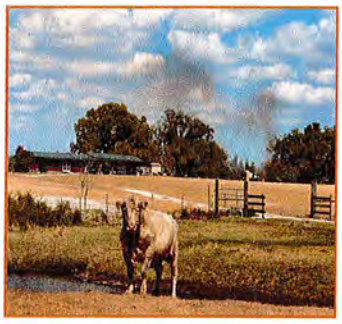
Celebrating 20 Years

March 15, 2018

Spring Ranchers Forum Proceedings
Central Florida Livestock Agents Group

Yarborough Ranches



UF | IFAS Extension
UNIVERSITY of FLORIDA
An equal opportunity institution

CENTRAL FLORIDA LIVESTOCK AGENTS GROUP

Spring Ranchers Forum
March 15, 2018
Proceedings

Central Florida Livestock Agents Group

Agents

Jonael Bosques-Mendez (Hardee County)
Sharon Fox Gamble (Volusia County)
Ed Jennings (Levi County)
Megan Mann (Lake County)
Dennis Mudge (Volusia County)
Francisco Rivera (Hillsborough County)
Mark Shuffitt (Marion County)
Joe Walter (Brevard County)
Tim Wilson (St. Johns County)
JK Yarborough (Multi-County)
Brittany Justesen (Osceola County)
Caitlin Bainum (Flagler County)
Clay Cooper (Citrus County)
Marcelo Wallau (UF Forage Specialist)
John Diaz (UF Agricultural Education Specialist)

Sponsored by the

Central Florida Livestock Agents Group

UF | IFAS Extension
UNIVERSITY of FLORIDA
An equal opportunity institution

SPRING RANCHERS FORUM

a program by the
Central Florida Livestock Agents Group
THURSDAY, MARCH 15, 2018
YARBOROUGH RANCH
1355 Snow Hill Road, Geneva, FL 32732

AGENDA

8:00 **Arrival and Registration**

8:15 **Field Demonstration: Tools of the Trade**
Dr. Todd Thrift, Beef Cattle Specialist, Animal Science, UF/IFAS
Tim Wilson, Extension Director, UF/IFAS St Johns County

9:00 **Trade Show Break**

10:00 **Common Sense Avoiding Poisonous Plant Problems in the Pasture**
Megan Mann, Livestock Agent, UF/IFAS Lake County
Dennis Mudge, UF/IFAS Extension Director, Volusia County

10:45 **Pasture Weed Control**
Ed Jennings, UF/IFAS Extension Director, Levy County
Clay Cooper, Livestock Agent, UF/IFAS Citrus County

11:30 **Tack and Gear For Handling Cattle on Horseback**
J.K. Yarborough, Livestock Agent, UF/IFAS Orange and Seminole Counties
J.W. Yarborough, Yarborough Ranches

12:15 **Official Welcome, Steak Lunch, and Trade Show "20th Year Celebration"**
Steak Lunch -Yarborough Family & Local Cattlemen

1:00 **Allied Giveaways and Presentations**

1:30 **UF Cool Season Forages Demonstration Plot**
Caitlin Bainum, Livestock Agent, Marion County and UF Agronomy Department Graduate Student
Liliane Serverino da Silva, UF Agronomy Department Graduate Student

2:15 **Calibrating Your Sprayer**
Sharon Gamble, Livestock Agent, UF/IFAS, Volusia County
Joe Walter, Livestock Agent, UF/IFAS Brevard County

3:00 **CFLAG Agent Panel Discussion: Cool Season Planting Choices**
J.K. Yarborough: Facilitator, Joe Walter, Ed Jennings, Francisco Rivera-Melendez, Brittany Justesen and Sharon Gamble

3:45 **Evaluation and Final Giveaways**

Tools of the Trade

Tim Wilson, UF/IFAS Extension, St. Johns County - Production Agriculture Agent III
Dr. Todd Thrift, UF/IFAS Extension Beef Cattle Specialist

Beef production efficiency in the US has increased over the past 40 years with the incorporation of newly developed management tools. Many technological improvements contribute to this increase in production. It is estimated that beef production today requires 33% less land, 30% fewer cattle, 18% less feedstuff and 12% less water (a portion of this is directly related to crop production improvements) compared to 1977 (Capper, 2011). This increase in efficiency is due to improvements in beef management (controlled breeding), reproduction (improved genetics, pregnancy evaluation), nutrition (body condition scoring, growth promoting implants, rotational grazing), and herd health (vaccine selection, handling, storage; Capper, 2011). Hersom et al., reports that the use of antibiotics, implants, ionophores, parasiticides, beta-agonists and vaccines improve beef production efficiency.

Ranchers combine basic management practices with improved technology to reduce production costs while maximizing revenues. Unfortunately, many ranchers do not use current technologies; therefore, this knowledge is not passed to the next generation of beef managers. Realizing that there are many management tools that are used to improve production efficiency, some producers may not know where to start.

Some tools that are used when working with cattle include:

Castration
- Banding
- Newberry knife
- Emasculator
- Emasculatome
    - Burdizzo
- Pocket knife

Dehorning
- Barnes
- Tube
- Electric
- Surgical

Reproduction
- Heat detection tools
    - Patches

    - Gomer bulls
    - Paint sticks
- Estrous synchronization tools
    - Hormones
- Artificial insemination
    - AI gun
    - Thaw box
    - Sheaths
    - Semen tank
- Calving tools
    - OB hooks
    - OB chains

Herd Health

- Drenches
- Needle size
    - Broken/bent needles
- Syringe types
    - Single vs. multi injection
- Vaccines
- Antibiotics
- Trocar
- Hemostat

Animal Identification

- Tattoo
- Fire brand
- Freeze brand
- Electric brand
- Ear tag
- Ear notching

Nutrition

- Growth promoting implants
- Ionophores
- Beta-antagonists
- Parasiticides

These are just a few of the many tools we use in the beef industry. Coupling these with management practices such as selection, breeding, grazing, and marketing, producers can improve their herds efficiency. If you have questions regarding these tools or management practices, contact your local county agent or large animal veterinarian.

Literature cited:

Capper, J.L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. J. Anim. Sci. 89:4249-4261.

Hersom, M, T. Thrift, J. Yelich. 2018. The impact of production technologies used in the beef cattle industry. Univ. of Fla. IFAS Extension, EDIS An272. (https://edis.ifas.ufl.edu/pdffiles/AN/AN27200.pdf)

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Central Florida Livestock Agents

Fact Sheet #031518

Dennis Mudge
University of Florida IFAS Extension Volusia County

Megan Mann
University of Florida IFAS Extension Lake County

Popular opinion is that farm animals "know enough" to not eat toxic plants. That would not be further from the truth. The fact is farm animals often eat toxic plants. Fortunately, severe sickness and/or death is uncommon among farm animals. There are many reasons why cows, horses and goats survive eating a poisonous plant; however, if a rancher looses even one animal to poisoning, it is too many. How sick one of these animals becomes depends on many factors, too numerous to list. Natural resistance, size, and health are three examples.

The part of the plant ingested and the condition, stage of the plant, it's level of toxicity that year are a few more. Avoiding toxic plants is a sure way to protect your animals and so this fact sheet is about common sense that is important that may save the life of a very important breeding stock animal on your farm.

Creeping indigo

Coral ardisia

A second misconception is that an animal like a goat is never in danger from toxic plant and so couldn't possibly be killed. Any farm animal, and person for that matter, can be killed by eating too much of the wrong plant.

Practices That Save Lives

Avoiding	Limited Exposure	Daily Monitoring Animals	Pasture Management
Land adjacent to lakes	Overgrazed pasture	Look for animals isolating themselves	Weed control
Grazing woodlands	Hay full of weeds	Depression, weakening, coughs, disorientation, trouble standing	Scouting for toxic plants
Creek side grazing	New Pastures	Change of temperament	Rotational grazing
Unkept fence lines	Young stock are more susceptible	Never leaving the water	Learn the toxic plants you have
Access to landscaping plants and tree trimming	Weedy pastures	Excessive sleep	Take IFAS classes
Stable or horse showing signs of trouble	Grazing trees	Watch for addicted animals	Healthy pasture has less weeds

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Concern for Cattle

The actual number of cattle lost to poisonous plants is higher than reported due to symptoms that can be wrongly diagnosed. This is because they often are similar to other health issues like pneumonia, infections, renal failure, colic, depression, heart failure, hyperactivity, gastritis, blood disorders, and the list goes on and on. Too often the correct diagnosis happens when every other possible cause has been eliminated.

Beware

Cattle ranchers themselves may deny the seriousness of toxic plants for good reason. They very often have seen the cattle eat the plant in question with very little or no visible issues or side effects seen. The reasons for this are complicated.

For starters, there are two basic types of poisoning: chronic and acute. While some plants are quick killers, many more accumulate poison like arsenic and kill slowly building up in the cows system over time. There are many other reasons why delayed sickness occurs but be sure if your cows are eating toxic plants they are being poisoned! An old timer practice was to use cattle to clear unwanted weeds in this way thinking they get as much nutrition out of weeds as they do grasses.

This is not only not true, but also a very dangerous practice!

Common Sense Avoiding Poisonous Plant Problems in the Pasture

The toxic weed list is not just certain native plants but it also includes numerous invasive exotics introduced from other parts of the world. Listed in the following are some weeds that have killed cattle in Florida in significant numbers as witnessed by UF Agents.

Coral ardisia

Lantana

Crotalaria

Pigweed

Sicklepod

Coffee Senna

Mexican Petunia

Castor Bean

Bracken Fern

Iris

Lillies

Cherry Tree

Elephant Ear

Yellow Jasmine

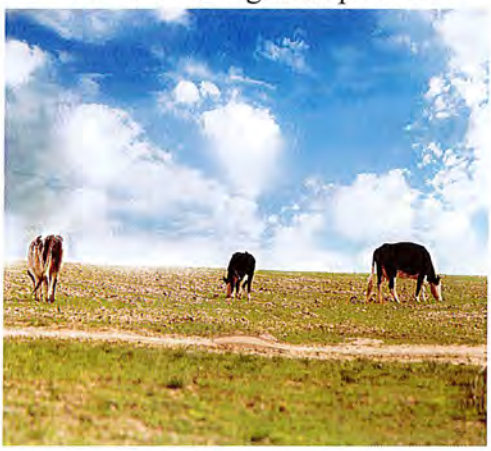
Black Nightshade

Chinese Tallow

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Young Stock

Cattle on overgrazed pastures



Any cattle recently moved to a new pasture

Cattle grazed in woods for the first time

Cattle grazed along bodies of water

Cattle eating hay with dry toxic plants in it

Also at risk are:

- Cattle supplemented in the winter (ie. cubes) who go looking for roughage
- Penned cattle surround by toxic weeds in the pen
- Cattle who have eaten a large amount of toxic plants
- Cattle that have eaten poisonous plants for years
- Cattle in pastures with little or no weed control

Common Sense Avoiding Poisonous Plant Problems in the Pasture

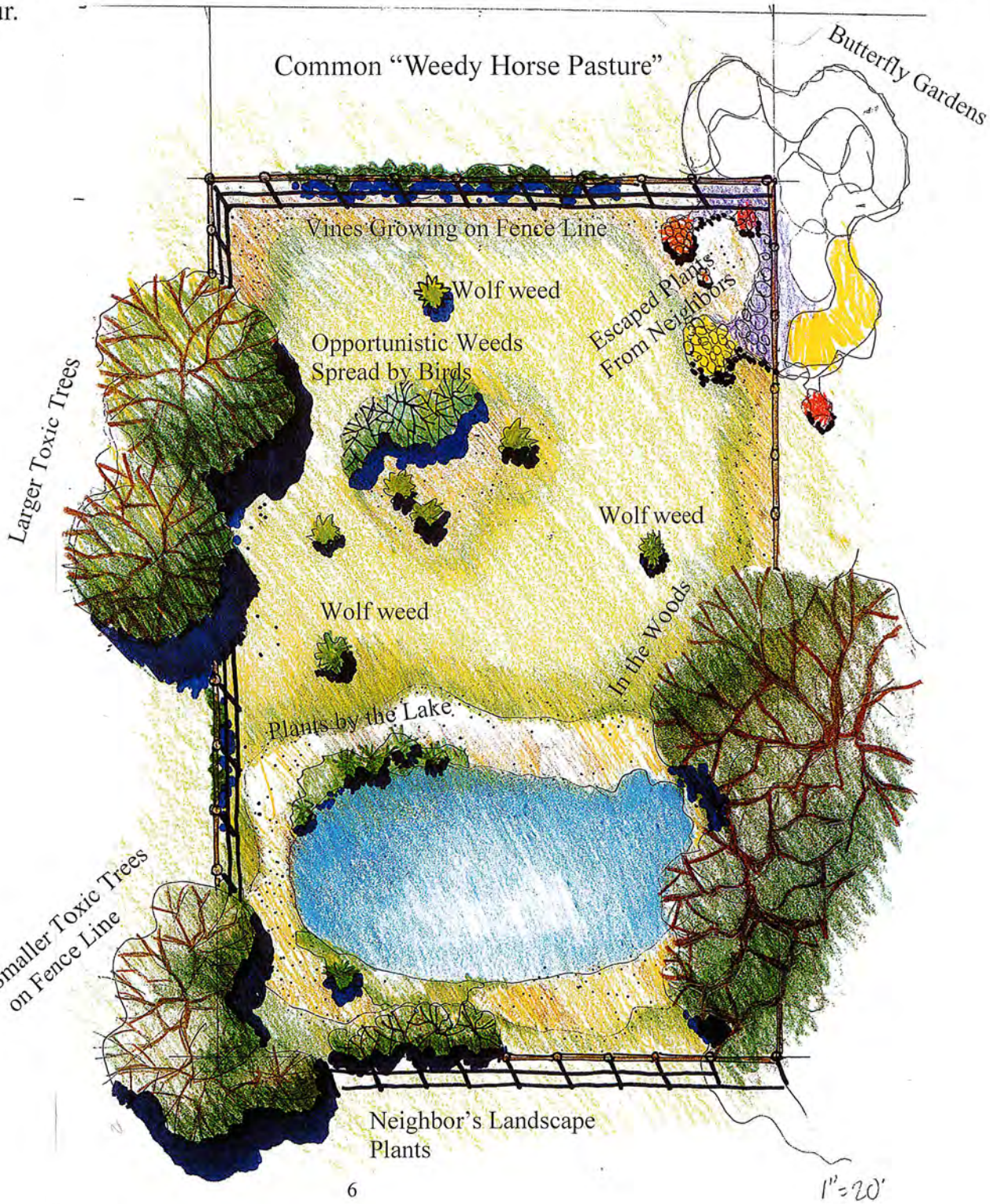
Care for Horses

Florida horse owners who pasture in paddocks or even small pastures need to be aware of plants that present a danger to their horses. Weed control is often the last item on the "to do" list when caring for a horse. This can be a dangerous practice in that some weeds can cause fatal toxic reactions if eaten in certain quantities, at a particular time of the year, or even when a more toxic part of the plant is consumed.

The first point to note is that if certain weeds are edible, then be sure your horse or horses would have already eaten them to the ground. Therefore, if there is a large, unconsumed weed in your pasture tempting your horse every day to take a bite, it is almost certain to be toxic or at the very least unpalatable. I call these weeds "wolf" weeds because they are just waiting for a hungry horse, new fold or a horse new to the paddock to take a taste. This is such a dangerous practice.

Common Sense Avoiding Poisonous Plant Problems in the Pasture

A poorly maintained horse pasture or paddock will have uncontrolled weeds typically in certain locations. Every time a horse owner does this they take a huge risk. Weeds are opportunistic and many are poisonous to horses. Below shows where weeds that poison horses most often occur.



Common Sense Avoiding Poisonous Plant Problems in the Pasture

Common Poisonous Weeds by Location

By the Lake Front
Sesbania, lilies, horsetail, iris, bladder pod and elderberry.


Chinese Tallow

Trees That Poison
Chinese tallow, red maple, cherry laurel, chinaberry, golden raintree, black locust and cherry tree.

Crotalaria

Cassia


Lantana

Common Landscape Plants that Can Poison
Sago palm, coonties, privet, oleander, crotons, rhododendron, and philodendron.

Most Butterfly Garden Plants are Toxic
Milkweed, lantana, cassia, crotalaria, and oleander.

Toxic Vines
Plants that grow on fence lines and trees such as balsam apply, English ivy, passion fruit, yellow jasmine, rosary pea and pathos.

Opportunistic Toxic Weeds
These weeds just seem to appear in pastures such as black nightshade, tropical soda apple, sickle pod, crotalaria, coffee senna and horse nettle.

Toxic Plants in Woods
Bracken fern, coral ardesia, jasmine and red root.

Tree Like but Smaller Poisonous Plants
(Commonly on fence lines) Elderberry, jimson weed, castor bean, spotted hemlock, poison hemlock, pokeweed and cassia.

Poisonous plants commonly grown in pastures to the size of "wolf" weeds are pigweed, black nightshade, lantana, sicklepod, crotalaria, coffee senna, and castor bean.

Sicklepod

Pokeweed

Coffee senna

Coral ardisia

Cherry Laurel

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Goats and Sheep Need Protection

Most common ways goats are poisoned:

- When they are used in clearing woodlands or wetlands.
- When they are fed clippings from brush or trees by their owners.
- When they are nearing starvation and they consume plants they would otherwise not eat.
- When they consume hay containing dried toxic weeds.
- When they are allowed to feed on landscape or garden plants.

