

UNDERSTANDING THE HORSE INDUSTRY..... BMPS THAT WORK



Penn State **Extension**

Horses 101: Understanding Horses, Owners, and the Industry

- **The Equine Industry**
- **The Horse Owner**
- **Survey of Adopted Best Management Practices**
- **The Horse - Behavior and Health Considerations**
- **Grazing BMPs**
- **Utilizing ACAs**
- **Weed Management**
- **Manure Management**
- **Fencing Considerations**
- **Succeeding with Horse Owners**

The Horse Industry in Pennsylvania



Economic Impact of PA Equine Industry

- **Number of Horses:** **215,693**
- **Annual Sale of Horses & Related Activities:** **\$435 million**
- **Related Assets/Investments:** **\$8.27 billion**
- **Total taxes:** **\$53.2 million**
- **Employment Compensation:** **\$412.3 million**
- **Economic Impact of Industry:** **\$615.1 million**

** Based on 2003 Economic Impact Study*

Horse Population - Breed Numbers

Light Horse Breeds

- Quarter Horses – 40,110
- Standardbreds – 21,132
- Thoroughbreds – 21,117
- Arabians & Half Arabians – 11,154
- Morgans – 10,136
- Appaloosas – 7,985
- Other light horse breeds – 7,248



Draft Breeds

- Belgians – 6,202
- Percherons – 3,000
- Other draft horse breeds – 1,831

Horse Population -Racehorse Breeds



Racing Industry

Standardbreds -14,815

Thoroughbreds - 11,550

Non Racing

Standardbreds -6,317

Thoroughbreds - 9,567

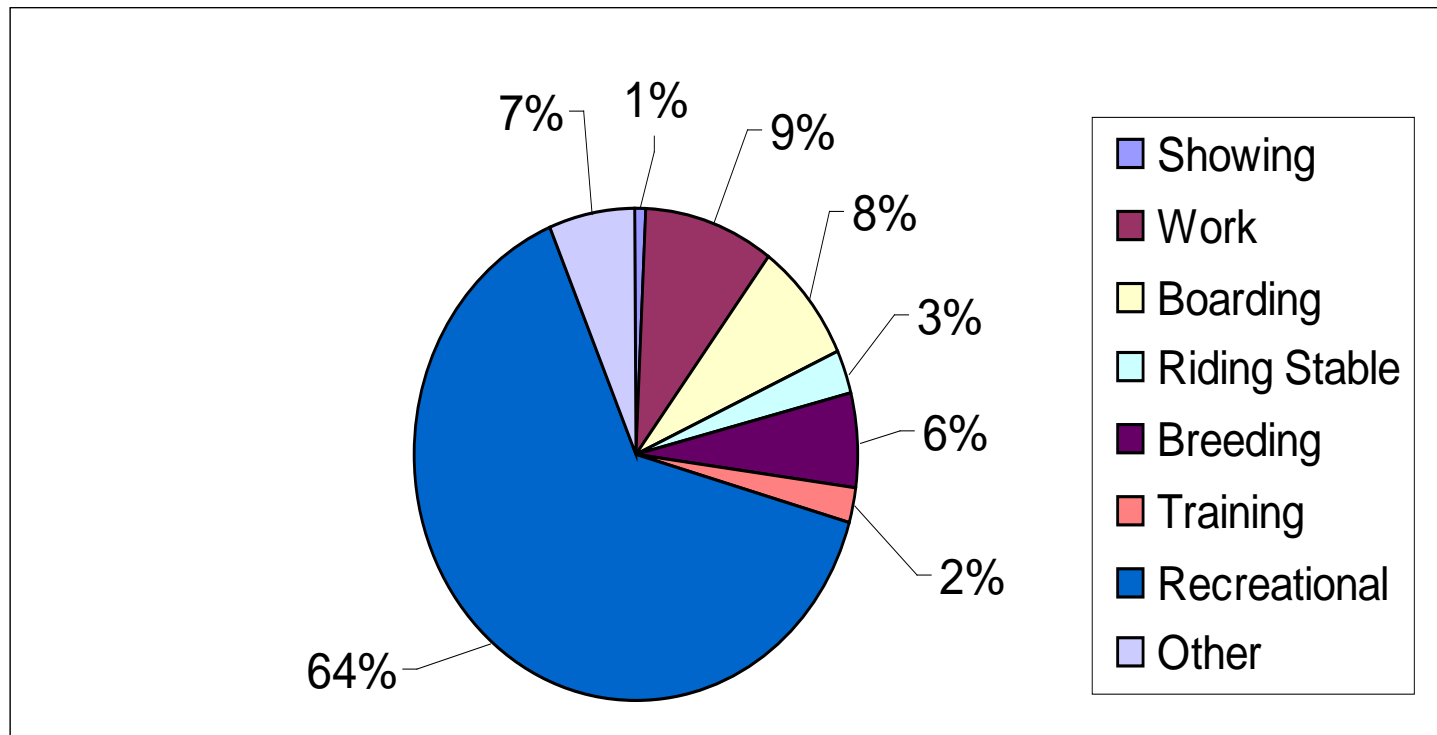
Use of Horses in Pennsylvania

- ✓ 38,000 households own horses
- ✓ 7,800 participate in activities without owning horses
- ✓ 27.0 %- Trail Riding/Recreation
- ✓ 22.0 %- Breeding
- ✓ 20.0 %- Shows, Events, Clinics



Types of Equine Operations

64% of horse farms are operated for recreational use.



Value of Horses by Region

Estimated value of Pennsylvania's Equine - \$1.3 billion.

