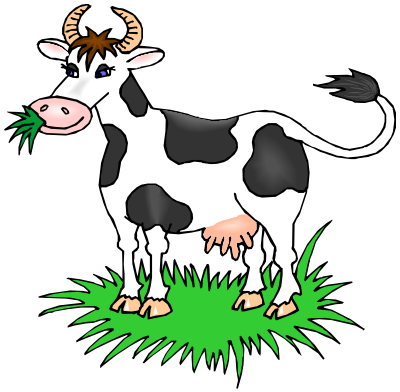
ForeFront HL: Watch hay/manure restrictions

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

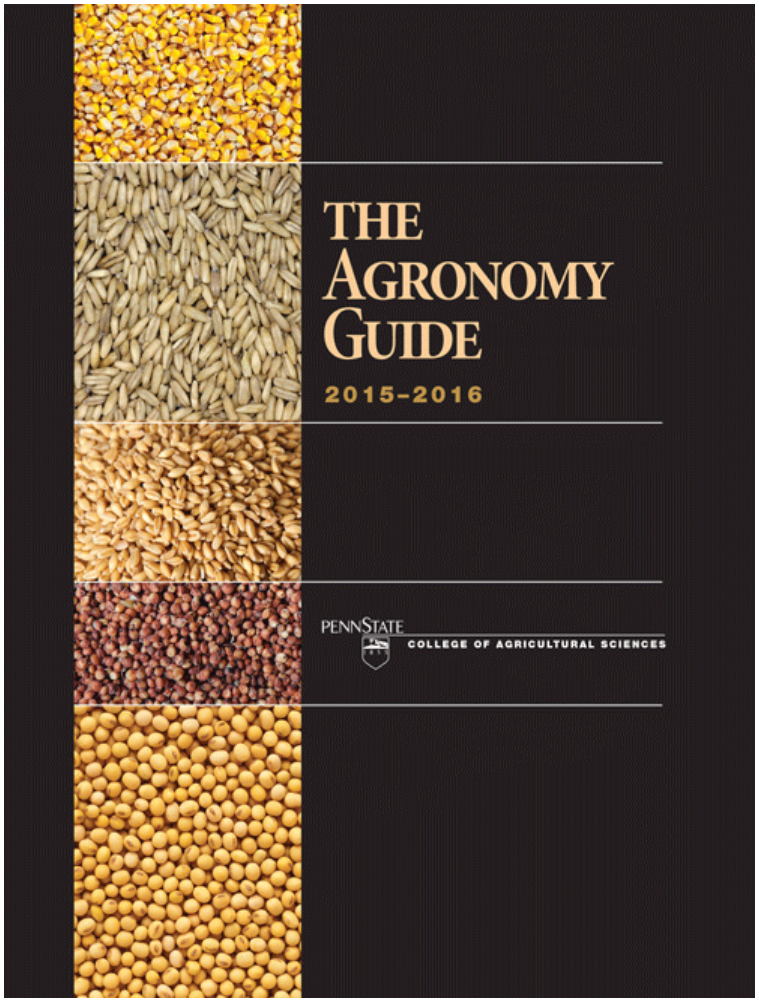
Grazing animals



- Can help or hurt weed management
- Concentrate during susceptible stages and remove to allow forage regrowth
- Cattle, sheep, and goats most common grazers
  - Cattle – prefer grasses and avoid forbs and shrubs
  - Sheep – prefer forbs over grasses and shrubs
  - Goats – prefer shrubs and forbs over grasses
- Single class of stock leads to particular problems
- Grazing does not usually eradicate a mature weed infestation
- Combining grazing with mowing and herbicide can provide more effective weed management

Integration

- Combine cultural, mechanical, chemical, and perhaps biological control tools
- Remember how weed life cycles and growth characteristics affect management options and success
- Prevention is the most important tactic in established pasture



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