Boer Goat

Here are some reasons goats often don't die when toxic plants are eaten:

- Low dose or insufficient quantity eaten.
- Toxic plants eaten at a time of year when low toxicity occurs.
- Toxic plants eaten with large quantities of edible forage.
- Seemingly high resistance to the toxicity by particular goats.
- Animals with larger body weights are able to eat without reaching toxic levels.
- Some toxic plants are more serious when wilted while others become more toxic when dry and in hay.
- Certain animal's "strong desire to live" or courage to go on when ill.

There are two general types of poisonings; acute and chronic. The first puts animals in immediate life-threatening danger while the second builds up toxic levels, accumulating over time. Plants usually fall in one category or the other while a few are dangerous both ways.

There are hundreds of poisonous plants from nearly a score of major toxic plant groups. These include alkaloids, oxalates, nitrates, cyanides, glycosides, resinoids, exalates, and minerals. It is alarming that more than 700 species of plants in the United States are known to have caused illness at one time or another. All livestock are at risk, as well as humans, if allowed to consume toxic plants.

Nubian Goat

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Fortunately the goat farmer only needs to learn the plants in their pastures. After over a decade of helping goat farmers locate plants that have killed or are capable of killing their goats, I have found that the average farmer has only 8 to 14 toxic plants to learn to recognize on their property.

Many toxic plants, however, are opportunistic annuals, so a good guide is important to own. This will assist goat farmers in the ongoing protection of their herd.

It is my opinion, as a forerunner in the science of toxic plant locations and diagnosis, that often animals that die and are otherwise healthy, are misdiagnosed because so many different symptoms are caused by toxic plants. These secondary conditions often bring additional problems and infections.

Proximity to toxic plants can be key in prevention, but management is a far more important issue.

Important Management Practices

- Fence out certain areas, i.e., wetlands, wooded areas.
- Greatly limit frequent exposure to these areas.
- Clearing land and planting of improved pastures.
- Sale of particular animals who frequently eat known toxic plants.
- Eliminate the practice of cutting browse from brush or trees to use as goat feed.
- Frequently observe your goats feeding habits in order to avoid dangerous situations.
- Find the true cause of any dead goat.
- Use less valuable animals to clear land.
- Examine hay for toxic weeds.
- Stable a goat at the first sign of illness to see if toxic plants are the cause. Observe the goat when released for
  returned consumption of a toxic plant.

Mechanical Injury

Plants that have spiny coverings or fine hairs can cause mechanical injury. Upon ingestion they may cause injury to the gut. Landscaping plants that have alkalis can also bring injury or eventual infection by small crystals that damage the goat's mouth or gut. A few examples are rhododendrons, elephant ear, philodendron, and crotalaria. Certain weeds can cause problems abrasively in the gut by causing a hair ball. Sandspur and cocklebur are examples.

Common Sense Avoiding Poisonous Plant Problems in the Pasture

More Observations - Toxic Plants Agents Have Witnessed in Florida Affecting Goats
Death


Crotolaria


Nightshade


Poison Hemlock


Spotted Water Hemlock


Cherry Laurel


Oleander


Sicklepod


Bracken Fern


Cherry Tree


Chinese Tallow


Yellow Jessamine


Pokeweed


Chokecherry


Elderberry


Lantana


Coffee senna


Milk


Cassia


Bladderpod


Lilies


Croton

Common Sense Avoiding Poisonous Plant Problems in the Pasture

Other Plants Known to Kill Goats

- Mountain Laurel
- Horse Nettle
- Tomato
- Potato
- Lily of the Valley
- Sago Palm
- Rhododendron
- Chinaberry
- Jimsonweed
- Rosary Pea
- Philodendron

Rosary Pea

Chinaberry Tree

Jimson Weed

Johnson Grass

Toxic Weeds In Northern Hay

- Bur Dock
- Mustard
- Lambs Quarter
- Milkweed
- Poison Hemlock
- Pigweed

Weed Management in Pastures and Rangeland—2018[1]

B. A. Sellers[2]

Weeds in pastures and rangeland cost ranchers in excess of $180 million annually in Florida by reducing forage yield, lowering forage quality, and causing animal injury through toxicity or specialized plant organs (thorns and spines). Effective weed management begins with a healthy pasture. Weeds are seldom a serious problem in a well-managed, vigorously growing pasture. Good pasture management involves the proper choice of the forage species and variety, an adequate fertility program, controlled grazing management, and pest management (weeds, insects, and diseases).

If pasture health declines, weeds will exploit the situation and become established. Bare ground is the perfect environment for establishment of weeds. Once established, weeds must be controlled with mechanical or chemical methods. However, unless the pasture-management problem that caused forage decline is corrected, the grass will not re-establish and weeds will re-infest the area.

Integrated weed management is both an economically and environmentally sound approach to weed management. An integrated approach involves scouting, prevention, and control (biological, cultural, mechanical, and chemical) in a coordinated plan.

Scouting

Scouting pastures is the foundation of a sound weed management program, but is often overlooked. Scouting involves routinely walking or driving through pastures and identifying weeds. This defines the scope of the problem and allows the best management practices to be implemented in a timely fashion. The number of weeds, the species present, and their locations are important. Note the dominant species as well as uncommon or perennial weeds. The management strategies adopted should focus on controlling the dominant species, while preventing the spread of less common species. If not managed proactively, the less common weeds in a pasture may become future dominant weed problems.

Proper identification of weeds is the first step toward weed control. A good example is knowing the difference between tropical soda apple (TSA) and red soda apple (cockroach berry). Of the two, only TSA is a troublesome invasive weed that must be controlled. However, some have occasionally confused the two species and allowed TSA to go uncontrolled. Unfortunately, this costly mistake results in TSA spreading throughout the ranch and potentially onto neighboring ranches. If there are questions concerning weed identification, contact your local UF/IFAS Extension office for assistance.

1. This document is SS-AGR-08, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date January 2000. Revised February 2009, February 2010, March 2011, January 2012, January 2013, January 2014, February 2015, December 2015, December 2016, February 2017, and January 2018. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. B. A. Sellers, associate professor, Agronomy Department, UF/IFAS Range Cattle Research and Education Center, Ona, FL 33865.

Some weeds grow best in wet sites (maidencane ponds, depressional areas, ditches, etc.), while others can be found on dry sites (ditch banks, upland areas, and fence rows). Scout pastures for weeds in conjunction with other activities, such as checking calves, working cattle, and feeding. When a weed is first discovered, remove it or spot treat with an appropriate herbicide. Do not allow that one plant to produce seed and give rise to hundreds of new plants. It is less expensive (in terms of both time and money) to control one plant than to wait and have to control hundreds of plants.

Poisonous plants (e.g., *Crotalaria*, black nightshade, spiny pigweed, lantana, etc.) are commonly found throughout Florida. Animals do not usually choose to graze most poisonous plants when forage is abundant; however, when quality forage is limited because of poor growing conditions or overstocking, they may graze these plants.

Prevention

Prevention is any activity that keeps weeds from infesting a pasture. Most weeds spread by seed. Thus, preventing the movement of weed seeds onto the ranch reduces potential weed pressure. Weed seeds can be transported in hay, harvested grass seed, sod, cattle, mowing equipment, or dispersed by wind, water, and wildlife. Producers should avoid buying hay or grass seed that is contaminated with weed seeds. Refuse to purchase hay from someone who cannot provide a weed-free product. Using certified forage seed reduces weed seed contamination and is highly recommended.

Also, consider TSA. Cattle have been shown to excrete TSA seeds for at least 7 days after consumption. If cattle are grazing in a TSA-infested pasture, it is recommended that the cattle are held in a clean area for 10 days before moving them to a new pasture. This will reduce the likelihood of transporting TSA seeds. Remember, an ounce of prevention is worth a pound of cure.

Control

Cultural Control

Cultural practices improve weed control by increasing the competitiveness of the forage. This involves optimizing forage production through monitoring soil pH, fertility, and, potentially, water management. Generally speaking, a thick sward will prevent weed emergence, will outcompete emerged weeds, and will capture the majority of environmental resources (light, water, nutrients) necessary for growth. The aim of cultural practices is to modify your management program so that the sward is as competitive as possible.

Soil pH is an important factor for forage growth as well as weed establishment. Forage agronomists and soil scientists at the University of Florida have determined the optimum soil pH for most forages grown in Florida. Acidic soils limit plant growth and can result in aluminum and manganese toxicity, and magnesium, calcium, phosphorous, molybdenum, and potassium deficiency. Soil acidity may also result in poor root growth, which can reduce water and nutrient uptake. Weeds that grow under such conditions can be indicators of low soil pH. For example, crowfoot grass germination is optimum at soil pH levels between 4 and 5, which is too low for optimum forage growth. Thus, the presence of crowfoot grass in your pasture may warrant a soil test and corrective action.

Mechanical Control

Mowing is one of the most often used weed control methods in pastures. Mowing improves the appearance of a pasture, temporarily increases forage production, and, if properly timed, prevents weeds from producing seed. Mowing is generally more effective on broadleaf weeds than grass weeds and is more effective on annual weeds than perennial weeds. Carefully consider the cost of mowing and the anticipated effectiveness. As fuel prices increase, it may be more cost-effective to avoid mowing and use other forms of weed control since other weed control methods may be more effective on a given species.

Mechanical weed control does have drawbacks. Large weeds with extensive root systems will not be controlled through mowing alone. Additionally, mowing misses prostrate-growing weeds like crabgrass, spurges, and matchweed. Mowing can also spread vegetative plant stems, allowing the plant (e.g., prickly pear) to root elsewhere. If mowing is performed after seed set, seeds can accumulate on the mowing equipment and worsen the weed problem by spreading seed to other pastures.

Biological Control

Biological control involves the use of biotic agents (e.g., plants, herbivores, insects, nematodes, and phytopathogens) to suppress weeds. Overall, biological control is still in its infancy, but great strides are being made, especially against invasive plants. Two good examples are the tobacco mild green mosaic tobamovirus (TMGMV), and the newly released insect, *Gratiana boliviana*, both used for TSA control. The virus TMGMV can be sprayed to control

existing TSA plants, while the beetle is used primarily for suppression.

Most biological control agents rarely provide complete weed control, but they usually suppress the weed population to a manageable level. Additionally, biological control agents are rarely fast-acting, so time is needed for the agent to suppress a given weed population. For example, the effect of *Gratiana boliviana* is not often seen until the year following the release of the beetle.

Chemical Control

Chemical weed control includes the use of herbicides. Herbicides kill weeds by inhibiting plant processes that are necessary for growth. Herbicides should be selected based on forage species being grown, weed species present, cost, and ease of application. Application method and environmental impact should also be considered.

Proper herbicide choice and application rate are extremely important. Lower-than-recommended application rates will not provide consistent weed control, while excessive application rates may cause injury to the forage or result in only killing the above-ground portion of perennial weeds. Also, herbicides must be applied at the correct time to be cost-effective.

Preemergence applications are made before weeds germinate and emerge. Understanding the life cycle of the weed is important when using a preemergence herbicide. Some weed seeds germinate in the summer, while others germinate in the winter months. Always refer to the herbicide label for additional information about controlling specific weeds.

Postemergence applications are made after the weeds emerge. The most effective and cost-efficient applications are made when the weeds have recently emerged and are small. For perennial weeds (regrowing from root storage organs), it is advisable to allow them to bloom before spraying, which allows sufficient leaf surface for coverage and ensures that the perennial is transporting photosynthates back to the roots.

Postemergence herbicides may be broadcast over the entire pasture or may be applied as a spot treatment to sparse weed patches. Spot treatment is less costly compared to broadcast spraying. Other application methods include wipers and mowers that dispense herbicide while mowing the weed. In all cases, it is extremely important to carefully read the herbicide label before purchase to determine if that herbicide controls the weeds in your situation.

PRECAUTIONS WHEN USING PHENOXY OR BENZOIC ACID HERBICIDES

1. For information about growth-regulating herbicides not covered below, see UF/IFAS Publication SS-AGR-12, *Florida's Organo-Auxin Herbicide Rule 2015* (http://edis.ifas.ufl.edu/wg051).

2. Application of other pesticides from sprayers previously used for 2,4-D, dicamba, or other phenoxy or benzoic acid herbicides to susceptible crops may result in injury.

3. Legumes in pastures or rangelands will be injured or killed by these herbicides.

4. Avoid drift to susceptible crops by applying at low pressures and when wind speeds are low and blowing away from susceptible crops. The use of a drift-control additive is advisable.

5. Clean sprayer thoroughly with household ammonia as follows:

   a. Flush system with water. Drain.

   b. Flush the system with ammonia (1 qt ammonia per 25 gallons water); let it circulate for at least 15 minutes, then flush the system again. Drain again.

   c. Remove screens, strainers, and tips, and then clean in fresh water.

   d. Repeat step 5b.

   e. Thoroughly rinse the tank, hoses, booms, and nozzles.

   f. Be sure to clean all other associated application equipment.

Forage Tolerance

Not all cultivars of a particular forage species respond similarly to a given herbicide (Table 5). 'Argentine' bahiagrass tolerates most pasture herbicides except Roundup, while 'Pensacola' may be severely injured by metsulfuron-containing products such as Cimarron and others. All herbicides may be used on stargrass and bermudagrass, with some level of injury from Velpar (hexazinone). *Hemarthria*, also known as limpograss, is the most sensitive to herbicide applications of all forage grasses grown in Florida.

It is important to realize that the response observed from an herbicide application can vary. For example, the chance

for forage injury can increase or decrease as the rate of herbicide applied either increases or decreases. Additionally, environmental conditions such as high temperature and high relative humidity may increase the potential for herbicide injury. For example, we have observed little or no injury to limpograss from 8 pt./acre 2,4-D amine when applied under cooler conditions, while 4 pt./acre in warmer weather caused moderate to severe injury.

The response of forages in Table 5 is for established forage cultivars. However, 2,4-D + dicamba (2 pt./acre) can be applied to sprigged forage cultivars, except for limpograss, seven days after planting/sprigging. A forage can be considered established when at least three tillers are present on bahiagrass or at least 6 in. of new stolon growth is present on sprigged forages.

Summary

Maintaining healthy, productive pastures will minimize the risk associated with weedy plants. Good pasture management practices such as adequate fertilization, insect control, and controlled grazing will result in healthy pastures. Unfortunately, weeds are present in pastures and the associated loss in forage production can have serious economic implications. An integrated weed management strategy involving prevention, detection, and control is the most economical and environmentally friendly approach to pasture weed management.

Table 1. Weed control in pastures and rangeland.

Trade Name and Rate of Commercial Product Per Acre	Common Name	Remarks
		DURING ESTABLISHMENT
		Preemergence to Weeds
2,4-D Several Brands[1] 1.0–2.0 qt. of 4 lb./gal. formulation	2,4-D amine or LV ester 1.0–2.0 lb.	**Bermudagrass and stargrass only.** Apply after sprigging and before emergence of sprigged bermudagrass. Will not give complete weed control; however, short residual control of seedling broadleaves, sedges, and certain grasses may be noted for 2–3 weeks, if proper environmental conditions exist.
Diuron 4L 1.5–4.5 pt. or Diuron 80 1–3 lb.	Diuron 0.8–2.4 lb.	**Bermudagrass only.** Will provide fair to good control of crabgrass, crowfootgrass, and goosegrass. Plant sprigs 2 inches deep. If sprigs have emerged at time of application, bermudagrass injury will occur. Do not graze or cut hay within 70 days. Before application, ensure that your product has proper labeling, since not all Diuron products are labeled for use in pastures. Do not use this herbicide when planting tops.
2,4-D + dicamba[1] (Weedmaster, others) 2 pt.	dicamba + 2,4-D	**Bermudagrass and stargrass only.** Similar to 2,4-D, but often provides greater weed control. Short residual control of seedling broadleaves, sedges, and certain grasses may be noted for 2–3 weeks if proper environmental conditions exist. **Do not apply to limpograss (*Hemarthria*).**
		Postemergence to Weeds
2,4-D Several Brands[1] (0.5–1.0 qt. of 4 lb./gal. formulation)	2,4-D amine	**Do not apply to bahiagrass until plants are 5"–6" tall. Do not apply to limpograss (*Hemarthria* sp.).** Bermudagrass can tolerate 2,4-D at any growth stage. Controls most seedling broadleaf weeds. Repeat application may be needed.
2,4-D + dicamba[1] (Weedmaster, others) 2 pt.	dicamba + 2,4-D	Can be used during establishment of hybrid bermudagrass, stargrass, and pangolagrass. Annual sedges and some grasses will be suppressed if less than one inch at time of application. Best results are seen if applications are made 7–10 days after planting. **Do not apply to limpograss (*Hemarthria*).**
Banvel, Clarity, Vanquish 1.5–2 pt.	dicamba	Primarily used for establishment of limpograss (*Hemarthria*). Annual sedges and some grasses will be suppressed if less than one inch at time of application. Best results are seen if applications are made 7–10 days after planting.
		ESTABLISHED STANDS
		Dormant Pastures
Gramoxone SL 1-2 pt.	paraquat	For **dormant** bermudagrass or bahiagrass. Apply in 20–30 gallons of water in late winter or early spring (probably in January or February) before grass begins spring green-up. Add one pt. surfactant (non-ionic) per 100 gal. spray mix. Do not mow for hay until 40 days after treatment. Can be mixed with 2,4-D or other herbicides for more broad-spectrum control.
Prowl H_2O 1.1–4.2 qt.	pendimethalin	Applications of 3 qt/ac. have provided satisfactory weed control, but late-season escapes should be expected. Provides preemergence control of crabgrass, goosegrass, Texas panicum, sandbur, and other summer annual grasses. Must have activating rainfall or irrigation within two weeks or control will be minimal at best. Does not control plants that have already emerged.
Roundup Weathermax (or other 5.5 lb formulations) 11 fl. oz. or Roundup Ulta (or other 4 lb formulations 16 fl. oz.)	glyphosate	Apply in mid- to late-winter months to bermudagrass or bahiagrass pastures and hayfields for the control of weedy grasses. Apply before new growth appears in the spring. Bermudagrass that is not dormant at the time of application may show a 2–4 week delay in green-up. No restrictions exist between application and grazing or haying.
		Non-Dormant Pastures
2,4-D Several Brands [1] 2.0–4.0 pt. of 4 lb./gal. formulation	2,4-D amine **or** LV ester 1.0-2.0 lb.	**Broadleaf weeds.** Annual weeds should be treated soon after emergence for best control with lower rates. Perennial weeds should be allowed to obtain a leaf surface large enough to allow sufficient spray coverage (about 12"–18" tall). Use amine formulations during warm weather and LV esters during cool weather. Avoid drift. Applications of 2,4-D to limpograss (*Hemarthria* sp.) will cause significant injury during periods of high temperatures and humidity; much less injury has been observed during cool and dry conditions.