(1998 - Not all horse farms reported county data)

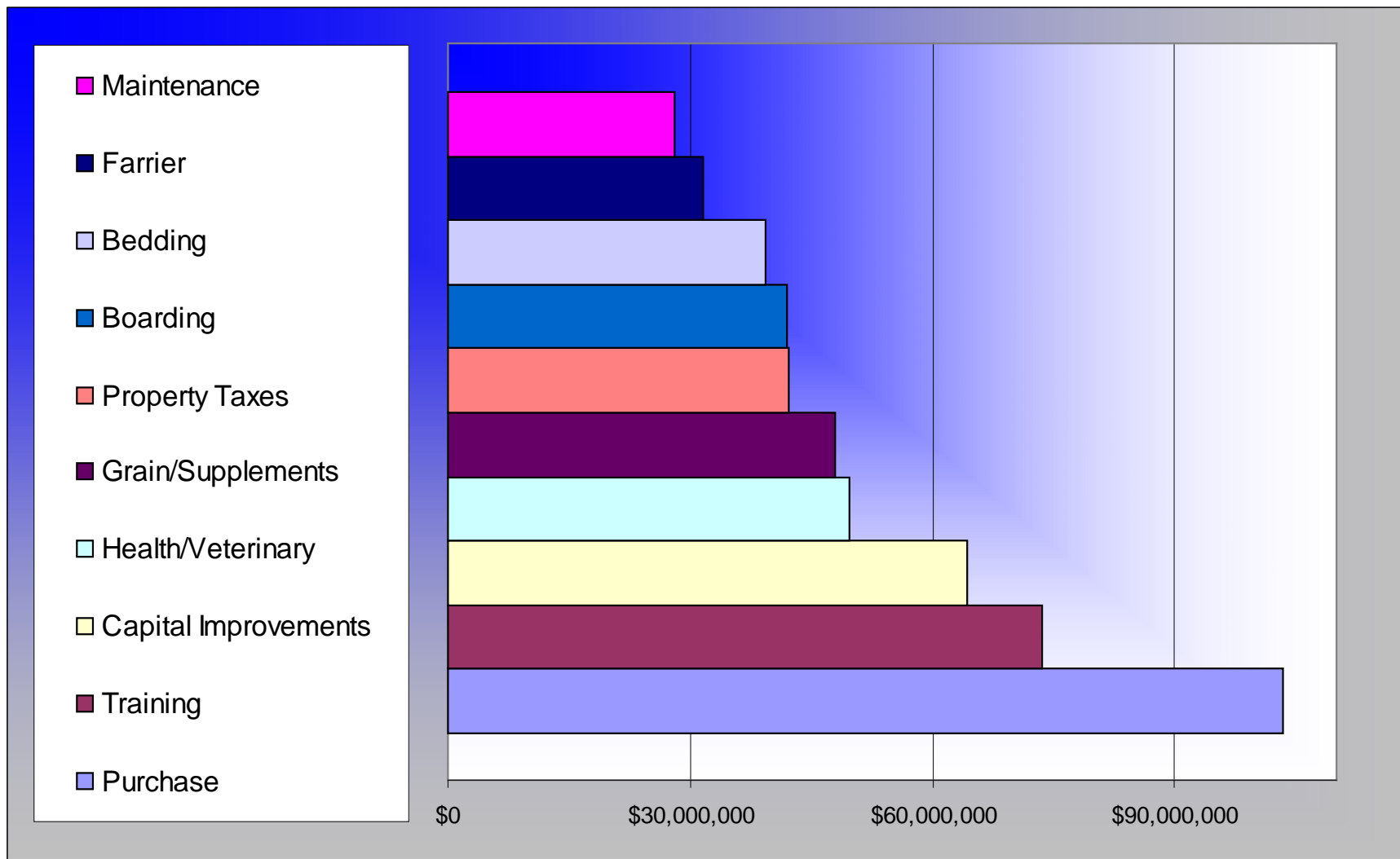
| <i>District</i> | <i>Total \$ Value</i> | <i>No. of Horses</i> | <i>Total \$ Value Per Head</i> |
|-----------------|-----------------------|----------------------|--------------------------------|
| Central | \$108,145,636 | 23,720 | \$4,559.26 |
| East Central | \$31,467,648 | 6,902 | \$4,559.21 |
| North Central | \$42,542,901 | 9,330 | \$4,559.80 |
| North Eastern | \$34,434,821 | 7,553 | \$4,559.09 |
| North Western | \$67,932,637 | 14,902 | \$4,558.63 |
| South Central | \$91,982,353 | 20,177 | \$4,558.77 |
| South Eastern | \$205,593,834 | 45,096 | \$4,559.03 |
| South Western | \$58,953,036 | 12,931 | \$4,559.05 |
| West Central | \$52,081,689 | 24,354 | \$2,138.53 |

Equine Related Income

Equine income, sales, and related equine and agricultural activities (1998)

| | | | |
|-----------------|--------------|-------------------|---------------|
| Show Winnings | \$8,977,772 | Training | \$51,610,565 |
| Racing Purses | \$69,936,916 | Sales Preparation | \$2,012,266 |
| Rodeo Winnings | \$417,430 | Boarding | \$64,824,184 |
| Tourism | \$514,650 | Sale of Horses | \$129,147,505 |
| Trail Riding | \$11,057,556 | Stallion Fees | \$10,956,259 |
| Manure Sales | \$930,615 | Mare Care | \$8,644,185 |
| Feed Sales | \$2,370,384 | Lessons | \$3,742,045 |
| Equipment Sales | 1,641,699 | Leasing Horses | \$8,564,507 |
| Other 1 | 43,923,841 | Judging | \$871,911 |

Equine Related Expenses



Horse Owners in Pennsylvania



The Horse Owner (source: HIA, 1997)



- ✓ Average age – 31 (getting older)
- ✓ 59% female, professional
- ✓ Average income – \$47,600
 - 34% less than \$50,000
 - 28% over \$100,000
- ✓ 97% ride for pleasure, 6% for competition
- ✓ Ride infrequently unless involved in competition
- ✓ No agricultural background

Results of a Penn State On-line Survey of Equine Industry's Best Management Practices

Pastures

- ✓ 65% used a rotation system
- ✓ 39% had a pasture management plan
- ✓ 25% continuously grazed
- ✓ 24% allowed grasses to recover to recommended heights
- ✓ 75% reported >80% canopy cover

Pastures continued

- ✓ 96% mowed at least 4 times a year
- ✓ 8% regularly use pasture herbicides; 25% sometimes use, 62% never used
- ✓ 50% never soil test
- ✓ 25% test every 3 years
- ✓ 46% apply lime without testing
- ✓ 37% never apply lime



Sacrifice Lots (ACAs)

✓ 54% did not use sacrifice lots

.....Of those that used sacrifice lots

✓ 68% used them to protect pastures during inclement weather

✓ 61% used them to prevent over eating

✓ 31% used them to restrict exercise



Manure Management

- ✓ 34% composted and used the manure; 8% disposed of compost off site
- ✓ 11% used fresh; 11% hauled fresh off site
- ✓ 2% had commercial contractors remove manure
- ✓ 52% stored manure on an unprepared site; 36% had a hard pack surface, 4% had a covered improved structure



Conservation Planning

- ✓ 51% did not have surface water on the farm
- ✓ 13% had an E & S or Conservation Plan
- ✓ 22% had a nutrient management plan
- ✓ 3% reported obvious soil erosion
- ✓ 25% indicated some erosion
- ✓ 76% had a water run-off system for buildings



Choosing BMPs for Equine Operations

Consider.....

- * Equine grazing behavior
- * Equine health
- * Equine “social” behavior
- * Farm manager and “customer” opinions and goals
- * Economics



Horse Health Considerations When Selecting BMPs



The equine digestive system is “unique” and designed for forage consumption. Management challenges may lead to colic and digestive upset

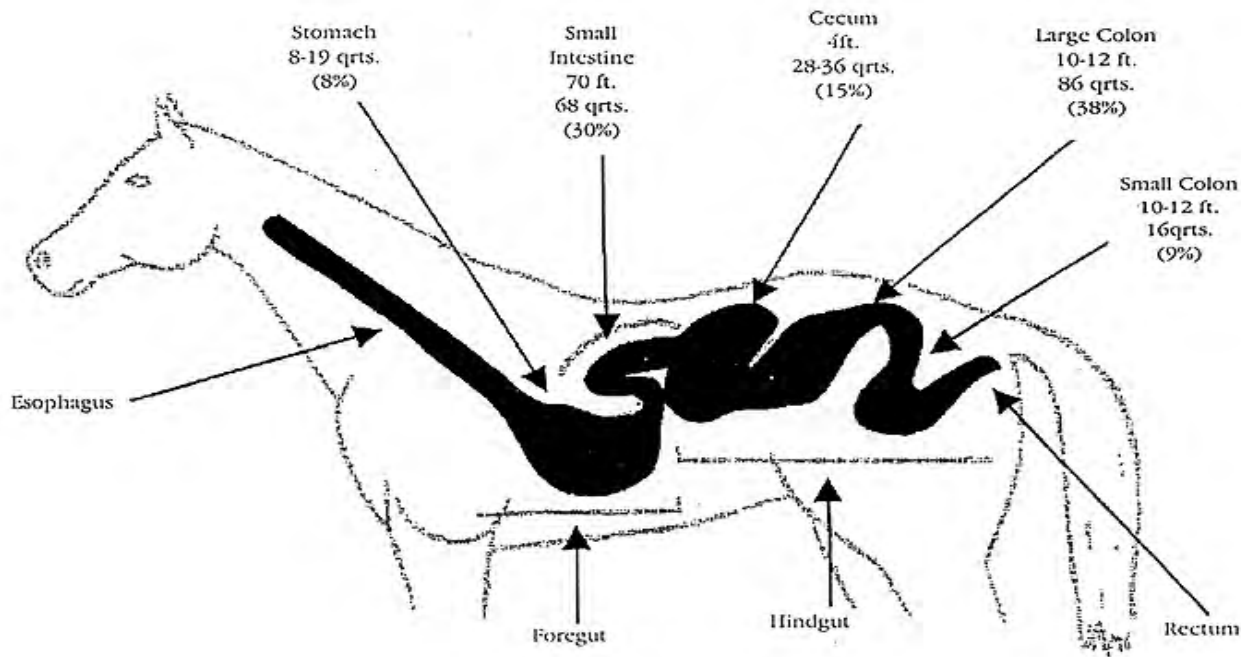
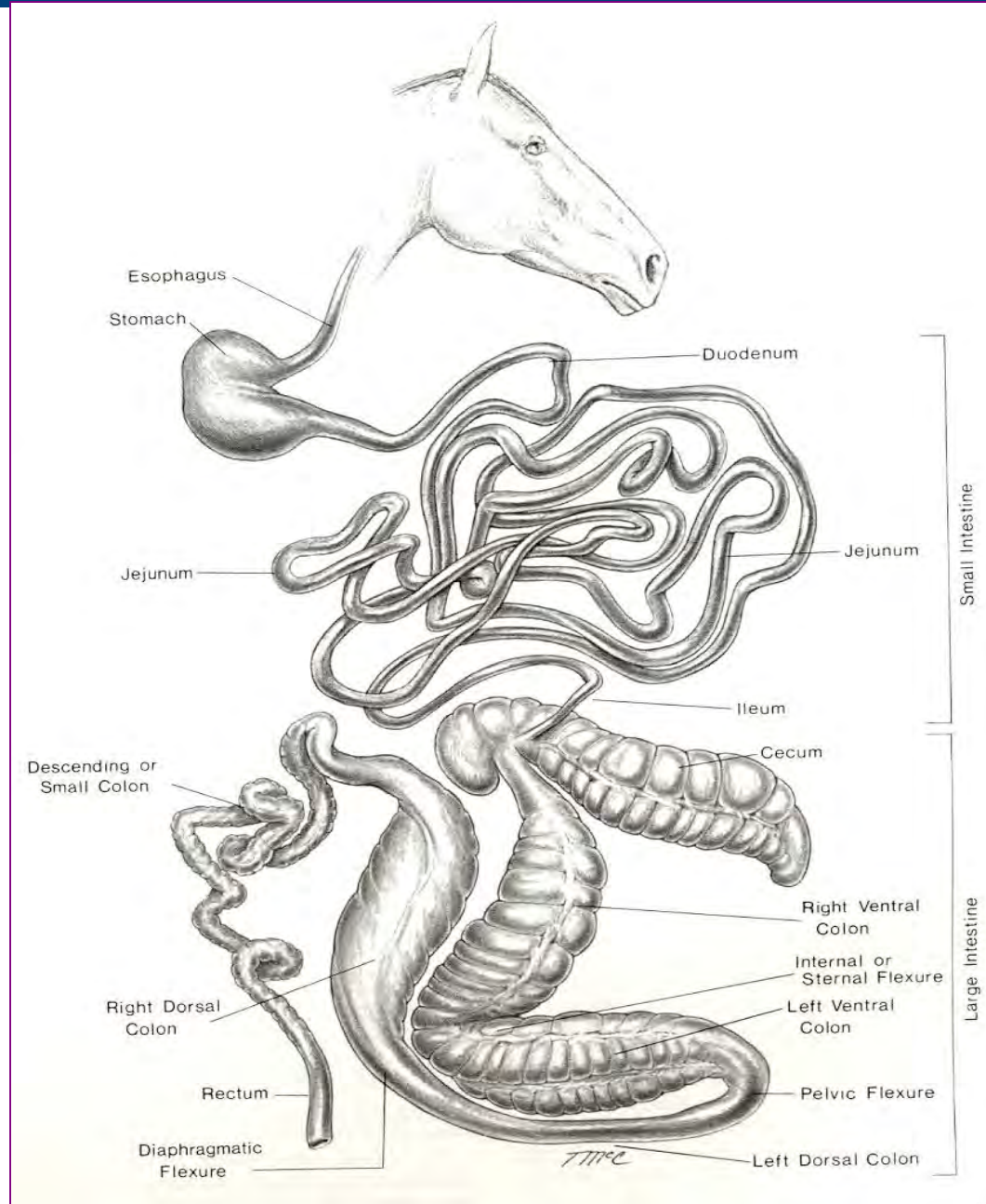