Trade Name and Rate of Commercial Product Per Acre	Common Name	Remarks
Banvel[1], Clarity, Vanquish 0.5–2.0 qt	dicamba	**Broadleaf weeds.** Rate depends on weed species and size. Refer to the label for grazing restrictions. Avoid drift. *Hemarthria* has generally exhibited more tolerance to dicamba than 2,4-D.
Chaparral 2.0–3.3 oz.	metsulfuron + aminopyralid	Use on bermudagrass, pangolagrass, stargrass, and limpograss. Do not use on bahiagrass. Controls tropical soda apple, pigweed, blackberry, and many other problematic weed species. Will not control dogfennel. Add a non-ionic surfactant at 1–2 pt./100 gal. of solution. Avoid applications during spring green-up.
Cimarron Plus 0.125–1.25 oz. or Cimarron Xtra 0.5–2.0 oz./ac.	metsulfuron + chlorsulfuron	Use on bermudagrass, pangolagrass, and stargrass. Controls several cool-season broadleaf weeds, pigweeds, and Pensacola bahiagrass. Bermudagrass should be established no less than 60 days prior to application. Add a non-ionic surfactant at 1–2 pts./100 gal. of solution. Avoid application during spring green-up.
Cimarron Max Part A (0.25–1.0 oz.) Part B (1.0–4.0 pt.)	Part A—metsulfuron Part B—2,4-D + dicamba	Cimarron Max is a two-part product that should be mixed at a ratio of 5 oz. *Part A* to 2.5 gallons *Part B*. Depending on the weeds present and the rate range that is selected, this mix will treat between 5 to 20 acres. For specific information on rate selection, consult the product label.
GrazonNext HL[1] 1.6–2.1 pt.	aminopyralid + 2,4-D	Excellent control of TSA, horsenettle, and other members of the nightshade family. Also controls pigweeds and other broadleaf weeds including less than 20" dogfennel. Do not apply more than 2.1 pt./ac./yr. Do not apply to desirable forage legumes or severe injury and stand loss will occur. Do not apply to limpograss. GrazonNext will pass through animals and remain in the waste. Do not mulch sensitive crops with manure if animals have been grazing on GrazonNext-treated pastures. Avoid applications of this product to limpograss pastures during hot and humid conditions.
MSM 60, others 0.3–1.0 oz.	metsulfuron	Use on bermudagrass, pangolagrass, and stargrass. Controls several cool-season broadleaf weeds, pigweeds, and Pensacola bahiagrass. Bermudagrass should be established no less than 60 days prior to application. Add a non-ionic surfactant at 1–2 pt./100 gal. of solution. Avoid application during spring green-up.
Impose or Panoramic 4–12 fl. oz.	imazapic	DO NOT apply to bahiagrass. DO NOT apply during spring transition or severe bermudagrass or stargrass injury will occur. In summer months, expect 3–4 weeks of bermudagrass stunting after application, followed by quick recovery and rapid growth. This will reduce harvest yields of that cutting by 30%–50%. If this yield reduction is not acceptable, do not use these herbicides. Yield reductions of subsequent cuttings have not been observed. For control of crabgrass, sandspur, nutsedges, and vaseygrass, use 4 oz./ac. For suppression of bahiagrass, use 12 oz./ac.
Milestone 3–7 oz.	aminopyralid	Excellent control of tropical soda apple, horsenettle, and other members of the nightshade family. Controls pigweeds and other broadleaf weeds, but does not control blackberry or dogfennel. Can be safely applied under trees. Do not apply more than 7 oz./ac./yr. Do not apply to desirable forage legumes or loss of stand will occur. The use of a non-ionic surfactant is recommended. Milestone will pass through animals and remain in the waste. Do not mulch sensitive crops with manure if animals have been feeding on Milestone-treated pastures. Safe on limpograss.
Outrider 1.0–1.33 oz.	sulfosulfuron	Safe to apply to established bermudagrass and bahiagrass. Provides excellent control of annual and perennial sedges.
Pastora 1–1.5 oz.	metsulfuron + nicosulfuron	**Established Bermudagrass Only**. Can be used to effectively control seedling crabgrass, sandbur, vaseygrass, and established johnsongrass. Established vaseygrass will require retreatment for long-term control. If sandbur or crabgrass is greater than 4" tall, only seedhead suppression should be expected. Do not apply more than 2.5 oz/ac./yr. Do not apply to limpograss or bahiagrass due to high injury potential.
PastureGard HL[1] 1–2 pt.	triclopyr + fluroxypyr	Provides excellent control of dogfennel, blackberry, teaweed, and other broadleaf weeds. Less effective on tropical soda apple than triclopyr-ester (Remedy Ultra, others) alone. Forage legumes will be severely injured or lost if present at time of application. Applications of 2 pt/A may result in less than desirable weed control. Do not apply more than 8 pts/A per season. Surfactant should be added to spray mixture at 0.25% v/v.

Trade Name and Rate of Commercial Product Per Acre	Common Name	Remarks
Prowl H_2O 1.1–4.2 qt.	pendimethalin	Apply only to established perennial warm-season grasses including bahiagrass and bermudagrass grown for forage or hay production between cutting or grazing events. DO NOT apply to bermudagrass and other warm-season grasses after greenup in the spring before the first cutting. DO NOT apply when surface water is present. Maximum application per year is 4.2 qt/acre. Provides preemergence control of annual and some perennial grass weeds, but does not control existing plants.
Remedy Ultra, others 2 pt.	triclopyr ester	Provides excellent control of herbaceous and certain woody plants in pasture and rangeland. For best results, apply in 30 or 40 gallons of water per acre. The addition of a non-ionic surfactant at 0.25% v/v will increase control. Applications at air temperatures >85F° may cause moderate to severe bermudagrass injury for 2–3 weeks.
Roundup Weathermax 8–11 fl. oz./ac.	glyphosate	For control of annual grasses in bermudagrass and stargrass. Apply immediately after hay removal, but prior to regrowth. Applications made after regrowth has occurred will cause stunting. Application rates as low as 6 oz./ac. are often effective for crabgrass and other small annual grass weeds. Do not apply more than 2 qt./ac./year. If Roundup Weathermax is applied to a dormant pasture, it cannot be sprayed again that season. Be sure to read the label of the particular brand prior to purchase to ensure that the application site is labeled for use.
Sandea 0.67 – 1.33 oz	halosulfuron	Safe to apply to bahiagrass, bermudagrass, and stargrass for annual and perennial sedge control. Does not control Surinam sedge. Do not apply more than 1.33 oz per acre in a 12 month period.
Telar 0.1–1.0 oz.	chlorsulfuron	For use on established warm-season forage grass species. Telar will control blackberry, pigweeds, wild radish, and selected winter weeds. Not effective on ragweed, tropical soda apple, and other common weeds. Ryegrasses will be severely injured or killed by Telar. Do not apply more than 1.3 oz./ac./yr. There are no grazing restrictions for any animals.
2,4-D + dicamba[1] (Weedmaster, others) 0.5–4.0 pt.	dicamba + 2,4-D amine	See remarks for 2,4-D and dicamba above. This mixture is usually more effective than either herbicide used alone.
		Hard-To-Kill Perennial Grasses
glyphosate 1.3–4. oz per gal	glyphosate 1%–3% solution for hand sprayer	**Spot treatment.** Apply when perennial weeds are actively growing. Surrounding forage will be killed if sprayed.
glyphosate 4–8 qt. to 2 gal. water	glyphosate 33%–50% solution	**Wiper application.** Apply at speeds up to 5 mph. Two passes in opposite directions. No more than 10% of any acre should be treated at one time.
		Smutgrass
Velpar L/Tide Hexar 2.75–4.5 pt., Velossa 2.29–3.75 pt. or Velpar DF 0.9–1.5 lb.	hexazinone	Apply hexazinone to established stands of bermudagrass or bahiagrass when soil conditions are warm and moist and weeds are actively growing. Best control of smutgrass is usually achieved in late spring to early summer when regular rainfall occurs. Some temporary yellowing of the bermuda or bahiagrass will be noted, but plants will soon outgrow this effect. Apply hexazinone by ground equipment only, and only **one** application is allowed per year. **KEEP SPRAYS WELL AWAY (AT LEAST 100 ft.) FROM THE BASE OF DESIRABLE TREES, ESPECIALLY OAKS.** Check label instructions for further precautions and safe use suggestions.
		Pensacola Bahiagrass
MSM 60, others 0.3 oz.	metsulfuron	Apply to bermudagrass hay fields early in the season, after bahiagrass green-up but prior to seedhead formation. Early applications are often most effective; fall applications rarely control bahiagrass. Do not apply with liquid fertilizer solutions, as poor control may occur. Prolonged periods of dry weather prior to application will greatly decrease herbicide effectiveness. Always include a non-ionic surfactant at a rate of 0.25% v/v. Common or 'Argentine' bahiagrass will not be effectively controlled. Pasture legumes will be severely injured or killed.

Trade Name and Rate of Commercial Product Per Acre	Common Name	Remarks
Cimarron Plus 0.5 oz. or Cimarron Xtra 1.0 oz.	metsulfuron + chlorsulfuron	Same as metsulfuron.
	Cogongrass	
Roundup, others 4 to 6 fl oz/ga	glyphosate 3 to 5% solution for hand sprayer	For spot treatment of cogongrass. For best results apply in the fall prior to frost. Applications to the entire patch plus an additional 5 ft beyond the patch is beneficial. Late fall treatment is typically better than spring treatments.
Roundup, others 128 oz.	glyphosate	For broadcast treatment of cogongrass infestations. Burning followed by 6 weeks of regrowth tends to improve control over treating long-established cogongrass stands. Late fall treatment is typically better than spring treatments.
Arsenal, others 1.4 fl oz/gal	imazapyr 1% solution for hand sprayer	For spot treatment of cogongrass. Do not apply near areas with desirable hardwood trees. Provides longer-term control than glyphosate. Applications to the entire patch plus an additional 5 ft beyond the patch is beneficial. Late fall treatment is typically better than spring treatments. **DO NOT** treat more than 1/10 of the available area to be grazed or cut for hay.
Arsenal, others 48 oz/acre	imazapyr	For broadcast treatment of cogongrass. Do not apply near areas with desirable hardwood trees. Provides longer-term control than glyphosate, but plant-back restrictions may limit opportunities to plant forage crops in treated areas with this herbicide. DO NOT treat more than 1/10 of the available area to be grazed or cut for hay nor apply more than 0.75 lb ae imazapyr (48 fl oz) per acre per year.
	Tropical Soda Apple	
Chaparral 2–3 oz.	metsulfuron + aminopyralid	Excellent control of TSA plants. Provides preemergence control of TSA seedlings for approximately six months after application. There are no grazing or haying restrictions; however, delaying cutting for 14 days will enhance weed control. Not for use on 'Pensacola' bahiagrass.
GrazonNext HL[1] 1.6–2.1 pt.	aminopyralid + 2,4-D	Excellent control of tropical soda apple. Provides preemergence control of TSA seedlings for approximately six months after application. The 1.6 pt./ac. rate is highly effective on emerged TSA plants, but the 2.1 pt./ac. rate will provide the greatest length of residual control. Do not apply more than 2.1 pt./ac./yr. Will severely injure desirable forage legumes. Do not apply to limpograss. There are no grazing restrictions, but do not harvest for silage or hay for seven days.
Milestone 5–7 oz.	aminopyralid	Excellent control of tropical soda apple. Provides preemergence control of TSA seedlings for approximately six months after application. The 5 oz rate is highly effective on emerged plants, but the 7 oz. rate will provide the greatest length of residual control. Do not apply more than 7 oz./ac./yr. Do not apply to desirable forage legumes or loss of stand will occur. Volatility is low. The use of a non-ionic surfactant at 0.25% v./v. is recommended.
Remedy Ultra, others [1] 1.0 qt.	triclopyr ester	Apply in late spring through summer as a broadcast spray for control of this species. Best results will occur when plants are adequately covered with spray solutions. Application of 30–40 gal./ac. of herbicide solution will be more effective than 20 or lower. The addition of a non-ionic surfactant at 0.25% v./v. will increase control. Retreatment will be required as new seedlings emerge. Spot spray rate is 0.5%–1.0% v./v.
	Prickly Pear Cactus	
Remedy Ultra, others [1] 20% + basal oil 80%	triclopyr ester 20% diesel fuel or basal oil 80% (Spot treatment)	Apply as a spot treatment directly to prickly pear pads during spring and summer. Grass will be burned in treated spots but will recover. The addition of diesel fuel drastically enhances herbicide uptake, which will lead to prickly pear control. Prickly pear will die slowly over a period of 6–8 months with a few plants requiring retreatment.
Trump Card 3 pt.	fluroxypyr + 2,4-D	Apply Trump Card as a broadcast treatment in water. The use of a surfactant is required. A maximum of 3 pt./acre per growing season is allowed, but 6 pt./ac. is required for effective control. Two applications of 3 pt./ac. over two growing seasons, has been shown to be effective.

Trade Name and Rate of Commercial Product Per Acre	Common Name	Remarks
Vista XRT 22 oz.	fluroxypyr	Apply Vista XRT at 22 oz./ac. as a broadcast treatment in water. The use of a surfactant is required. For spot treatment, use 0.5 fl. oz. (15 ml) per gallon of water. Control is very slow, and it often takes more than one year to see satisfactory results.
		Blackberry
Chaparral 2 oz.	metsulfuron + aminopyralid	Chaparral will provide good to excellent control of blackberry. For best results, apply when moisture conditions are sufficient and blackberry plants are not under drought stress. Late bloom and fall applications of Chaparral are the most effective. DO NOT apply in bahiagrass pastures. Do not mow within six months prior to application or control will be greatly reduced.
Cimarron Plus 0.75 oz. or Cimarron Xtra 2.0 oz./ac.	metsulfuron + chlorsulfuron	Cimarron will provide good to excellent control of blackberry. Results are best when applied at blooming or late in the fall. Do not mow within six months prior to application or control will be reduced. **DO NOT** apply to bahiagrass pastures.
MSM 60, others 0.3–0.5 oz	metsulfuron	Metsulfuron will provide good to excellent control of blackberry. Results are best when applied at blooming or late in the fall. Apply to bahiagrass pastures only as a last resort and expect 6–8 weeks of reduced growth and some stand thinning. Mixing with 1 pt./ac. 2,4-D amine will help reduce bahiagrass injury when applying in bahiagrass.
PastureGard HL[1] 2 pt.	triclopyr + fluroxypyr	Control similar to Remedy.
Remedy Ultra, others [1] 2 pt.	triclopyr	For best control of blackberry, apply 2 pt. when blooming and do not mow within one year prior to application. Remedy does not control dewberry. Applications made during prolonged periods of dry weather can greatly decrease control. Fall applications often provide more consistent blackberry control.
Telar 0.75 oz.	chlorsulfuron	Similar to control with Cimarron. Telar can safely be applied to bahiagrass or bermudagrass.
		Dogfennel
2,4-D + dicamba[1] (Weedmaster, others) 2–3 pt.	dicamba + 2,4-D	Apply when plants reach a height of 12"–18". Weedmaster is most effective approximately one month after dogfennel transition from winter dormancy. Refer to previous comments for dicamba and 2,4-D above.
GrazonNext HL[1] 24 oz.	aminopyralid + 2,4-D	Apply when plants are less than 30" tall. If plants are larger than 30", tank-mix GrazonNext with 3 pt./ac. 2,4-D, or 8 oz/A PastureGard HL.
PastureGard HL[1] 24 oz.	triclopyr + fluroxypyr	For control of larger dogfennel that has reached 40 inches or more in height.
Trump Card 3 pt.	fluroxypyr + 2,4-D	For control of dogfennel that are 18"–36".
		Mixed Stands: Grass - Clover/Lespedeza Pastures
2,4-D amine[1] 0.5–1.0 pt.	2,4-D (0.25 + 0.5 lb)	Apply only one treatment per year to established perennial clover. Slight to moderate injury may occur. See label for specific use information.
		Thistles
2,4-D 2 qt.	2,4-D	Highly effective if applied to thistles in the rosette stage. 2,4-D is not effective on thistles that have bolted or flowered. During cool temperatures, the ester formulation of 2,4-D will be most effective.
GrazonNext HL[1] 1.6–2.1 pt.	aminopyralid + 2,4-D	Excellent control of thistles at any stage of growth.
2,4-D + dicamba[1] (Weedmaster, others) 1.0–2.0 qt	dicamba + 2,4-D	Apply late fall to early spring when daytime temperatures are > 50°F. Applications are most effective if applied before flower stalks elongate. The addition of crop oil will increase herbicidal activity. Refer to previous comments for dicamba and 2,4-D above. For small rosettes, 1 qt./ac. rate is sufficient. For larger rosettes, 1.5–2 qt./ac. will be required.