Figure 1: Digestive tract of the horse.

DIGESTIVE SYSTEM

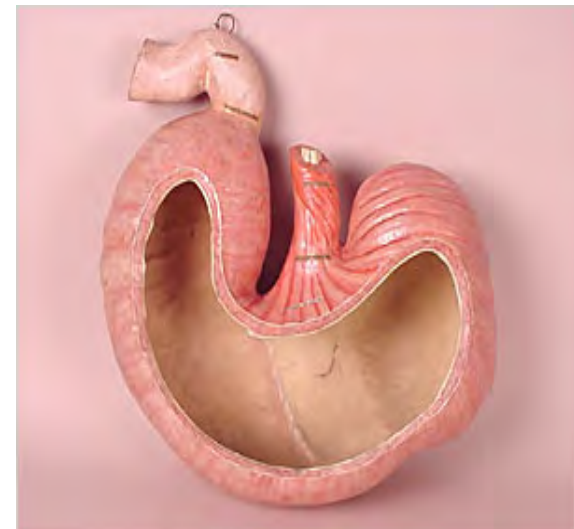
FOREGUT:

- Mouth
- Esophagus
- Stomach
- Small Intestine



Stomach

- Small stomach - 2-4 gallons for a 1100 lb horse
- Secretes hydrochloric acid and Pepsin to begin the breakdown of food
- Unable to regurgitate food - can't throw up!
- Functions best when $\frac{3}{4}$ full
- Food begins to leave the stomach in 15 minutes



Small Intestine

Small intestine is 50-70 ft long and holds 10-23 gallons

- Most of the nutrients (carbohydrates, protein, oils, fats) are digested here and enter the bloodstream.
- Most of the vitamins and mineral are absorbed here.
- Water is not absorbed but helps move the food.
- Anything that a horse eats that is toxic is absorbed here- horses are very susceptible to toxins.

Large Intestine (Hind Gut)

- Cecum
- Large and Small Colon
- Rectum



Cecum

- **The cecum, like a cow's rumen, contains bacteria and protozoa capable of digesting dietary fiber.**
- **Horses require fiber for the cecum to function normally.**
- **Microbes are specific to the food that the horse has been eating.**
- **Anything that disrupts the microbes sets the horse up for colic and digestive disaster.**

Large Colon

- **10-12 ft. long and holds 14-16 gallons.**
- **Flexures are a common place for impaction.**
- **Finishes digestion of fiber.**
- **Lots of gas production.**

The Horse – Health Considerations

- * Evolved as a grazing (perhaps browsing) animal!**
- * Forage species were not developed with the in mind**



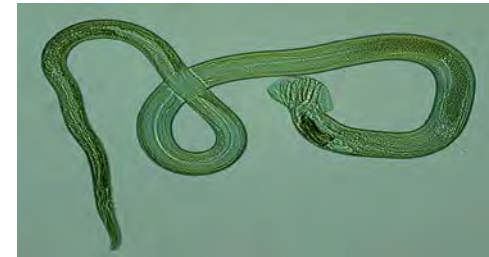
FIBER IS IMPORTANT!!!



Horses should consume 1.5 to 3% of their body weight in feed each day. At least 70% should be forage!

Pasture-related Health Issues:

- Excessive weight gain
- Colic
- Laminitis
- Insulin resistance
- Spread of gastrointestinal parasites
- Toxic plants



“EASY KEEPERS”

- ✓ Get fat on hay or pasture alone.
- ✓ Most (but not all!) more prone to laminitis and colic
- ✓ Most are insulin resistant (high insulin response to increases in blood glucose) that is often associated with obesity

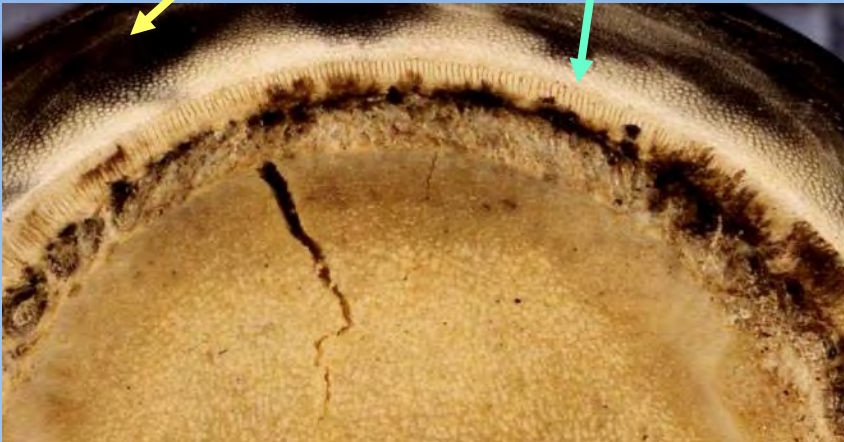


HOOF ANATOMY

Coffin bone

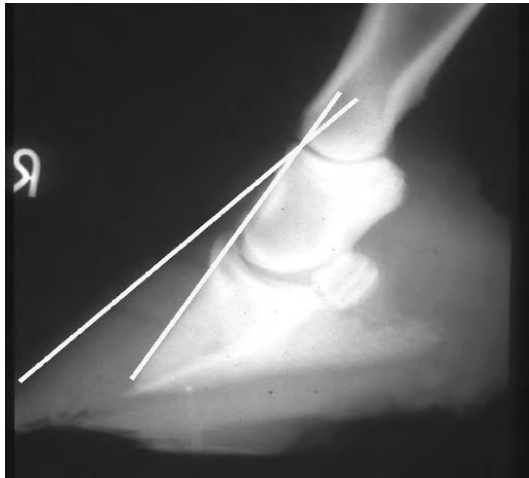
Hoof wall

Laminae



Laminitis

- A very real concern
- Subtle, easy to miss onset
- Excruciating pain
- Potential for laminar failure and hoof deformity
- Can result in permanent lameness



Causes of Laminitis

- 1. Inflammation in the hoof cause by acute catastrophic conditions:**
 - *System illness (salmonella, Potomac horse fever)**
 - *Sudden carbohydrate induced overload of the gut**
 - *Retained placenta**
 - *Pleuropneumonia**
 - *Black Walnut shavings**
- 2. Too much weight bearing on one leg due to injury of the other. (Barbaro)**

Causes of Laminitis

3. Endocrinopathic

- * Results from metabolic disorders (Cushings/insulin resistance)**
- * High insulin levels are responsible for the majority of laminitis cases**
- * Can develop when at risk horse grazes “lush” pasture**
- * Usually less severe- rarely catastrophic failure of the laminae**
- * Caused by a gradual build-up of high insulin levels over months and years**
- * Not a lot known – difficult to model**

Grazing BMPs for Equine Operations



Benefits Of Pastures for Horses

- * Nutrition
- * Movement
- * Reduces stress
- * Recycles nutrients
- * Less labor
- * Reduces bedding costs
- * Enhances overall health
- * Reduces feed costs – more \$\$\$ to buy more horses!



Grazing – Good for the Environment

A well managed pasture:

- ✓ **Recycles nutrients from dropped manure**
- ✓ **Reduces the need to deal with manure and bedding from stalls and dry lots.**
- ✓ **Generates good neighbor relations**



What is a Good Pasture?

Data Collected from farms in the Chesapeake Bay Watershed

A good plant canopy may not necessarily mean the pasture is high quality.

| Farm Number | % Canopy Cover | % Desirable Plant |
|-------------|----------------|-------------------|
| <i>1</i> | <i>80%</i> | <i>43%</i> |
| <i>2</i> | <i>83%</i> | <i>64%</i> |
| <i>10</i> | <i>98%</i> | <i>83%</i> |
| <i>13</i> | <i>90%</i> | <i>41%</i> |
| <i>17</i> | <i>97%</i> | <i>92%</i> |
| <i>19</i> | <i>53%</i> | <i>21%</i> |

Horse pastures consist of *grasses* such as timothy, brome, orchard grass, ryegrass, bluegrass, and fescue...

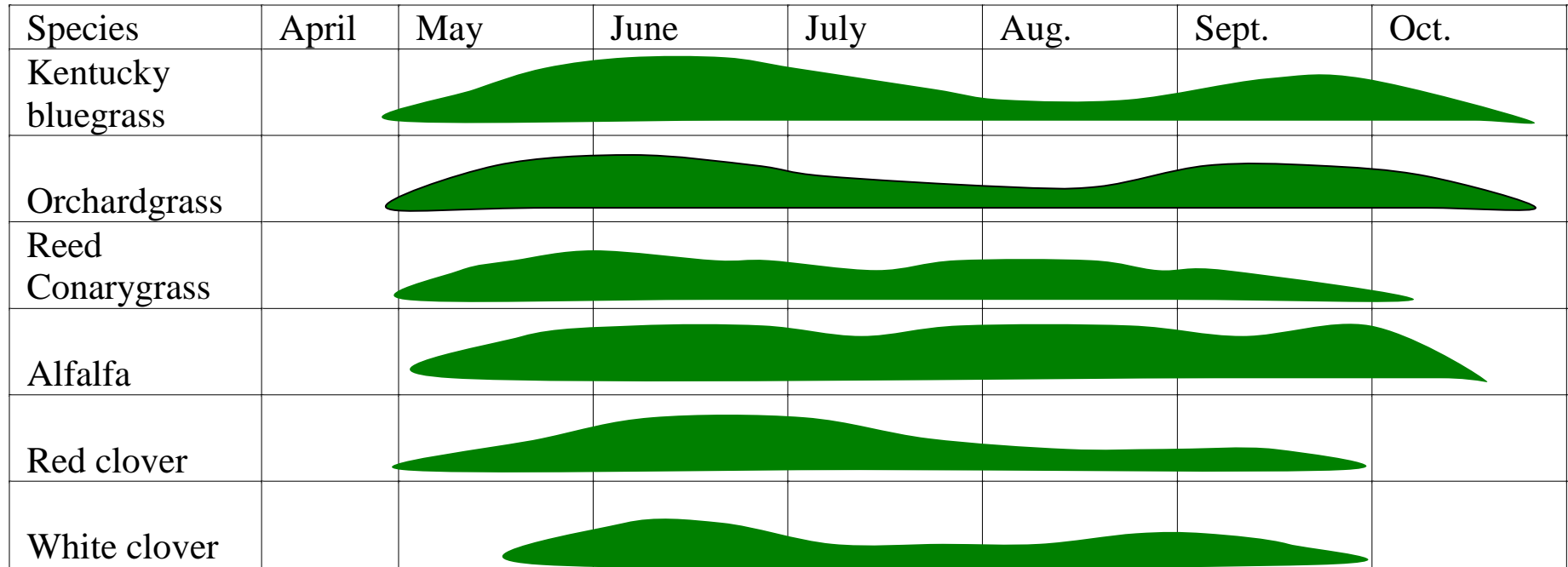


and *legumes* such as white clover, red clover, or alfalfa. What are legumes?