[1] For state rules pertaining to application of organo-auxin herbicides in Florida, see EDIS Publication SS-AGR-12, *Florida Organo-Auxin Herbicide Rule 2015* (http://edis.ifas.ufl.edu/wg051).

Herbicide recommendations in this report are contingent upon their registration by the U.S. Environmental Protection Agency. If an herbicide's EPA registration is canceled, the herbicide is no longer recommended.

Table 2. Estimated effectiveness of herbicides on common broadleaf weeds in pastures and hayfields (2,4-D through Impose/Panoramic).[1]

Weed Name	2,4-D	Chaparral	Cimarron Plus or Xtra	Banvel or others	Vista XRT	Diuron	GrazonNext HL	Metsulfuron	Impose/ Panoramic
bagpod	F–G	E	E	G	-	-	E	E	-
bitter sneezeweed	E	E	E	E	-	G	E	E	-
blackberry	P	G–E	G–E	F–G	F	P	P–F	G–E	P
bracken fern	P	E	E	P–F	P	P	P	E	-
Brazilian pepper-tree	P	P	P	P	P	-	P	P	P
bullrush	G	-	-	G	P	P	P	-	-
bushmint	P	-	-	F	F–G	-	F	-	-
butterweed	F–G	E	E	F–G	-	-	E	E	-
buttonbush	P	-	-	-	-	-	-	-	-
Caesarweed	G–E	G	G	-	G–E	-	G–E	G	-
camphor weed	F–G	-	-	F–G	-	-	G	-	-
Carolina geranium	P–F	G	G	F–G	G	-	F–G	G	-
castor bean	F–G	-	-	-	-	-	F–G	-	-
chickweed	F	E	E	E	-	P	F	E	-
coffee weed	G	E	E	E	G	-	E	E	-
coral ardisia	P	P	P	P	P	-	P	P	G
creeping indigo	G	E	E	G	-	-	E	E	-
crotalaria, showy	G	G	-	G	G	-	G	-	-
cudweed	F	G	G	E	-	-	E	G	-
curly dock	F	E	E	E	-	P	E	E	-
dayflower	G	F	F	F	-	-	F–G	F	-
dewberry	P	F–G	F–G	P	-	-	P	F–G	-
dodder	P	-	-	P	-	P	-	-	-
dogfennel	F–G	P	F	F–G	G	P	F–G	F	-
dollarweed	G	G	G	E	F	-	G	G	-
elderberry	F–G	-	-	F-G	-	-	F-G	-	-
evening primrose	E	G	G	E	-	G	E	G	-
Florida pusley	P	-	-	P–F	P	E	G–E	-	-
flat-top goldenrod	G	P	P	F–G	P	-	G	P	-
gallberry	G	-	-	E	-	P	-	-	-
goatweed	G	G	G	F–G	P–F	-	-	G	P
goldenrod	F	P	P	G	-	P	G	P	-
greenbrier	P	F	F	P	F–G	-	P	F	-
groundcherry	F–G	-	-	F–G	-	-	E	-	-
hairy indigo	F–G	E	E	F–G	F–G	-	E	E	-
hempvine	F–G	E	-	F–G	E	-	E	-	-
honeysuckle	-	-	-	E	-	P	-	-	-
horsenettle	P	E	P–F	G	F	P	E	P–F	-
horseweed	F	G	F	E	-	P	E	F	-
kudzu	P–F	G	P–F	G	P	P	G	P–F	P
lantana	P	P	P	P	F–G	-	P	P	-
matchweed	G	-	-	G	F–G	-	G–E	-	-

Weed Name	2,4-D	Chaparral	Cimarron Plus or Xtra	Banvel or others	Vista XRT	Diuron	GrazonNext HL	Metsulfuron	Impose/ Panoramic
maypop	P	P	P	P	-	-	-	P	-
Mexican tea	G	E	E	G-E	-	-	E	E	-
milkweed	F–G	-	-	G	-	-	F–G	-	-
morningglory	G–E	E	G–E	E	E	-	E	G–E	-
palmetto	P	P	P	F	G	P	P	P	P
pawpaw	P	P	F	P	F–G	-	P	F	-
persimmon	P	-	-	F–G	-	P	P	-	P
pigweed	F	E	E	E	P	F	E	E	G
plantains	E	E	E	E	-	-	-	E	-
pokeberry	G	-	-	E	P	P	P	-	-
prickly pear	P	P	P	F	G	P	P	P	P
prickly poppy	G	E	G	G–E	G	-	E	G	-
ragweed	E	E	G	E	G	G	E	G	F
red sorrel	P	E	E	E	-	F	-	E	-
redroot, Carolina	-	P–F	P–F	-	P–F	-	-	P–F	F–G
rosary pea	F	E	G	G	F–G	-	E	G	-
sand vetch	F	E	G	G	G	-	E	G	-
saltbush	P	P	P	P	F	-	P	P	-
shepherd's purse	E	-	-	E	-	G	-	-	-
sicklepod	G	G	G	E	G	F	G	G	F–G
smartweed	G	E	G	G	-	-	E	G	-
softrush	G	P	P	F–G	P	-	F–G	P	-
Spanish needles	G–E	E	G	E	-	-	E	G	-
stinging nettle/ fireweed	P	E	-	-	G–E	-	E	-	P
tall elephant's foot	F	-	-	F–G	-	-	F–G	-	-
teaweed	P	G	G	G	-	-	G	G	-
thistles	E	E	F	G	G	F	E	F	-
toadflax, oldfield	F–G	G-E	G-E	G	-	-	G–E	G–E	-
tropical soda apple	P	E	P	F–G	F	P	E	P	P
Virginia pepperweed	G	-	-	E	G	G	-	-	-
wax myrtle	P	P	-	P–F	-	P	P	-	-
whitehead broom	P	P-F	P–F	P	P	-	P	P–F	-
winged sumac	F–G	-	-	-	F–G	-	F-G	-	-
wild garlic	G–E	G	G	E	-	P	-	G	-
wild radish	G	G–E	G–E	E	-	P	G	G–E	-
yellow jessamine	-	G	G	-	-	-	-	G	-
yellow woodsorrell	P	F–G	F–G	G	F	-	F–G	F–G	-

Weed control symbols: E = 90%–100% control; G = 80%–90% control; F = 60%–80% control; P < 60% control.

Table 3. Estimated effectiveness of herbicides on common broadleaf weeds in pastures and hayfields (Milestone through WeedMaster or others).[1]

Weed Name	Milestone	Outrider	PastureGard HL	Remedy	Velpar	WeedMaster, others
bagpod	E	-	G	F–G	-	F–G
bitter sneezeweed	E	-	E	E	-	E
blackberry	P	P	G–E	G–E	F	P–F
bracken fern	P	-	P–F	P–F	F	P
Brazilian pepper-tree	P	P	P–F	G–E	G–E	P
bullrush	P	-	P	F–G	-	-
bushmint	P	-	G	G	-	P
butterweed	G–E	-	G–E	-	-	F–G
buttonbush	-	-	F–G	G	-	-
Caesarweed	G–E	-	E	E	-	G–E
camphor weed	-	-	G	F–G	-	G
Carolina geranium	G–E	-	-	-	-	G
castor bean	-	-	G	G	-	F–G
chickweed	-	-	F	E	E	E
coffee weed	E	-	E	E	-	G
coral ardisia	P	-	F–G	G	-	P
creeping indigo	E	-	G	G	-	G
crotalaria, showy	-	-	E	E	-	G
cudweed	E	-	G	E	-	G
curly dock	E	-	F	E	P	E
dayflowers	-	-	G	G	-	G
dewberry	-	-	F–G	F–G	-	P
dodder	-	-	P	P	-	P–F
dogfennel	P–F	P	E	G–E	G	G
evening primrose	E	-	G	E	E	E
Florida pusley	-	-	G	-	-	F
flat-top goldenrod	P	-	P	P	-	G
gallberry	-	-	E	E	P	G
goatweed	-	-	F	F	-	G
goldenrod	G	-	G	G	-	G–E
hairy indigo	E	-	G–E	G	-	G
hempvine	E	-	E	E	-	F–G
honeysuckle	-	-	P	P	-	E
horsenettle	E	-	F	F–G	-	F
horseweed	E	-	G	G	-	E
kudzu	G	P	F	F	-	F
lantana	P	-	P–F	P–F	-	P
matchweed	G	-	G	G	-	G
maypop	-	P	G	F	-	P–F
Mexican tea	E	-	E	E	-	E
milkweed	F–G	-	F–G	F–G	-	F–G
morningglory	E	-	E	E	-	E
palmetto	P	P	G	F	P	P–F

Weed Name	Milestone	Outrider	PastureGard HL	Remedy	Velpar	WeedMaster, others
pawpaw	P	-	F–G	G	-	P
persimmon	P	P	F–G	F–G	F	P–F
pigweed	E	-	F	E	G	E
plantains	P	-	-	-	-	E
pokeberry	F	-	P	P	-	E
prickly pear	P	P	F	G[2]	P	P–F
prickly poppy	E	-	E	E	-	G–E
ragweed	E	-	E	E	F	E
red sorrel	-	-	F	E	-	G
redroot, Carolina	-	-	F–G	G	-	G
rosary pea	E	-	G–E	G–E	-	F–G
sand vetch	E	-	E	E	-	E
saltbush	P	-	G–E	E	-	F
shepherd's purse	-	-	G	E	E	E
sicklepod	-	-	G–E	E	-	E
smartweed	E	-	G	G	-	G–E
softrush	P	-	F	P–F	-	F–G
Spanish needles	E	-	E	E	-	E
stinging nettle/fireweed	E	P	E	E	-	F
tall elephant's foot	F	-	F–G	F–G	-	F
teaweed	-	-	G	G	-	F-G
thistles	E	-	G–E	E	E	E
tropical soda apple	E	P	G	G–E	F–G	F–G
Virginia pepperweed	-	-	G	P	E	E
wax myrtle	P	-	F–G	G	P	P–F
whitehead broom	P	-	P	P	F–G	P
winged sumac	-	-	G	G	-	F–G
wild garlic	P	-	P	-	-	E
wild radish	P	-	G–E	E	E	E
yellow jessamine	-	-	G	G	-	-
yellow woodsorrell	-	-	F	F	-	F

[1] Estimated effectiveness based on rates recommended in this report. Effectiveness may vary depending on factors such as herbicide rate, size of weeds, time of application, soil type, and weather conditions.
[2] When applied as spot-treatment in basal oil.
Weed control symbols: E = 90%–100% control; G = 80%–90% control; F = 60%–80% control; P < 60% control.

Table 4. Estimated effectiveness of herbicides on common grass and sedges in pastures and hayfields.

Herbicide	bahia-grass	bermuda-grass	broom-sedge	crab-grass	dallis-grass	guinea-grass	johnson-grass	rye-grass	sandbur	smut-grass	vasey-grass	nutsedge
2,4-D	P	P	P	P	P	P	P	P	P	P	P	P
Banvel or others	P	P	P	P	P	P	P	P	P	P	P	P
Chaparral	G	P	P	P	P	P	-	P	P	P	P	P
Cimarron Plus or Xtra	G	P	P	P	P	P	-	P	P	P	P	P
Diuron	P	P	P	F–G	P	P	P	P	G	P	P	P
GrazonNext HL	P	P	P	P	P	P	P	P	P	P	P	P
Metsulfuron	G	P	P	P	P	P	-	P	P	P	P	P
Impose/ Panoramic	P–F	P	P	E	F	-	G	F	G–F	P	P–G	G–E
Milestone	P	P	P	P	P	P	P	P	P	P	P	P
Outrider	P	P	P	P	P	P	E	-	-	P	F–G	E
Pastora	F–G	P	P	F–G	F–G	F–G	G	G	G	P	F–G	P
PastureGard HL	P	P	P	P	P	P	P	P	P	P	P	P
Remedy	P	P	P	P	P	P	P	P	P	P	P	P
Velpar	P	P	P	P	-	-	-	G	-	E	-	P
Vista XRT	P	P	P	P	P	P	P	P	P	P	P	P
Weedmaster or others	P	P	P	P	P	P	P	P	P	P	P	P

[1] Estimated effectiveness based on rates recommended in this report. Effectiveness may vary depending on factors such as herbicide rate, size of weeds, time of application, soil type, and weather conditions.
Weed control symbols: E = 90%–100% control; G = 80%–90% control; F = 60%–80% control; P < 60% control.

Table 5. Tolerance of ***established*** (for at least 6 months) forage cultivars to commonly used herbicides.

Forage Species	Cultivar	2,4-D	Aim	Banvel	Chaparral	Cimmaron Plus	Cimmaron X-tra	Vista XRT	Grazon-Next HL	Impose/ Panoramic	Metsulfuron (MSM 60, others)	Milestone	Outrider	Pastora	Pasturegard HL	Remedy Ultra, others	Roundup/ others	Telar	Vista	Banvel + 2,4-D (Weed-Master, etc.)	Velpar
Bahiagrass																					
	Argentine	T	T	T	I	I	I	T	T	S	I	T	T	NL	T	T	S	T	T	T	T
	Pensacola	T	T	T	S	S	S	T	T	S	S	T	T	NL	T	T	S	T	T	T	T
Bermudagrass																					
	Coastal	T	T	T	T	T	T	T	T	I	T	T	T	T	T	T	I–S	T	T	T	T-I
	Florakirk	T	T	T	T	T	T	T	T	I	T	T	T	T	T	T	I–S	T	T	T	T-I
	Jiggs	T	T	T	T	T	T	T	T	I–S	T	T	T	T	T	T	I–S	T	T	T	T-I
	Tifton-85	T	T	T	T	T	T	T	T	I	T	T	T	T	T	T	I–S	T	T	T	T-I
Brachiaria																					
	Mulato	T	I	T	N	N	N	T	T	N	N	T	T	NL	T	T	S	N	T	T	N
Stargrass																					
	Florico	T	T	T	T	T	T	T	T	I	T	T	T	NL	T	T	I–S	T	T	T	NL
	Florona	T	T	T	T	T	T	T	T	I	T	T	T	NL	T	T	I–S	T	T	T	NL
	Okeechobee	T	T	T	T	T	T	T	T	I	T	T	T	NL	T	T	I–S	T	T	T	NL
	Ona	T	T	T	T	T	T	T	T	I	T	T	T	NL	T	T	I–S	T	T	T	NL
Hemarthria																					
	Floralta	I–S	T	T	T	T	T	T–I	I–S	T–I	T	I	T	NL	I	I	S	T	I	I-S	NL
	Gibtuck	I–S	T	T	T	T	T	T–I	I–S	T–I	T	I	T	NL	I	I	S	T	I	I-S	NL
	Kenhy	I–S	T	T	T	T	T	T–I	I–S	T–I	T	I	T	NL	I	I	S	T	I	I-S	NL

T = tolerant; very little injury if any
I = Intermediate; slight injury, will regrow in approximately one month
S = Severe injury; more than two months to recover or complete death
N = No current information available
NL = Not labeled

Table 6. Days between herbicide application to forage or pasture and feeding, grazing, or animal slaughter.

Herbicide	Non-lactating Cattle			Lactating Dairy Cattle		Horses
	Grazing	Hay Cutting	Slaughter	Grazing	Hay Cutting	
Banvel (Up to 1 pt.)	0	0	30	7	37	0
Banvel (Up to 1 pt.)	0	0	30	21	51	0
Banvel (Up to 1 pt.)	0	0	30	40	70	0
Chaparral	0	0	0	0	0	0
Cimarron Plus and Cimarron Xtra	0	0	0	0	0	0
Vista XRT	0	7	0	0	7	0
2,4-D	0	30	3	7	30	0
GrazonNext HL	0	7	0	0	7	0
Metsulfuron	0	0	0	0	0	0
Impose or Panoramic	0	7	0	0	7	0
Milestone	0	0	0	0	0	0
Outrider	0	14	0	0	14	0
Pastora	0	0	0	0	0	0
PastureGard HL	0	14	3	1 season	1 season	0
Prowl H_2O	0	0	0	0	0	0
Remedy Ultra, others	0	14	3	1 season	14	0
Roundup Weathermax (Dormant application)	0	0	0	0	0	0
Roundup Weathermax (Between cuttings)	0	0	0	0	0	0
Roundup Weathermax (Pasture renovation)	56	56	56	56	56	56
Sandea	0	37	0	0	37	0
Telar	0	0	0	0	0	0
Trump Card	7	14	2	7	14	7
Velpar	0	38	0	0	38	0
2,4-D + dicamba (Weedmaster, others)	0	37	30	7	37	0

Saddle and Tack Care in Hot and Humid Environments[1]

Joel McQuagge, Todd Thrift, and Ed Johnson[2]

The southern United States has a very active horse community. From hunters and jumpers to western show enthusiasts, trail riders and working cowboys, many have found the South's climate to be appealing for equestrian activities. While riders enjoy the weather, it creates some challenges in caring for saddles and other tack.