Cool Season Grasses

- ✓ Are the mainstay of most horse pastures
- ✓ Grow best at temperatures of 65° to 80° F.
- ✓ Growth slows in summer
- ✓ Will not effectively grow back if grazed close in hot dry weather

Seasonal Growth Patterns in Forages



Estimates of Acreage Required to Provide Forage Needs for One Animal Unit

| Pasture Species | Pasture Prod. | Annual Yield (T/ADM) | Acres required to provide forage needs for one animal unit ¹ | | | | | | |
|--------------------------------|---------------|----------------------|---|-----|-----|------|------|-----|-----|
| | | | Apr | May | Jun | Jul | Aug | Sep | Oct |
| Ky. Bluegrass/ white clover | Low | 1.0 | 10.7 | 1.2 | 2.7 | 11.1 | 11.1 | 4.5 | 6.9 |
| | Medium | 2.0 | 5.4 | 0.6 | 1.3 | 5.5 | 5.5 | 2.2 | 3.5 |
| | High | 3.0 | 3.6 | 0.4 | 0.9 | 3.7 | 3.7 | 1.5 | 2.3 |
| Alfalfa/grass | Low | 3.0 | - | 0.6 | 0.9 | 1.2 | 1.2 | 1.8 | 3.1 |
| | Medium | 4.5 | - | 0.4 | 0.6 | 0.8 | 0.8 | 1.2 | 2.1 |
| | High | 6.0 | - | 0.3 | 0.4 | 0.6 | 0.6 | 0.9 | 1.5 |
| Tall grass plus nitrogen | Low | 2.0 | 5.4 | 0.8 | 1.3 | 2.8 | 2.3 | 1.8 | 9.2 |
| | Medium | 3.0 | 3.6 | 0.5 | 0.9 | 1.8 | 1.5 | 1.2 | 6.2 |
| | High | 4.5 | 2.4 | 0.4 | 0.6 | 1.2 | 1.0 | 0.8 | 4.1 |
| Warm-season grass | Low | 3.0 | - | - | 0.9 | 0.6 | 0.6 | 1.2 | - |
| | Medium | 4.0 | - | - | 0.7 | 0.4 | 0.4 | 0.9 | - |
| | High | 5.0 | - | - | 0.5 | 0.3 | 0.3 | 0.7 | - |

¹Based on an animal unit consuming 25 lb dry matter (DM) forage per day with 70% of pasture utilized.

Acreage Required to Provide Forage for One Horse

Varies greatly with season

| | April | May | June | July | Aug. | Sept. |
|---|--------------|------------|-------------|-------------|-------------|--------------|
| White Clover / KBG 1 ton /acre | 10.7 | 1.2 | 2.7 | 11.1 | 11.1 | 4.5 |
| Mixed Tall Grass 2 tons /acre | 5.4 | .8 | 1.3 | 2.8 | 2.3 | 1.8 |

Basic Forage Biology

How Does Grass Grow?

Vegetative stage of growth - Non-reproductive stage which has higher nutritional value than mature reproductive stages. Why?



Reproductive Stage

- ✓ In early summer, grasses that are not mowed or grazed will develop a seed head.
- ✓ Once the seed head emerges, the grass will not produce additional leaves.
- ✓ Reproductive grasses are lower in nutritional quality than vegetative grasses.



Pastures should be Mowed Regularly

- ✓ Increases nutrition.
- ✓ Reduces weed pressure.
- ✓ Reduces stress caused by mowing when stems are elongating.
- ✓ Kentucky bluegrass and perennial ryegrass should be maintained at 2-3 inches in height.
- ✓ Tall grasses should be maintained at 4-5 inches.

Leaves and Sugar Production

- ✓ Leaf surface critical to healthy plants
- ✓ Site of “plant food” production which is called...
- ✓ Requires: CO₂, water, sunlight, minerals, favorable temperature.
- ✓ Produces simple sugars (glucose/fructans) and carbohydrates.



Sugar Use (Respiration)

- ✓ During night time hours, the sugars and carbohydrates supply energy for the synthesis of proteins and structural materials used for plant growth. Sugars are used in the process.
- ✓ Energy use and growth ceases when night time temperatures fall below 45°. Sugars may accumulate in plants when bright, sunny days precede cold nights.

Some sugar and starch is stored so that plants can initiate growth in spring and after clipping.

| <u>Species</u> | <u>Storage Site</u> |
|----------------|----------------------|
| Alfalfa | Tap root |
| Red clover | Tap root |
| White clover | Stolons and tap root |
| Bluegrass | Roots and rhizomes |
| Tall fescue | Lower stem (0"-3") |
| Orchard Grass | Lower stem |
| Timothy | Lower stem and corms |



Horses can damage pastures.....

- ✓ Graze plants at ground level.
- ✓ Graze favorite species and continually graze the same area.
- ✓ Forage species that store food above ground can be eliminated if grazing pressure is high.
- ✓ Hooves tear up sod and cause compaction.
- ✓ Will not graze plants in manured areas or mature plants.
- ✓ **Grazed plants must have time to recover !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!**

Healthy pastures are healthier for horses

- *Overgrazed plants may have higher % fructans, sugar and starch and are lower in fiber**
- * Horse owners fear “lush” pastures**
- * Overgrazed pastures allow weeds and toxic plants to establish**



To maintain healthy pastures with unlimited turnout generally requires _____ acres per horse.



< 1.5 acre per horse = exercise lot

> 1.5 acre per horse = pasture

Grazing “Guidelines”

Under “normal conditions” one horse can be maintained on:

- ½ acre of pasture, if turnout time = < than 3 hr/d
- 1 acre of pasture, if turnout time = 3 to 8 hr/d
- 1 ½ acre of pasture, if turnout time = 8 to 12 hr/d
- > 2 acres = unlimited turnout time

Mowing, irrigating, fertilizing, over-seeding, and rotating pastures can allow higher animal densities while still maintaining proper vegetative cover. Adverse environmental conditions, poor soil health, and lack of management will reduce recommended grazing time.

How can we keep horses from overgrazing pastures? What practices can we employ?



Keep them in the barn
or??????????