During the cooler months and during periods of drought, most horse owners have little problem with their leather equipment. But when the weather becomes hot and the humidity climbs and the rains are frequent, a tack room can become a breeding ground for mold and mildew. Frequent care, particularly of tack used daily, can become a chore. There are several things a rider can do, however, to lower the incidence of mildew on saddles and tack.

Cleaning

Leather items under frequent use should be kept as clean as is practical. Headstalls, reins, stirrup leathers, and other saddle parts contact sweat from the horse and may additionally be impacted by dirt, rain, and sweat from a rider. Daily cleaning can involve a simple wipe-down with a cloth and proper storage in the tack room. Several times each year (or as is practical), saddles and bridles should receive a thorough cleaning. This should involve some disassembly of the piece (Figure 1). Each item can then be scrubbed with a good liquid glycerin saddle soap, sponge or brush, and adequate water (Figure 2). Don't be afraid to use a water hose on light pressure to rinse away soap and dirt. However, absolutely avoid submerging a saddle, because damage to the saddle tree could occur. When cleaning and conditioning saddles, attention should be given to the back of fenders, top of stirrup leathers, and back of riggings, as these areas take abuse and are often missed in the maintenance process.

Saddle soap comes in bar, cake, and liquid varieties. Bar and cake soaps tend to build up in tooling and stitching and can be difficult to rinse clean. Liquid saddle soaps are easier to apply and easier to remove. Some horsemen report good results with Murphy's Oil Soap. There is the occasional misconception that leather can be cleaned and conditioned in one process. Most saddlemakers disagree; they contend that leather must first be cleaned, allowed to dry, and then conditioned. An exception to this rule applies to antique leather items. To discourage excessive cracking and drying, very old leather should not be allowed to completely dry before being oiled.

Vintage saddle leather can be a challenge to restore. Leather can become as porous as a sponge when it has aged for a long period of time. There is the temptation to continue to add oil as it is absorbed; however, discretion should be used. Only add enough oil to restore life back to the saddle. When in doubt, consult an experienced saddlemaker who deals in restoration.

1. This document is AN303, one of a series of the Animal Sciences Department, UF/IFAS Extension. Original publication date August 2014. Reviewed October 2017. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Joel McQuagge, Department of Animal Sciences; Todd Thrift, PhD, Department of Animal Sciences; and Ed Johnson, PhD, Department of Animal Sciences; UF/IFAS Extension, Gainesville, FL 32611.

Figure 1. When cleaning and oiling a western saddle, make sure to pull the stirrup leathers loose. The stirrup leathers generally pass over the bars on the saddletree and must receive care to prevent breakage.
Credits: Joel McQuagge, UF/IFAS

Figure 2. Particularly dirty saddles may be "scrubbed" using saddle soap and water. A good rule of thumb for selecting a brush is to select one with plastic bristles that would be appropriate for cleaning your fingernails.
Credits: Joel McQuagge, UF/IFAS

Oiling and Finishing

A side effect of leather cleaning is removal of oils from the leather. Those essential oils must be replaced in order for tack to remain flexible and to have a long life. One hundred percent pure neatsfoot oil is derived from livestock byproducts and serves as excellent nourishment for dry leather. In hot, humid environments, however, pure neatsfoot oil has some disadvantages. It mildews more readily than other oils and will sometimes leave residue on a rider's pants. Blended oils such as Tee See penetrate and condition well. They also soften the leather fibers, making the leather more pliable. Saddles treated with blended oils are less likely to mildew than those conditioned with pure neatsfoot oil. Remember, though, not all blended oils are equal. Certain "neatsfoot compounds" contain heavy petroleum products and should be avoided. As an alternative, some saddlemakers use extra virgin olive oil to condition saddles. Olive oil does penetrate well but does not provide the same conditioning and softening effect as neatsfoot oil and many of the blended oils. Corn and vegetable oils should be avoided for leather care, because these oils can become rancid and they tend to promote the growth of molds.

Any saddle or tack item being oiled should first be allowed to dry after the cleaning process (though antique leather items should not be allowed to completely dry out before oiling). Oils will penetrate better if warmed, and many saddlemakers will also place the leather in the sun to "warm up" prior to oiling. This process allows oil to penetrate the pores deeply and more evenly.

In locations with high humidity, it is important not to over-oil an item. The goal is to add life back to the leather but not to saturate the leather fibers. One to two coats are typically sufficient for the task. Too much oil will break down leather, cause excessive mildew, and leave residue on clothing. Oiling leather can also have a darkening effect. This might not be a problem for many horsemen but can be a concern for a western showman attempting to keep a saddle as light-colored as possible.

Once a saddle or bridle has been oiled and allowed to dry, apply a finish to the leather. A finish will serve to seal the fibers and add protection from moisture and dust. Finishes fall into two categories: lacquers and conditioners.

Lacquers such as Fiebing's Tan-Kote do an excellent job of sealing and waterproofing but do add some stiffness to the leather. This might be a plus for someone who wants their tack to have a shine and be scratch resistant, but it may sacrifice suppleness in that favorite, broken-in saddle. Tan-Kote does do an excellent job in helping to prevent the molds and mildews that can be a problem in Southern climates. Some riders have used commercial wood lacquers and floor polishes as finishes for their saddles, but these should be avoided as they are very difficult to remove when an item needs to be re-oiled and the finishes can crack after time in sunlight.

Leather conditioners such as Passier's Lederbalsam may contain oils, natural waxes, and lanolin. These products provide an excellent finish while tending to enhance the pliability, softness, and suppleness of the leather. They are generally applied with the fingertips and worked into the leather. After drying, any excess may be buffed with a soft cloth. Conditioners are typically a better choice than

lacquers for English saddle leather and for western saddles where a fast break-in and soft leather are considered important. Applied in moderation, conditioners do not typically encourage the growth of mildew.

Figure 3. Left: Oiling a saddle's swell, with the front and seat jockeys unbuttoned to facilitate cleaning and oiling. Right: Oiling the skirt, after the saddle has been cleaned and the rear jockeys have been removed to facilitate oiling and cleaning.
Credits: Summer Best, UF

Protecting an Ultra-Light-Colored Western Show Saddle

For a number of years, many riders showing in Western Pleasure classes have selected saddles with a very light finish. These saddles are often only used at the horse show and spend the remainder of their time in the trailer or tack room. Keeping the leather light on a saddle is a challenge. Saddle skirting tans just like human skin in sunlight and in man-made lighting. Therefore, keep such a saddle covered when not in use. Saddle covers should be stored unzipped so air may circulate, particularly when a saddle might still have moisture from a recent ride. Care for a light-oil saddle should be minimal and less frequent than for a daily work saddle. A wipe-down with a damp sponge and saddle soap should be sufficient for cleaning. One of the few oils that does not darken is Lexol-NF Leather Dressing. Some saddlemakers will also use Tan-Kote as a protective finish and to add a shiny coat to a light-finished saddle.

Cleaning Suede

Many western saddles have suede padded seats and some English saddles have suede knee rolls. Often the best cleaning technique is simply to take a stiff plastic brush or a brass brush and remove dust and dirt. This method will also help to raise the nap of the leather. Some saddlemakers use a brass brush on a cordless drill. That procedure works well but should be avoided on padded seats with quilting because the drill will damage the stitches. Suede typically does not need to be conditioned.

Rough-out Saddles

Ranch saddles are often made with the rough (flesh) side of the saddle skirting turned to the outside. This "rough-out" texture provides grip for the rider and may be found on the seat, fenders, skirts, or the entire saddle. Rough-out saddles should be cleaned and oiled the same way as tooled or smooth saddles. Additional finishes are typically not applied to the leather; however, conditioners are an excellent choice for the back side of fenders, stirrup leathers, and any rigging parts that may contact the horse.

Storage

Heat and humidity are tack's enemies. When practical during the summer months, saddles and bridles should be stored in a tack room with some method of removing moisture from the air. Using a dehumidifier or an air conditioner will make for a drier storage environment.

Points to Remember

- All leather products have a useable life expectancy.
- There are high-quality leathers and poor-quality leathers. Purchasing high-quality tack will cost more upfront, but the horseman will enjoy its use for a longer period of time.
- Saddle and bridles should be evaluated frequently to ensure the rider's safety. Cracked leather in stress areas should be replaced.
- Healthy leather in occasional use can and will harbor mold and mildew during hot, humid weather.
- Without routine care, saddles and bridles can become too dry. While these items may not grow mildew, they may be in danger of breaking and causing injury to horse or rider.
- Mold and mildew on leather tack can be successfully managed with the correct products and a moderate amount of time and effort.

UF | IFAS Extension
UNIVERSITY of FLORIDA

Calibration of Pesticide Application Equipment

2018 Spring Rancher's Forum

Sharon Fox Gamble, Extension Agent, IV and Joe Walter, Extension Agent, III

The label is the law. Labels will tell you what the application rate should be for the product and is often expressed as apply at a rate of ounces, pints, quarts or gallons of product applied/acre or pounds/1000 ft^2. Water is often used as a carrier to dilute the product so that it can be more easily applied with conventional equipment. In order to follow label directions, it immediately becomes necessary to determine the sprayer output over distance and time to determine how much product and water must be put into the tank to deliver the specified rate of ounces, pints, quarts or gallons of product and water per acre.

Calibration is the process of measuring and adjusting application equipment to deliver a defined quantity of product to a defined area. For example: gallons/ acre or pounds/1000 ft^2. Spray application equipment calibration may be accomplished by using several different methods. Common methods for boom and boom-less sprayers are known as the 5940 or 1/128 acre methods or single-nozzle backpack or ATV sprayer method. When you find a method that you are particularly comfortable with, keep the written process in the barn along with important items like RPM and gear preferences. If you only spray every couple of months, you will appreciate being able to quickly refresh your memory.

There is a whole art and science to nozzle types, manufactured materials, angles, etc. There are charts available that will tell you delivery rate, but unless you calibrate your equipment to determine the actual delivery rate, you may be over or under applying expensive pesticides, damaging crops, or not getting the job done, in effect causing calibration errors.

Calibration errors are caused by either equipment performance or operator error. For equipment, the calibration process will find obstructed or worn nozzles/screens/pump, design feature or improper adjustment.

For operator error, it will be from improper speed, poor operation patterns, and carelessness to settings, or equipment proficiency.

Applicators need to be aware and trained in basic pesticide safety and take into account important variables such as wind speed, direction, chemical risks and potential non-target species impact.

When beginning to calibrate, determine the engine RPMs and the gear you will be using. Write it down! Groundspeed variation has the greatest impact on sprayer output per acre!

The four variables required to properly calibrate a broadcast sprayer are operating pressure, swath width, equipment traveling speed and nozzle flow rate (output/minute). When all four of these variables are taken into consideration the result will be rate applied per acre (gallons/acre).

There are different types of spray application equipment. Most farms are using boom type sprayers. Some have boom-less type sprayers and then we all use backpack sprayers. The following two UF/IFAS publications will discuss calibration methods specific to boom type sprayers and backpack sprayers. If you have a boom-less sprayer, follow the manufacturers' guidelines or use the 5940 method.

Important commonly used acronyms and information:

GPA = gallons per acre (5940 x GPM) / MPH x Width)

GPM, gallons per minute (GPA x MPH x Width) /5940

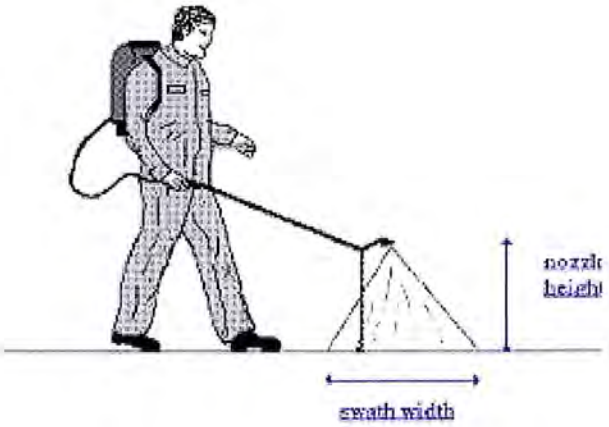
MPH, miles per hour

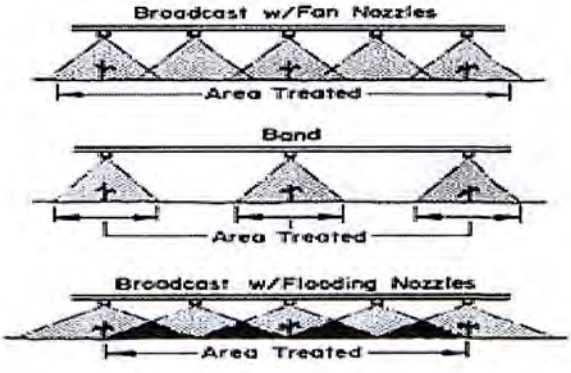
W, spray width of one nozzle in inches

5940, constant

Swath Width, width of all nozzles

1 acre = 43560 square feet.





Boom Sprayer Nozzle Performance Test[1]

Frederick M. Fishel[2]

Introduction

Calibration is adjusting equipment to determine the amount of material being applied to the target area. The main reason for calibration of liquid spray equipment is to determine how much pesticide to put into the sprayer's tank, so you can apply the recommended volume to the target site at a determined speed. Making sure all nozzle tips on the spray boom function uniformly is the fundamental first step of sprayer calibration. The nozzle tips can be affected by several things. Age, lack of maintenance, or type and amount of spray can cause nozzle tips to wear or clog. Worn or clogged nozzle tips make a boom sprayer unable to deliver a uniform spray pattern. The use of a boom sprayer that has a non-uniform nozzle tip output will very likely result in a misapplication.

Why You Need to Calibrate Equipment

Applicators are legally liable for injuries or damage caused by improper pesticide application. Several problems are associated with applying a pesticide at the incorrect volume.

- *Illegal residues.* Applying higher than legal volumes of a pesticide may result in residues on crop plants that exceed the legal tolerance level. If over-application results in illegal residues on plant surfaces, regulators have the authority to confiscate and destroy an entire crop to protect consumers.
- *Impact on effective pest control.* Pesticide registrants and/or manufacturers of pesticides spend millions of dollars researching ways to use their products correctly and effectively. This research includes determining the right amount of pesticide to apply to control target pests. Using less than the labeled rate is legal in most cases but may result in inadequate control, wasting time and money. Application volumes that are too low also may lead to problems such as pest resistance and resurgence. Using higher than the labeled rates is illegal and wastes pesticides and using too much pesticide may adversely affect natural enemies of the pest being controlled.
- *Human health concerns.* Pesticides applied at higher than label rates could endanger the health of pesticide handlers, field workers, yourself, and other people working in or around an area where you applied them.
- *Environmental concerns.* Pesticide concentrations higher than label directions may cause serious environmental problems. Calibrating equipment to maintain application volumes within label requirements reduces the potential for contaminating surface water, groundwater, and the air.
- *Impact on treated plant surfaces.* Certain pesticides are phytotoxic (injurious to plants) and damage treated plant surfaces when used at higher than label-prescribed rates. Manufacturers evaluate these potential problems while testing their products, so they can determine safe concentrations.
- *Soil contamination.* Using too much pesticide increases the chance of building up excessive residues in the soil. A buildup of certain pesticides sometimes seriously limits

1. This document is PI-23, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date April 1998. Revised March 2005, March 2008, and February 2011. Reviewed March 2017. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Frederick M. Fishel, professor, Agronomy Department and director, Pesticide Information Office; UF/IFAS Extension, Gainesville, FL 32611.

the types of future crops that can safely be grown in the treated area.

- *Wasting resources.* Using the improper amount of pesticide wastes time and adds unnecessary costs to the application.

Conducting the Test

Begin by making certain the boom sprayer has clean water in its tank, is mechanically sound, and has clean screens and intact plumbing. Make sure that all of the nozzle tips on the boom are the same type and size (for example, all tips are AI8002).

Commercial tip testers that measure nozzle flow rate are available but not necessary (Figure 1). Only a few simple items are needed for conducting the test (Figure 2), including the following: a clipboard, a nozzle performance data form (Table 1 located on the last page), a pencil, a wristwatch with a second hand or stopwatch, and a hand-held graduated container marked in milliliters and/or ounces.

Figure 1. Commercially-available flow meter for testing tip output.
Credits: UF/IFAS Pesticide Information Office

Steps to Perform the Test

1. Using the graduated container, catch the output from each nozzle for a predetermined time; either 30 seconds or 1 minute is usually adequate (Figure 3). Write down the nozzle outputs by nozzle on the data form.

2. Sum total amounts from each nozzle. Divide by the number of nozzles to get the average nozzle output. Write down the average output on the data form.

3. Determine the tolerance value by multiplying the average nozzle output by 0.10. In other words, you will replace any nozzle that is applying more or less than 10% of the average nozzle output.

4. Determine the upper limit by adding the tolerance value to the average nozzle output, and determine the lower limit by subtracting the tolerance value from the average nozzle output.

5. If output from any nozzle is greater than the upper limit, the nozzle tip is probably worn out, and a new tip is needed. If output from any nozzle is less than the lower limit, cleaning may bring it into the correct range. If not, replace the nozzle, and repeat the test.