Keep them in a barnyard

Managing pastures on high density farms

- * Select forages that are appropriate for horses and that can better handle grazing pressure
- * Utilize rotational grazing
- * Manage turnout time using sacrifice areas

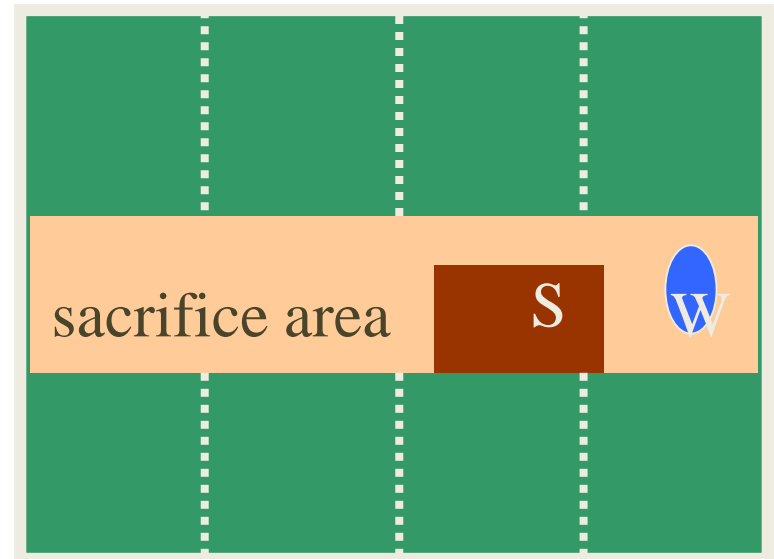
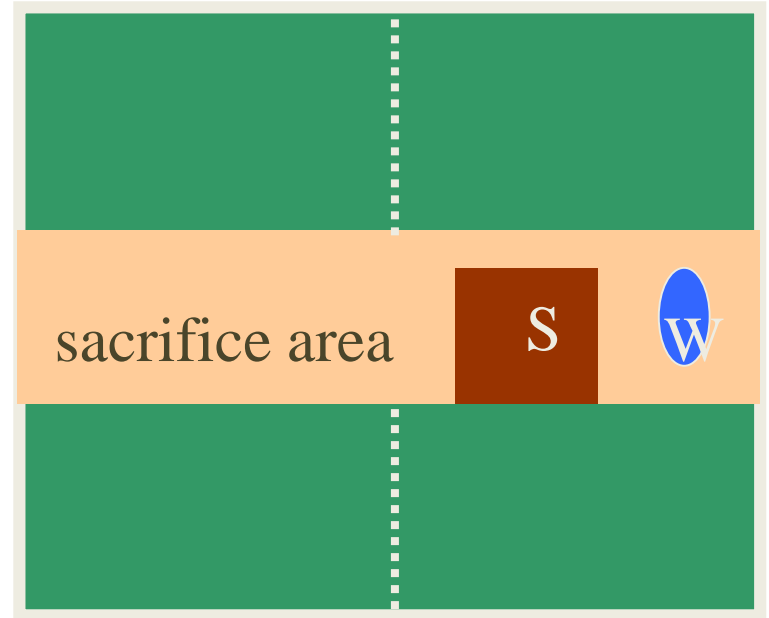
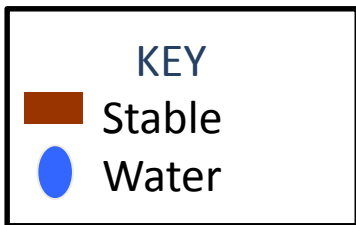
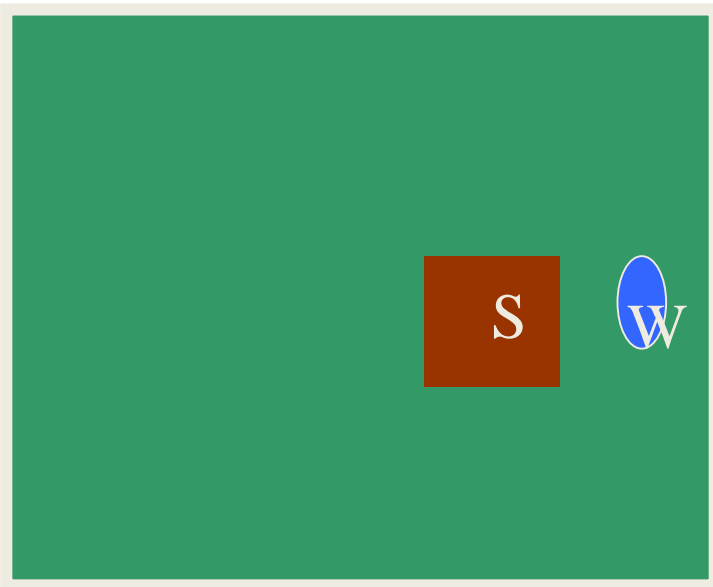


Rotational grazing

- ✓ What is rotational grazing?
- ✓ How do you know how long to keep horses on a pasture before moving them?



Rotational Grazing Paddock layout



Animal Concentration Areas (ACAs)



Sacrifice Area (ACA, Stress Lot)

- * Small enclosure - paddock or corral
- * Generally has no vegetation
- * Small area is sacrificed to benefit the rest of the pastures.

When should horses be confined to a sacrifice area?



Obstacles to using stalls, stress lots, and small rotational paddocks

- ✓ **Movement is critically important to equine health and well-being.**
- ✓ **Can't change food rapidly – must gradually introduce to pastures.**
- ✓ **Strong herd hierarchy – alpha animal dominates food and shelters.**
- ✓ **Can't combine horses of all age groups and sexes.**
- ✓ **Some horses just don't get along.**

Sacrifice Area Size

- ✓ **Highly variable**
- ✓ **Based on number of horses, ages, and behavior**
- ✓ **Often need separate sacrifice areas for different age groups**
- ✓ **Need larger areas for younger horses**
- ✓ **Need larger areas if horse population is constantly changing due to challenges to herd hierarchy**
- ✓ **20' x 20' for one animal; 20 x 100' allows several animals to exercise**