6. If tips are replaced after the initial test, repeat steps 1–5.

Figure 2. Simple items needed for performing a nozzle performance test.
Credits: UF/IFAS Pesticide Information Office

Figure 3. Performing a nozzle output check.
Credits: UF/IFAS Pesticide Information Office

Example Calculation

1. You have a boom with 8 nozzles and catch the following outputs in 30 seconds per nozzle:

- Nozzle 1: 16 ounces
- Nozzle 2: 12 ounces
- Nozzle 3: 15 ounces
- Nozzle 4: 16 ounces
- Nozzle 5: 16 ounces
- Nozzle 6: 15 ounces
- Nozzle 7: 14 ounces
- Nozzle 8: 19 ounces

2. The average nozzle output is 15.4 ounces (123 ÷ 8).

3. The tolerance value is 1.5 (15.4 x 0.10).

4. The upper limit is 16.9 (15.4 + 1.5), and the lower limit is 13.9 (15.4 – 1.5).

5. Nozzles 2 and 8 should be replaced and the test repeated.

Additional Information

Dean, T.W. and F.M. Fishel. 2008. *Broadcast Boom Sprayer Calibration.* Gainesville: University of Florida Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/pi016.

J.A. Ferrell, B.A. Sellers, and R. Leon. 2012. *Calibration of Herbicide Applicators.* Gainesville: University of Florida Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/wg013.

Table 1. Nozzle tip performance data form

Date		Nozzle tip code	
Pump pressure (psi)		Number of nozzles on boom	
Spray catch time (seconds)			
Nozzle number	Fluid ounces caught	Nozzle number	Fluid ounces caught
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	
Average nozzle output (fluid ounces)			
Tolerance value (average nozzle output x 0.10)			
Upper limit (average nozzle output + tolerance value)			
Lower limit (average nozzle output – tolerance value)			
Notes:			

Calibration of Herbicide Applicators [1]

J. A. Ferrell, B. A. Sellers, and R. Leon[2]

Calibrate your pesticide applicators on a regular basis to ensure that output from each nozzle is consistent and the desired application rate is achieved. If a pesticide applicator is not properly calibrated, the pesticide will probably be applied below or above the desired application rate. Under-application of pesticides generally leads to a lack of pest control and poor pesticide performance, while over-application will cost more money than necessary and may also unintentionally result in harm to desirable species.

The two most common methods for sprayer calibration are discussed below.

5940 Method

The 5940 equation is a very accurate way to determine sprayer output (Equation 1). (Each term in this equation is discussed in order, from top and first to bottom and last.)

Equation 1

GPA = (5940*GPM) / (MPH*W)

GPM, Gallons Per Minute

GPA, Gallons Per Acre

MPH, Miles Per Hour

W, Spray Width of One Nozzle in Inches

5940, Constant

GPM—Gallons Per Minute. The amount of water discharged from a nozzle in 1 minute. This measurement is achieved by turning on the sprayer and holding a measuring cup underneath the nozzle for one minute. Next, transfer the water obtained into a measuring device that will accurately quantify the water in terms of either fluid ounces or milliliters. Next, convert that amount of water from ounces or milliliters to gallons (since gallons-per-minute is the desired unit).

One gallon consists of 128 fluid ounces or 3786 milliliters. To convert to gallons, divide the amount of water acquired in one minute by 128 or 3,786, depending on whether the container you are using measures the water volume in terms of ounces or milliliters. The result of this calculation is gallons per minute (GPM).

For the most accurate measurement, collect water from multiple nozzles to ensure that output is similar across the boom. (It is common for a nozzle to become plugged, and this practice will identify any malfunctioning nozzle). You can also pour the samples together to determine an average GPM.

1. This document is SS-AGR-102, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date April 1999. Revised April 2004, October 2009, and September 2012. Reviewed October 2015. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. J. A. Ferrell, professor, Agronomy Department; B. A. Sellers, associate professor, Agronomy Department, Range Cattle Research and Education Center; and R. Leon, assistant professor, Agronomy Department, West Florida Research and Education Center; UF/IFAS Extension, Gainesville, FL 32611.

W—Spray Swath (or Width). A measurement in inches describing an area covered by one nozzle. If calibrating a boom sprayer, this measurement is the spacing between the nozzles (Figure 1). Common spacing for flat fan nozzles ranges between 15 and 24 inches (see manufacture specifications). If using a boomless nozzle (Figure 2), W will be the width of the pattern for that nozzle. One boomless nozzle will commonly spray a pattern of 12–15 feet. In that case, W for that nozzle will be between 144 and 180 inches.

Figure 1. Measuring nozzle spacing to determine "W".
Credits: J. Ferrell, UF/IFAS

Figure 2. A wide-swath, boomless nozzle.
Credits: J. Boyd, U. of Arkansas

MPH—Miles per hour. Most equipment will have a somewhat reliable speedometer. Nonetheless, check the accuracy of the instrument periodically because speed is directly linked to sprayer output in gallons per acre (GPA). If speed is doubled, GPA decreases by half; therefore, small changes in ground speed cause large changes in the amount of pesticide being applied. To check speed, measure off an area (usually 100 feet) and time how long it takes to travel that distance. If using a tractor, make sure that the engine speed (RPM) and transmission gear are at the same settings as when used for spraying. After you have traveled the course, use the following equation:

MPH = (distance (ft)*60) / (time (sec)*88)

After GPM, W, and MPH have been determined, plug these values into Equation 1 and solve.

Changing GPA. Equation 1 will allow you to determine sprayer output in terms of gallons-per-acre. However, if GPA is too high or too low, change GPM (by increasing pressure or changing sprayer nozzles) or change the driving speed.

Increasing spray pressure will increase GPM, but only slightly. To illustrate, spray pressure will have to be quadrupled in order to double GPM. Since most spray nozzles are not rated to operate over such a large range of pressures, adjusting pressure is simply a way to "fine tune" sprayer output. Large adjustments in GPM are best achieved by changing to different size nozzles or changing driving speed.

What GPA is common? GPA varies depending on the type of application. As a general rule, carrier volumes that range from 15–30 gallons per acre will perform very well. If a specific GPA is desired, Equation 1 can be reorganized—as in the example below—to solve for GPM.

Equation 2

GPM = (GPA*MPH*W) / 5940

In this example, inputting the desired GPA, speed (MPH), and nozzle spacing (W), will give the exact amount of water that must be caught from 1 nozzle in 1 minute (GPM). However, the equation will give the answer in gallons per minute. Since gallons are difficult to measure with accuracy, convert the answer to ounces or milliliters. Multiplying GPM by 128 (for ounces) or 3786 (for milliliters) will give the amount of ounces or milliliters that will need to be caught from 1 nozzle in 1 minute to achieve the desired GPA.

1/128th Acre Method

The 1/128th acre method is a simplified form of calibration based on spraying 1/128th acre. There are 128 ounces per gallon; therefore, the number of ounces sprayed per 1/128th acre is equal to the number of gallons sprayed per acre. The advantage of this method is that, because little or no math is involved, there are fewer opportunities for mistakes. This procedure is ideal for "boom-type" sprayers, but is less effective for "boomless" sprayers. If calibrating a boomless sprayer, use the 5940 equation. A boom-type applicator can accurately be calibrated by following the steps below.

1. Determine nozzle spacing or swath width. (This is the W term from Equation 1).

2. Using Table 1, determine the course length you will need to travel, relative to nozzle spacing. Measure and mark the distance required and prepare to drive that distance.

3. Record the time required to drive the length of calibration course at gear, engine rpm, and implement settings to be used while spraying.

4. Park sprayer, maintain engine rpm used to drive course, and turn on sprayer.

5. Collect all spray from one nozzle for the amount of time determined in Step 3.

6. Measure the ounces caught. Ounces caught is equal to gallons per-acre of spray applied.

7. Repeat Steps 5 and 6 for several other nozzles to ensure accuracy.

Table 1.

Swath Width or Nozzle Spacing (in)*	Course Distance (ft)
16	255
18	227
20	204
22	186
24	170

*If the necessary nozzle spacing is not listed, the spacing can be calculated using the following equation: Course Distance (ft) = 340 / (Nozzle Spacing (ft))

DIVERSIFYING YOUR PASTURE BASE

Liliane Severino da Silva – UF Agronomy Department Graduate Student
Caitlin Bainum – UF Agronomy Department Graduate Student and Marion Co. Agriculture & Natural Resources Extension Agent
Marcelo Wallau – UF/IFAS Forages Extension Specialist
Chris Prevatt - State Specialized Extension Agent II Beef Cattle and Forage Enterprise Budgeting & Marketing

Why should I diversify my pasture base?

One of the greatest benefits to livestock production in Florida is our great capacity for producing forage. We have species adapted to most of our climatic and soil conditions, and plenty of choices for each season which allows for grazing almost year-round. With this said, most of the beef cattle production in the state relies on one or more - warm-season perennial grass species, like bahiagrass and bermudagrass. Those species are indeed the main forage crops, but forage production of those crops is concentrated in the summer months, requiring supplemental feed for a significant part of the year. There are many management practices and forage alternatives that can help to overcome this shortfall of forage during fall through spring months. For example, stockpiling limpograss for fall and winter use, or cool-season forages for winter and spring use. In both cases, the key is diversifying your forage base, and not depending on only one or two species.

A diverse forage base has many benefits for your production system. By using species that complement each other in terms of growing cycles, we can time the demands of our production system, both in terms of quantity and quality of forage with the livestock capacity. This way it is possible to increase the number of days grazing and more adequately attend to the nutritional needs of the different animal categories. Furthermore, by selecting the best species for each soil type (e.g. wet areas vs. high ground) and each season, we can optimize the use of the area and resources. Having active growing forage year-round has important impacts on soil quality; promoting ground coverage, increasing soil organic matter and optimizing nutrient cycling. Lastly, by introducing legumes into a pasture, we are adding nitrogen to the system and reducing the need for chemical fertilizer inputs and increasing the nutritive value of the forage. Besides reducing the costs of production, this alternative management practice also contributes to a decrease in the carbon footprint from the system, due to a decrease in production, transportation and application of nitrogen fertilizer.

Therefore, a diverse system is more resilient to changes in weather patterns (e.g. drought, flood), less dependent on market prices (e.g. keeping animals on pasture longer is cheaper than feeding hay) and has the potential to deliver a broader range of ecosystem services. In essence, ecosystem services relate to the benefits that we can achieve by having a well-managed forage system. Some of those benefits are permanent ground coverage, decrease of nutrient and water runoff, erosion and leaching, improved soil quality, biodiversity and nutrient recycling. Over the last two decades, this ecological perspective of systems has been gaining importance in agricultural systems, mostly due to growing environmental concerns.

Challenges lead to diversification:

The challenges faced by cattle producers that can be addressed by diversification of the forage base can be seen from two views: environmental and production. From the environmental perspective, there is growing concerns of water quality impairments, calling for reductions in manure and fertilizer pollution and mitigation of greenhouse gases prevenient from livestock production. From the production perspective, the need to extend the grazing season, reduce the dependence on external inputs (e.g. feed or fertilizer), and improve soil fertility. With temperatures seemingly increasing , it becomes more important to have alternatives to cope with potential impacts on foragesystems. For example, in 2017, after a very dry spring and early summer we had record rainfall in part to Irma`s aftermath, and the southern United States saw an effect on forage production and pasture persistence. Many areas were flooded for some period affecting feed availability for animals to graze during the summer also having an impact on hay production to provide feed for the cool season, which has been reflected in the hay market prices. Therefore, we need to have flexible production system that offers alternatives in case of such events. This is called *resilience*.

Resilience is defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker et al., 2004). Over the last decade, resilience of agricultural systems has become an important topic of discussion due to climate change and the eminent risk of extreme climatic events to happen potentially impacting overall food production. Considering these possible scenarios, plan for potential alternatives to undergo situations of feed shortage and increased hay prices by devising a strategy of cool-season forages best suited as an alternative in Florida. Resilience in agricultural systems is hard to measure and is usually more easily noticed in long-term cultivated systems, because then it is possible to notice the patterns attributed.

There are many factors that can contribute to resilience in forage systems, from enhancing opportunity for plant survival via grazing management, fertilization or irrigation, to increasing biodiversity, and choosing species adapted to different scenarios. The grazing management will need to consider frequency and intensity of events, but mainly proper stocking rate, because that will have a great impact on plant (pasture) persistence in the long-term, which is the ultimate goal. The increase of biodiversity in a forage system can be done by using annual and perennial species, cool season plants and introducing legumes (N biological fixation), for example. There are many advantages to this approach, especially for improving soil quality. By adding organic matter to the system, there will be an increase in its stability and potential to recycle nutrients, then making them available to plants and microfauna ("animals") in the soil. But, this process is usually slow and requires good management, especially of the pasture and t on the nutrient distribution of the system. Also, biodiversity may contribute to decrease in pest and disease pressure.

In this context, the diversification of a forage base can be done by either introducing two or more species in the same area, or by establishing different areas with different species. For this, you could strategically divide your farm into several areas,

identify which species would be better suited for each area, especially in terms of soil characteristics, and plant accordingly in each area. This alternative allows you to plan for different diet requirements by allocating specific areas inside the property for specific animal categories, or just to plan a rotation of successive crops or preparation of new pasture areas in early Spring.

Alternatively, you can implement a succession (e.g. annual cool-season species overseeded in warm-season perennial pasture) or establishment of multiple species (e.g. mixing small grains, ryegrass and clovers, or bahiagrass and rhizoma peanut). The introduction of legumes, as legume-grass mixtures, has been gaining more attention recently in the U.S. This is largely due to the legume's ability to fix nitrogen from the atmosphere; however, there are some management challenges associated with these systems that complicate its broader use. Nevertheless, yield advantages of grass-legume mixtures have been found in many studies (compiled in Tracy et all, 2017), and animal performance can be optimized once N is supplemented in the animal's diet, as well as an increase in soil N due to biological fixation by the legumes.

The idea is to organize your forage base in a way to minimize the forage gaps throughout the year (Figure 1). In this context, it is very important to be able to establish a good forage budget for your enterprise. To accomplish that, it is essential to understand the needs of your herd or hay business. Also, be familiar with how forage production is spread throughout the year so you can plan ahead accordingly, and select proper species for your system.

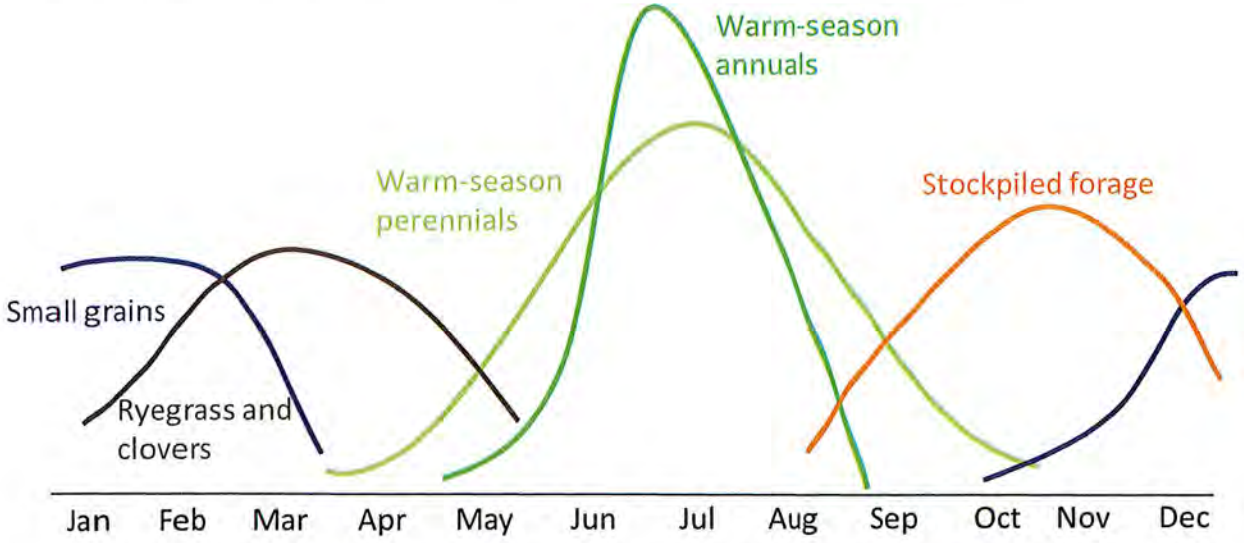


Figure 1. Schematic representation of growth curve for different groups of species along the year. The objective is to have forage available for the animals during all year.

How to effectively diversify your pasture:

COOL-SEASON FORAGES

Cool-season forages are an important alternative for filling the gap in productivity from the summer-perennial pastures through the winter and into the spring. Although risky because of uncertain precipitation predictions during the establishment period

(October through December), those species can be an important source of high quality forage for the winter and spring period. With peak of productivity between December (small grains) and March (ryegrass), those forages can produce between 2000 and 5000 lb/acre of dry matter, with digestibility between 65 and 90% and crude protein between 15 and 25% (Dubeux et al., 2016).

In Florida, there are two important determinants for establishing cool-season forages: moisture and temperature. Soil moisture is usually the most critical factor for determining when to start planting and whether establishment will be successful. Rainfall during the recommended establishment phase, between mid-October and early-December is generally scarce and can delay implementation of the pasture. Irrigation, especially in south Florida, is beneficial for establishing cool-season forages and can allow for an early implementation, thus, early grazing. With warm temperatures in the fall, summer forages or weeds can still be active which increases the competition and can prevent or delay germination and growth of cool-season species. The warm temperatures can also increase the probability of fungal diseases, such as rust. For this reason, it is important to use recommended species and planting dates for each region (Blount at al., 2017 – SS-AGR-84).