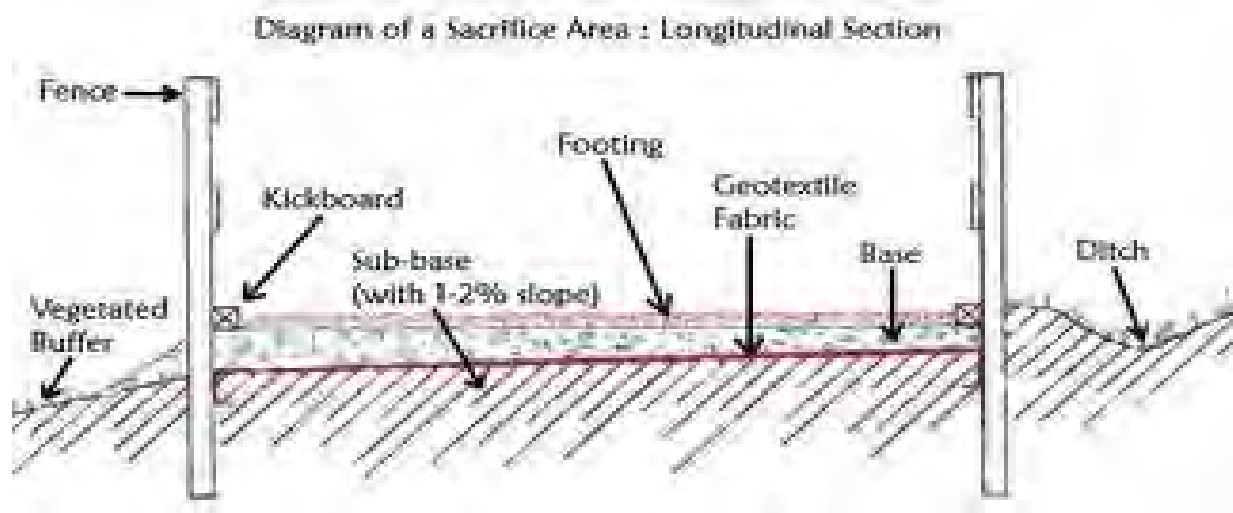
Sacrifice Area Construction

- ✓ Remove top soil.
- ✓ Slightly slope the area so that water runs off of the stress lot.
- ✓ Cover the area with a layer of stone aggregate topped with a minimum of 2-3 inches of finer stone dust.



Top of the Line-Sacrifice Lot Design

- ✓ Geotextile can be used to separate layers.
- ✓ Cover geotextile with 4 to 6 inches of crushed rock (1/4 to 1 1/2") and a minimum of 2 to 3 inches of stone dust.



Surface Options

No concrete

Sand / gravel

- ✓ **Do not feed on sand- ingested sand causes repeated colic**

Wood chips / sawdust

- ✓ **Avoid Black Walnut and Cherry, etc.**
- ✓ **Higher maintenance - wood chips breaking down and making mud.**





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Pasture Weed Management



What is a weed?

- A plant out of place
- A plant growing where it is not wanted
- A plant whose virtues have not yet been discovered
- Plants that are competitive, persistent, and interfere negatively with human activity

Weed Benefits

- Stabilize soil - reduce erosion
- Absorb excess nutrients
- Provide habitat and food for wildlife
- Provide nectar for bees
- Serve as a genetic reservoir
- Can serve as a source of nutrition
- Employment opportunities

Seed Production for Some Common Weeds

| Grass/grass-like | Life cycle | No. | Broadleaves | Life Cycle | No. |
|-------------------------|-------------------|------------|---------------------|-------------------|------------|
| Downy brome | Annual | 700 | Canada thistle | Perennial | 680 |
| Shattercane | Annual | 6500 | Cocklebur | Annual | 900 |
| Yellow nutsedge | Perennial | 2400 | Common ragweed | Annual | 3400 |
| Barnyardgrass | Annual | 7000 | Curly dock | Perennial | 30,000 |
| Green foxtail | Annual | 34,000 | Dandelion | Perennial | 15,000 |
| Yellow foxtail | Annual | 6,420 | E. black nightshade | Annual | 178,000 |
| Witchgrass | Annual | 11,500 | Lambsquarters | Annual | 72,000 |
| Wild oats | Annual | 250 | PA smartweed | Annual | 19,500 |
| | | | Redroot pigweed | Annual | 117,000 |
| | | | Shepherdspurse | Annual | 38,500 |
| | | | Velvetleaf | Annual | 7,761 |

Weed Seed Longevity in Soil

| <u>Weed</u> | <u>Longevity (yrs)</u> |
|------------------------|------------------------|
| • Common lambsquarters | 39 |
| • Shepherdspurse | 35 |
| • Common ragweed | 39 |
| • Dandelion | 6 |
| • Redroot pigweed | 10 |
| • Green foxtail | 39 |

Movement of Weeds into New Areas

- Weed seeds can be in manure and hay.
- Weed seeds can contaminate crop seeds (buy certified seed).





Burcucumber



Cocklebur

Common Milkweed



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**Bittersweet
Nightshade**

The best defense against weeds is maintaining a thick stand of healthy plants that can suppress weeds.



A photograph of a pasture that has been overgrazed. The ground is covered with sparse, low-growing green plants and weeds, with significant areas of bare, brown soil visible. The overall appearance is one of a degraded and less productive pasture.

When pastures are overgrazed and forages are eliminated, weeds fill in the bare areas and thrive.

- If weed pressure is high, it is best to develop a management plan to improve the survival and health of pasture grasses before choosing to eliminate weeds.
- Proper soil fertility and grazing management will eliminate, or greatly reduce, the need to control weeds.

- **If weed pressure is high and management changes warrant control of existing weeds, weed management techniques should be considered.**
- **However before determining the best weed control approach, it is important to identify the weeds that you wish to control and understand their life cycle.**

Weeds occur as:

- **Winter annuals**
- **Summer annuals**
- **Biennials**
- **Perennials**



- **Summer annual weeds tend to proliferate in horse pastures**
- **Seedlings are growing in early summer when forage growth is slowing**
- **Pastures should be rested or rotated to allow grasses to grow so that they can compete with weeds**
- **Weeds should be mowed to reduce seed production**

Common Ragweed



Redroot Pigweed



- Perennial weeds can be difficult to control, since they survive for multiple years and reproduce from seeds or underground roots or stems (rhizomes).
- Roots and rhizomes are often unaffected by grazing or mowing
- The best time to control perennials is generally late summer when the plants are moving food reserves from their leaves to their roots.
- Some perennial weeds, such as horsenettle, can be effectively controlled when flowering.

Milkweed



Horsenettle





Buttercup



Buckhorn Plantain