Table 1. Requirements of establishment and potential forage production for most used cool season species in the Southern Region.

Species	Soil conditions	Growth cycle	Seeding rate (lb/acre)	Approximate herbage production range (lb/acre)
Oat	prefer dry areas, triticale and rye can tolerate lower pH (5)	Early	80 - 120	2000-5000
Rye		Early to supper early (FL 401)	80 - 120	2000-5000
Triticale		Early	80 - 120	2000-5000
Ryegrass	Tolerate wet areas and acidic soils	Medium to late	20 - 30	2000-5000
White Clover		Late	3 - 5	2000-4000
Crimson Clover	Dry areas and soil pH around 6.5	Early	20 - 25	2000-4000
Red Clover		Medium	10 - 15	2000-4000

Crimson clover (Left), rye (Middle) and mixture of clovers+ryegrass+rye (Right)

Some important aspects of establishing cool-season forages:

Prepare the area: seedbed preparation or overseeding on sod. In both cases, the important aspect is to reduce competition and increase seed-to-soil contact. Tilling will result in faster germination and a more even stand, however it will kill your summer pasture. This technique can be used in areas previously cultivated with row crops or in preparation for implementing new summer pasture (i.e. prepare the area during the fall, seed cool-season forages, and seed bahiagrass or plant bermudagrass in the following spring/summer). Light disking is an alternative that will not kill the summer pasture but will delay growth the following spring.

Broadcasting vs. drilling. Ryegrass and clovers can be broadcast, but it reduces and delays germination because of competition. The best planting method is always drilling, to ensure good seed-to-soil contact. In the absence of drilling equipment, the area can be tilled or disked prior to broadcasting, and again after, for burying the seeds. However, be aware not to plant the seeds too deep. An offset disk harrow, if set close to "straight" (not to disturb the soil too much) can be a solution. In any case, it is important to roll the area after seeding to ensure proper soil-to-seed contact. Some drills are equipped with press wheels that compact the row simultaneously.

Choosing the right species or mix of species:

The most popular species are the small-grains (especially rye, oat and triticale) and ryegrass. Small-grains are better suited for higher ground. When using legumes mixed with grasses, it is still helpful to add some starter N, at 30 lb/acre, to enhance the grasses earlier in the season. At first, the legumes will not supply much nitrogen in the form of fixed N to the soil. The benefit will come as the legumes finish their cycle and leaves N in the system, incorporated as roots and leaves that will decompose, meaning that the grasses will not benefit until then. When thinking about multiple years, however, then there is an important input of N in the system as a whole while increasing soil quality. The idea of mixing is to have species that complement each other on the growing cycle and have different peaks of production throughout the season. Small-grains have fast germination and growth, being ready for grazing as early as 45 days after planting, while ryegrass is a late player.

Are cool-season forage systems affordable?

It depends on your system! Due to their high-quality, cool-season species allow animals to achieve greater average daily gains and more competitive costs per pound of gain over supplemental feedstuffs. Ball and Prevatt (2009) compared 37 stocker grazing studies conducted in Alabama and observed that among the lowest calculated costs of gain per pound achieved, five were in cool-season forage systems. The costs of production will be affected by many factors and are highly sensitive to variations in market prices. The economic return on a system will be dependent on animal performance, forage production and length of the grazing period. For this reason, it is crucial to aim for good establishment and determine an adequate grazing management scheme. When considering the costs of planting perennial forage systems

establishment costs should be amortized over their expected useful life (>10 years). . Annual forage systems are expensed in the year they occur.

Choosing the proper specie(s) and cultivars that are better suited to be used in a specific livestock production system is essential, as well as knowing what level of animal performance is desired to be achieved and the associated cost of that goal. Variables surrounding the cost of production for a forage system are subject to fluctuations of prices in the market. Therefore, it is essential to make a budget for each enterprise, specifically, to assess its feasibility. There are many forage budget tools available that can be used to estimate costs of production, and the costs obtained will be helpful in making decisions needed in the enterprise. But for any tool chosen, as simple as a spreadsheet, it is necessary to have notes collected about items purchased and services used, and always have your goals in mind to be able to make decisions based on the numbers obtained (vide Panhandle AgNews reference for steps to plan).

The estimation of cost of gain (per pound) seems to be the most appropriate tool allowing to not only compare systems, but also analyze their practicality. Usually, indexes come in handy to compare forage quality between different options, especially for the hay feed/market. Definitions based on attributes such as coloror smell may be biased, and not informative of the forage quality. The relative forage quality (RFQ) index was proposed by Moore and Undersander (2012) and it is "an estimate of voluntary intake of available energy when forage is fed as a source of energy and protein". Using RFQ, forages are classified from premium (>140) to utility (<90), and different types and categories of animals have different requirements. It is important to emphasize that this index was not built to be used for diet formulation, but to serve as a tool, the ultimate decision will be based on the cost versus value relationship.

Recently, we estimated costs of production on legume- and N-fertilized grass-systems being managed year-round using an overseeding strategy during the cool season under grazing (Silva et al, 2018). In the legume-system, a mix of white, crimson and red clover, ryegrass and rye was planted, while In the N fertilized grass-system, only rye and ryegrass were planted. An initial fertilization of 30 lb of N, 30 lb of P and 53 lb of K per acre was applied. For the grass system, an additional 132 lb of N was split in two applications. The cost estimates correspond to January 2018 prices, and is an example of a simple assessment that can help you to define the cost of forage production in your enterprise. The calculated costs of establishment included soil testing, seeds, fertilizer, lime, labor, equipment and machinery, and land opportunity costs (Table 2). We considered the particularities of each system due to different species and tried to represent a common Floridian system.

Table 2. Estimate of establishment costs for cool-season forage species in year-round systems managed under grazing or hay production.

Description	**Legume system**	**N-fertilized grass system**
	cost per acre ($)	***cost per acre($)***
Soil Testing	5.0	5.0
Seeds	129.1	63.8
Fertilizer (N,P,K)	64.1	177.8

Misc. expenses	7.5	7.5
Machinery & Fuel	4.7	4.7
Land opportunity (per acre)	10.4	10.4
Total ($)	**183.2**	**211.6**

The costs for establishment ranges around $200 per acre, with the N fertilizer systems being more expensive due to fertilizer prices. Although, the return the N input can generate will be reflected as greater forage production which allows for a higher stocking rate. In table 3, we show estimates obtained for both systems, and values for crude protein and digestibility that reflect actual data collected over four-years of field work. For these estimates, we opted to show a potential forage production, since cool-season specie mixtures can vary in production depending on many factors, especially with regards to inputs to the system (i.e. fertilization rate). We are also presenting the relative forage quality (RFQ) and quality index (QI) values once they allow for better comparison between systems, and the RFQ was also used to estimate a value of cost for dry matter (DM) produced on its basis.

Table 3. Estimated Forage cost of gain per pound and indexes of forage quality for legume- and N-fertilized grass systems.

System	***Legume-system***	***N grass-system***
Potential forage production (lb acre $^{-1}$)	3000	4000
Crude protein (%)	18.4	20.4
Digestibility (%)	67.2	69.1
RFQ	186	204
QI	2.4	2.7
$ lb $^{-1}$ DM RFQ (equiv.)$^{-1}$	1.01	1.06
$ lb $^{-1}$ DM	0.10	0.08
Grazing days	100 to 120	100 to 140
Estimate gain (lb acre^{-1})	408	612
Forage cost of gain ($ lb^{-1})	0.46	0.35

The estimation of costs of DM were made considering 60% for forage utilization level and shows a short margin of difference between systems. For these estimates, we are assuming average daily gain around 1.7 lb per day, and between 2 and 3 heads per acre, respectively, for legume- and N-fertilized systems, but this will vary depending on the forage production of each system. This difference in stocking rates may affect the total weight gain per area on the season, and also will reflect on total net return of investment after selling the animals. These estimates being provided show that we can have feed price per ton less than $100 in a critical period of the year, and definitely cheaper than hay bales that are being sold at the same time. Prevatt (2014) shows a comparison of prices in different levels of production of cool-season systems, which has

a great potential to decrease even more costs, and makes a good point- emphasizing those costs will be even lower once the animals harvest the material themselves.

Usually, feed costs are the greatest expense in livestock production systems, so having alternatives that can decrease those costs may be worth looking at but has to be done on a farm to farm basis. As we saw, the higher potential production comes in a system with greater inputs, which will require more investment of time,, management, and should reflect the type of approach from an ecological point of view you may want to follow. So, being able to look at cost of DM production and forage cost of gain allows us to have a more appropriate comparison to hay market prices to help guide a decision to plan for a cool-season pasture for next year.

Summary

Cool-season forages are a good alternative to extend the grazing season, provide high-quality feed while allowing high average daily gain of grazing animals. These forages also compete with prices in the hay market and can provide many benefits to the system such as; increasing biodiversity and nutrient cycling, while also providing coverage through the winter months of the year which may impact maintenance and/or the improvement of soil quality. However, it is crucial to keep in mind that their use requires planning ahead, good stand establishment and proper management to achieve good net return. Cost determination of an enterprise is a powerful tool to help in decision making. Be sure to check the feasibility of production in livestock-production systems. Costs are highly dependent on the production achieved, which means that they can be diluted with a higher mass produced, but the opposite is also true. Thus, there are indexes, such as RFQ and QI that helps compare systems and feed quality, and are more consistent than aesthetic characteristics; however, they may not be used as a tool to calculate animal diets. The estimation of the forage cost of gain per pound of animal product produced can be used to determine the feasibility of that strategy/management. As we all know, since margins of profit on livestock systems always depend on many factors, with cool-season species this rule also applies, and this strategy requires good management to succeed.

References

Blount, A.R.; Wallau, M. O.; Rios, E.; Vendramini, J.M.B.; Dubeux, J.C.B.; Babar, Md A.; Kenworthy, K.E.; Quesenberry, K.H. 2017 Cool-Season Forage Variety Recommendations for Florida. Available in: https://edis.ifas.ufl.edu/pdffiles/AA/AA26600.pdf

Dubeux, J. C. B., Dilorenzo, N., Blount, A., Mackowiak, C., Santos, E. R. S., Silva, H. M. S., Schulmeister, T. (2016). Animal performance and pasture characteristics on cool-season annual grass mixtures in North Florida. Crop Science, 56(5), 2841–2852. https://doi.org/10.2135/cropsci2016.03.0141

Prevatt, C. The Economics of Grazing Cool-Season Annual Forages October 21, 2014, Southeast Cattle Advisor. Available at: http://www.secattleadvisor.com/2014/10/21/the-economics-of-grazing-cool-season-annual-forages/

Silva, L.S.; Mullenix, M.K.; Sollenberger, L.E.; Wallau. M.O.; Kohmann, M.M.; Quesenberry, K.H.; Dubeux, J.C.B.; Vendramini, J.M.B. Economic Feasibility and Ecosystem Services Delivery of Grass-N and Legume-Forage Systems in the Southeastern US. Southern ASA Branch, Jacksonville, FL. 2018. Available in: https://scisoc.confex.com/scisoc/2018srb/webprogram/Paper110696.html

UF | IFAS Extension
UNIVERSITY of FLORIDA

SS-AGR-84

2017 Cool-Season Forage Variety Recommendations for Florida[1]

A. R. Blount, M. Wallau, E. Rios, J. M. B. Vendramini, J. C. B. Dubeux, Md. A. Babar, K. E. Kenworthy, and K. H. Quesenberry[2]

Introduction

Perennial warm-season pasture grasses used in Florida become dormant in late fall and winter because of short days, cooler temperatures, and frosts. Many livestock producers may choose to establish cool-season annual pasture species to supplement their forage production. These plants are usually higher in total digestible nutrients (TDN) and crude protein (CP) than summer perennial grasses. Planting and growing these forage crops can involve considerable expense and is somewhat risky because rainfall is often unpredictable during the fall establishment period. The species and varieties for potential use vary in the distribution of production during the cooler months and in the type of soils where they are best adapted.

This publication provides the most up-to-date information on current adapted cool-season forage varieties. The recommendation of varieties is based on multi-location, multi-year cultivar evaluation experiments that may include trials in Georgia and other states. Table 1 includes information about the planting dates, seeding rates, and other considerations. If you have questions about a particular variety, contact your local UF/IFAS Extension agent for additional information (http://solutionsforyourlife.ufl.edu/map/).

Recommended Cultivars (Varieties)

Alfalfa

Alfalfa is usually grown as a winter short-term perennial in Florida, typically used for haylage, green chopping, or hay. Alfalfa requires good management practices for establishment and maintenance. It is not tolerant to flooding or soils with high water tables, and requires a soil pH of 6.5 or greater. This species is not widely cultivated in Florida because it is difficult to produce timely hay cuttings with Florida's humid conditions. However, the cost of producing alfalfa haylage and silage has decreased in recent years, and this has made it a viable and cost-effective option as a high quality, conserved legume forage. Some new cultivars have been developed for tolerating a certain amount of grazing, but are not as grazing-tolerant as other legume species, such as most of the clovers.

1. This document is SS-AGR-84, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date September 2003. Revised June 2010, October 2011, December 2012, September 2013, September 2014, and September 2017. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. A. R. Blount, professor, Agronomy Department, UF/IFAS North Florida Research and Education Center; M. Wallau, assistant professor, Agronomy Department; E. Rios, assistant professor, Agronomy Department; J. M. B. Vendramini, associate professor, Agronomy Department, UF/IFAS Range Cattle REC; J. C. B. Dubeux, assistant professor, Agronomy Department, UF/IFAS NFREC; Md. A. Babar, assistant professor, Agronomy Department; K. E. Kenworthy, associate professor, Agronomy Department; and K. H. Quesenberry, professor emeritus, Agronomy Department; UF/IFAS Extension, Gainesville, FL 32611.

RECOMMENDED VARIETIES

Alfagraze 600RR (Roundup Ready) and Bulldog 805

Clover, Arrowleaf

Arrowleaf clover is an annual species, similar to crimson clover in soil adaptation, management, and fertility requirements. It is mainly grown on heavier soils in northwestern Florida. Arrowleaf clover makes more growth in late spring than crimson clover.

RECOMMENDED VARIETIES

Blackhawk and Apache (for North and Central Florida). Yuchi is not recommended because it is an older variety and is more susceptible to disease. Blackhawk and Apache have improved virus resistance compared to Yuchi.

Clover, Ball

Ball clover grows on a wide range of soil types, including poorly drained soils. Although it is well adapted, it is not considered to be a highly productive forage in Florida.

RECOMMENDED VARIETIES

Don, Grazer's Select, and Segrest. Pre-inoculated seed is recommended.

Clover, Berseem

Berseem clover has low bloat potential and is well adapted to many soil types in Florida, including more alkaline and wet soils. Care should be given to the management of berseem clover when grazed. It is advisable to graze at about 10 inches and leave a 3–4 inch stubble height.

RECOMMENDED VARIETIES

Bigbee and Frosty.

Clover, Crimson

This clover is a reseeding annual adapted to fertile, well-drained soils. It has a relatively short grazing season. Crimson clover may be grown in combination with ryegrass or a small grain crop.

RECOMMENDED VARIETIES

Dixie and AU-Robin (seed availability may be limited).

Clover, Red

Red clover behaves as a winter annual under Florida conditions and usually does not reseed itself. It does not tolerate poorly drained soils. Red clover provides long-season forage production in North Florida.

RECOMMENDED VARIETIES

Barduro (mid-dormant, released by UF-IFAS), Red Ace, Southern Belle (non-dormant, released by UF/IFAS), and FL2,4D (resistant to herbicide 2,4D, released by UF/IFAS). Southern Belle is a non-dormant red clover. It offers earlier forage production and greater total-season forage yields than more dormant varieties. Barduro is a UF red clover cultivar that is a mid-dormant type. Bulldog Red is also marketed in the southeastern United States but data is limited on its performance in Florida. FL2,4D was released by UF/IFAS in 2016 and licensed to Grassland Oregon.

Clover, White

White clover is usually a winter perennial, but may act as an annual depending on moisture conditions. It is adapted to moist soils throughout Florida and is moderately tolerant to acidity. Production and persistence of white clover can be limited by nematodes and other pests.

RECOMMENDED VARIETIES

Louisiana S-1, Ocoee (released by UF/IFAS, nematode tolerant), Osceola (released by UF/IFAS), Regal Ladino, and Regalgraze. Durana is also well adapted, has a prostrate growth habit, and persists well under grazing, but it has lower initial forage yields.

Fescue, Tall

In general, fescue should not be planted in Florida. It does not persist as a perennial, and small grains and ryegrass are more productive as a cool-season annual. A few producers have had limited success with Ga-5 when planted on low, wet clay soils in northwestern Florida.

RECOMMENDED VARIETIES

Max Q II and Texoma endophyte-friendly fescue where adapted.

Lupine

Lupine is an annual plant adapted to well-drained soils in northern and western Florida. It is an excellent cover crop. Seed supply has been low in recent years, and forage production has been limited by diseases and insects. Only sweet lupine varieties are suitable for forage.

RECOMMENDED VARIETIES

Tifblue. Frost and Tifwhite are also recommended; however, commercial seed production of these lupine varieties has been limited and seed is currently unavailable.

Medic

Medics are small seeded legumes that grow on a wide range of soil types. Although they are well adapted, they are not considered to be highly productive forages in Florida.

RECOMMENDED VARIETIES

Armadillo burr and Devine little burr. Pre-inoculated seed is recommended.

Oat

Oat is very palatable, but is susceptible to freeze injury. Oat may be planted and grazed earlier than rye. Legend 567 and Horizon 720 are new crown rust resistant varieties. In 2013, a new strain of crown rust was identified on all commercially available eastern oat varieties and symptoms ranged from mild infection to early plant senescence. We recommend planting disease-resistant varieties when available; however, in grazing systems, crown rust resistance is less critical since rust inoculum is reduced by the grazing animal. Other commercially available varieties of oat are often are very productive, although susceptible to crown rust. Early planting of susceptible varieties is not recommended. Few fungicides are labeled for use by the grazing animal, or have hay use limitations. Horizon 306, Horizon 201, and RAM LA 99016 are excellent forage types that have winter hardiness and good grain production, however are susceptible to the new strain of crown rust that is prevalent state-wide. Susceptible oat plantings may need to be scouted for rust and treated with legal fungicides, particularly if grown for silage or grain. In some years, some varieties, such as NK-Coker 227, may be injured by Barley Yellow Dwarf Virus (BYDV), an aphid transmitted virus. Typically, oat varieties grown for grazing, which are early planted, are not sprayed with insecticides for aphid control. Grazing reduces populations of aphids but may not prevent early infection of BYVD in early planted situations where warm fall weather prevails.

RECOMMENDED VARIETIES

Legend 567 (currently crown rust resistant), Horizon 720 (currently crown rust resistant), Horizon 201, Horizon 306, and RAM LA 99016.

Peas, Austrian Winter (Common)

This annual legume is best suited to well-drained soils with high clay content.

RECOMMENDED VARIETIES

Common, Maple, and Whistler.

Rye

Rye is the small grain most widely used for winter grazing. Rye is more cold tolerant than oats and generally produces more forage than either oat or wheat. If rye is planted very early in the season, there may be a decreased stand caused by various seedling diseases. Normally rye developed from northern states produces little forage in late fall or early winter and usually is severely damaged by leaf rust; therefore, only plant varieties recommended for the southeastern United States.

RECOMMENDED VARIETIES

FL 401 (for early grazing or use in blends), FL 104 (seed availability may be limited, full-season grazing), Wrens Abruzzi and late-forage season producers, developed in Oklahoma: Bates RS4, Elbon, Oklon, Maton, and Maton II.

Ryegrass

Ryegrass is a valuable winter and spring grazing crop for use on flatwoods soils or the heavier sandy loam soils in northwest Florida. Ryegrass may be seeded alone or with a small grain on a prepared seedbed or overseeded onto permanent grass pastures. Seeding ryegrass with a small grain crop lengthens the grazing season. (NOTE: Few differences were found between early and late variety performance in the 2016-17 season of production.)

EARLY RECOMMENDED VARIETIES

Attain (released by UF/IFAS), Big Boss (released by UF/IFAS), Diamond T, Earlyploid (released by UF/IFAS), Flying A, Jumbo (released by UF/IFAS), Marshall (susceptible to rust and gray leaf spot), Maximus, Nelson, Prine (released by UF/IFAS), TAMTBO, and Tetrastar.

LATE RECOMMENDED VARIETIES

Attain, Big Boss, Jumbo, Marshall (susceptible to rust and gray leaf spot), Maximus, Nelson, Prine, TAMTBO and Tetrastar.

These varieties were selected based on their recent three-year, multi-location performance. Other ryegrass varieties, such as Beefbuilder III, Big Daddy, Brigadier, Ed, Fantastic, Florlina, Fria, Graze-N-Gro, Jackson, King, Ocala, Passeral

Plus, Rio, Surrey II, Verdure, and Winterhawk have also performed well in regional trials. Other new varieties may be suitable but have not been adequately evaluated in Florida.

Sweetclover

Sweetclover grows on slightly drier soils than white clover. It will not tolerate flooding. Sweetclover has an earlier but shorter grazing season than white clover. Sweetclover should be reseeded each year.

RECOMMENDED VARIETIES

None at present. New varieties should be commercially available shortly.

Triticale

Triticale is a cross between wheat and rye. It is well adapted to the southern United States and peninsular Florida. Triticale has the forage quality of wheat and the excellent disease resistance of rye. Triticale does not respond well to close grazing and therefore is recommended for haylage or silage if grown alone. If used for grazing, consider blending with ryegrass to promote a longer growing season. It is advisable to use recommended varieties as there are triticale varieties sold in the state that are not adapted to Florida growing conditions and will not perform well.

RECOMMENDED VARIETIES

Trical 342 (developed in Florida), Monarch (developed in Florida), SS 1414, and NF 201.

Vetch

Vetch grows best on well-drained, fertile, loamy soils. Although it is well adapted, it is not considered to be a highly productive forage in Florida.

RECOMMENDED VARIETIES

AU-Early Cover (seed may be unavailable in 2017), Cahaba White, Hairy, and Nova II. Commercial seed production of most vetch varieties is limited and it may be necessary to special order seed.

Wheat

Wheat is similar to oat in forage yield and palatability. Wheat is less susceptible to freeze injury than oat. Wheat should not be planted for grazing before October 15, and take caution to plant only Hessian-fly-resistant varieties for grazing.

RECOMMENDED VARIETIES

AGS 2024, AGS GrazeAll (AGS 2027), AGS 2033, AGS 2038, Dyna-Gro Savoy, Pioneer 26R94, SRW 9410, and SS8641.

Remember the Following

- Planting cool-season forages on a clean-tilled seedbed results in earlier and more total forage production compared to overseeding on grass sod. If overseeding on bahiagrass, the sod should be disked to 30% disturbance. For overseeding on bermudagrass, a pasture drill or no-till drill can be used alone. Excess warm-season forage should always be removed as hay or by grazing before planting the cool-season forage.
- Success of winter pastures depends on adequate rainfall. This is especially true when overseeding.
- In central and south peninsular Florida, sod seeding (overseeding) of cool-season annuals into an established grass sod often fails because of insufficient soil moisture and warm-season grass competition. Sod seeding is generally not recommended unless irrigation is available or rainfall is adequate.
- Look for opportunities to plant on a clean-till seedbed, such as following vegetables or a row crop, after lifting sod, or in a pasture renovation program where the sod is plowed or turned under.
- In south central Florida, small grains and ryegrass have been successfully grown on flatwoods in a pasture renovation program. If the sod is turned with a moldboard plow (late October-early November), the soil harrowed, planted, and packed the same day, there will usually be enough moisture conserved to establish the new planting. If equipment and labor does not allow for such a rapid progression of work, then it may be best to turn the sod and then disk in early to mid-October and wait for adequate rainfall before planting.
- Winter legumes are more dependable on the heavier clay soils of northwestern Florida or on sandy soils underlain by a clay layer compared to deep upland sands or sandy flatwoods. However, white clover and ryegrass overseeded can also be grown successfully on flatwoods soils in northeast Florida and south central Florida where the soil remains moist throughout the growing season.
- Remember to add the correct inoculant (nitrogen-fixing bacteria) to the legume seed before planting. Coated (already pre-inoculated) seed is sometimes available, but seed coatings with bacteria have a limited shelf life and may be costly when compared to purchasing raw seed

and inoculant separately and mixing just prior to planting. Be aware of proper storing for pre-inoculated seeds or inoculants; excess heat can kill bacteria.

Table 1. Planting dates, seeding rates, planting depths, and grazing parameters for certain cool-season forage crops.

Seed-propagated crops[1]	Planting dates[2]	Seeding rates (lb/A broadcast)	Seeding depth (in)	Grazing height (in)		Rest period
				begin	end	
Alfalfa	Oct. 1–Nov. 15	15–20	1/4–1/2	10–16	3–4	Hay: 35–40 Grazing: 15–30
Clover, Arrowleaf	Oct. 1–Nov. 15	8–12	0–1/2	8–10	3–5	10–20
Clover, Ball	Oct. 1–Nov. 15	2–3	0–1/4	6–8	1–3	7–15
Clover, Berseem	Oct. 1–Nov. 15	15–20	1/4–1/2	8–10	3–5	10–20
Clover, Crimson	Oct. 1–Nov. 15	20–25	1/4–1/2	8–10	3–5	10–20
Clover, Red	Oct. 1–Nov. 15	10–15	1/4–1/2	8–10	3–5	10–20
Clover, Subterranean	Oct. 1–Nov. 15	15–20	1/4–1/2	6–8	1–3	7–15
Clover, White	Oct. 1–Nov. 15	3–4	0–1/4	6–8	1–3	7–15
Fescue, Tall	Nov. 1–Dec. 15	20–25	1/4–1/2	4–8	2–3	15–30
Medic	Oct. 1–Nov. 15	10–15 rates differ	0–1/4	6–8	1–3	7–15
Oats for forage	Sept. 15–Nov. 15	100–120	1–2	8–12	3–5	7–15
Pea, Austrian Winter	Oct. 1–Nov. 15	40–60	1/2–1	Poor grazing tolerance. Better suited as a hay or silage crop.		
Rye for forage	Oct. 15–Nov. 15	90–120	1–2	8–12	3–4	7–15
Ryegrass, Italian (annual)	Oct. 1–Nov. 15	20–30	0–1/2	6–12	3–4	7–15
Sweetclover	Oct. 1–Nov. 15	10–15	1/4–1/2	8–10	3–5	10–20
Turnips	Oct. 1–Nov. 15	5–6	1/4–1/2	6–8	2–3	varies
Vetch, hairy	Oct. 1–Nov. 15	20–30	1–2	6–8	3–4	varies
Wheat for forage	Oct. 15–Nov. 15	90–120	1–2	8–12	3–5	7–15
Triticale for silage or use in blends	Oct. 15–Nov. 15	90–120	1–2	Harvest for silage at milk or soft dough stage of maturity.		

[1] Always check seed quality. Seed germination should be 80% or higher for best results.
[2] Planting date range: in general, cool-season forage crops in northern Florida can be planted in the early part of the planting date range, and in southern Florida, in the latter part of the planting date range.

UF | IFAS Extension
UNIVERSITY of FLORIDA

COOL SEASON FORAGES IN CENTRAL FLORIDA

Francisco P. Rivera Meléndez, UF/IFAS Extension Hillsborough County
Jonael Bosques, UF/IFAS Extension Hardee County

1000 square foot area with Forty-three plots planted with cool season forage at UF/IFAS Extension at Hardee County.

Livestock Grower Goal

The cattle grower's goal is to produce the best quality of meat, in the least possible time, at the lowest cost. This benefits provide the agricultural operation with high performance and return of their investment. The use of winter crops is an

alternative to increase forage availability and provide the highest nutrition in the cool season.

Winter Forages

In the winter, common grasses used in Florida stay dormant, limiting the pastures available for livestock (beef cattle, goats, sheep and horses). A good cover crop meets important requirements including: easy establishment, low maintenance, high quality, good biomass and good palatability to the livestock. Cool season forages need to provide good performance in the winter when the temperature drops below 40°F. Cover crops are an alternative to improve soil characteristics, maintain humidity, and provide high-quality forage for animals in the cool season. University of Florida recommends a group of cool season forages that will perform well in Florida.

Full plot cut for legumes

Materials and Methods

A total of forty-three plots of four square feet (total area of 1000 square) of cool season forage was planted in a field at UF/IFAS Extension Service in Hardee County to evaluate its establishment and growth. Forages were evaluated (Table 1.) and composed of three main groups: legumes, grasses and cereals (peas, clovers, vetch, blue lupin, and a mix of clovers and peas, oats, rye, wheat, and ryegrass). The soil was prepared in each plot for planting the seed. Each plot had a total area of four square feet. 40 days after planting, the forages were harvested, simulating cow-cattle eating behavior. Forages were cut at a height of four inches. The full plot of legumes and half plot of grasses and cereals were harvested to evaluate the regrowth of the plants (see photos 2 and 3). After 11 days of harvest, height of the forage was evaluated, measured and assigned three different scores based on visual production and forage health (Table 1).

UF | IFAS Extension
UNIVERSITY of FLORIDA

LIVESTOCK

Table 1. Height of forage planting in cool season at UF/IFAS Extension Office in Hardee County

Cool Season Forages Evaluation					
	Health and vigor Score (A Excellent, B Fair, C Not Recommended)	Plant Height Mowed Inches	Plant Height Mowed cm	Plant Height Not Mowed Inches	Plant Height Not Mowed cm
Legume Demonstration					
1. Durana White Clover	A	4	10.16	N/A	N/A
2. Nachez White Clover	A	6	15.24	N/A	N/A
3. Regalgraze White Clover	A	6.5	16.51	N/A	N/A
4. Ocoee White Clover	A	5	12.7	N/A	N/A
5. Barduro Red Clover	A	6	15.24	N/A	N/A
6. Southern Belle Red Clover	A	8	20.32	N/A	N/A
7. AU Red Ace Clover	A	8.5	21.59	N/A	N/A
8. Ball Clover	C	0	0	N/A	N/A
9. Dixie Crimsom Clover	A	5.5	13.97	N/A	N/A
10. AU Sunrise Crimsom Clover	A	6	15.24	N/A	N/A
14. Fixation Balansa Clover	B	5	12.7	N/A	N/A
15. Persian Clover	A	10.5	26.67	N/A	N/A
19. Pennington Clover Trio	A	7.5	19.05	N/A	N/A
11. Austrian Pea	B	5	12.7	N/A	N/A
12. Whistler Winter Pea	B	6	15.24	N/A	N/A
13. Lynx Winter Pea	B	4.5	11.43	N/A	N/A
16. Cahaba White Vetch	B	4.5	11.43	N/A	N/A
17. Blue Lupine	C	0	0	N/A	N/A
18. UF- Triple Treat Blend: Crimson Clovers, White Clovers, Red Clovers	B	4.5	11.43	N/A	N/A
20. Trical/Clover-Winter Pea Blend	A	10.5	26.67	N/A	N/A
2018 Milk Check-Off					
21. Triticale 342	B	9	22.86	9	22.86
22. Trical 342 (Trical 342/Earlyploid Ryegrass)	A	2.5	6.35	18	45.72
23. Cosaque Oat	B	13.5	34.29	17	43.18
24. Legend 567 Oat	A	17.5	44.45	25	63.5
25. Horizon 306 Oat	B	13.5	34.29	12.5	31.75
26. FL 501 Oat	C	11.5	29.21	13.5	34.29
27. Coker 227 Oat	C	8	20.32	12	30.48
28. Feed Oat	C	7	17.78	11.5	29.21
29. Florida 401 Rye	C	9.5	24.13	16.5	41.91
30. Wrens Abruzzi Rye	C	5	12.7	7	17.78
31. Kelly Grazer II Rye	C	6	15.24	5	12.7
32. Elbon Rye	C	6	15.24	2.5	6.35
33. Maton Rye	B	7.5	19.05	8.5	21.59
34. Hass Wheat	B	10.5	26.67	12	30.48
35. Gore Wheat	A	9	22.86	10.5	26.67
36. Earlyploid Ryegrass	A	12.5	31.75	9.5	24.13
37. Big Boss Ryegrass	A	11	27.94	10.5	26.67
Prine RyeGrass	A	11.5	29.21	7	17.78
38. Tamtbo Ryegrass	A	5.5	13.97	8.5	21.59
39. Jumbo Ryegrass	B	7	17.78	7	17.78
40. Attain Ryegrass	A	9.5	24.13	9.5	24.13
41. Florilina Ryegrass	A	7	17.78	9.5	24.13
42. Common Gulf Annnual Rye Grass	C	3	7.62	3	7.62

Results

Twelve legumes and nine cereals were assigned a score of A and are recommended for cultivation in the cool season in South Central Florida. We observed in legumes a higher height for the cultivars Persian clover, and Tritical clover peas blend, followed by UF Red Clover. Nine cereals scored an A and were recommended for use as cover crops in South West Florida. For cereals, the maximum height observed was for the oats cultivars Legend and Cosaque, Trical 342 (Blend). It is crucial for the next evaluation to test and determine the right density for the forages. This could improve the total yield of the cold season forages.

Half plot cut for cereals and grasses

Conclusion

Forages with an A score grow better in Hardee County and can be use in counties with similar soils characteristics, temperatures, and sun hours. A palatability test is needed for beef cattle and other ruminants to determine which forage is better.

References:

A. R. Blount, Bob Myer, Cheryl Mackowiak, and Ron Barnett (2009).Triticale as a Forage Crop for the Southeastern United States. http://edis.ifas.ufl.edu/pdffiles/AN/AN22300.pdf

D. L. Wright, C. Mackowiak, and A.Blount (2017). Cover Crops http://edis.ifas.ufl.edu/pdffiles/AA/AA21700.pdf

Y.C. Newman, D.W. Wright, C. Mackowiak, J.M.S. Scholberg, and C.M. Cherr (2014). Benefits of Cover Crops for Soil Health. http://edis.ifas.ufl.edu/pdffiles/AG/AG27700.pdf

http://sfyl.ifas.ufl.edu/agriculture/cover-crops/

UF | IFAS Extension
UNIVERSITY of FLORIDA

LIVESTOCK

RYEGRASS (LOLIUM MULTIFLORUM)

Francisco P. Rivera Meléndez, UF/IFAS Extension Hillsborough County
Jonael Bosques, UF/IFAS Extension Hardee County

Ryegrass

Ryegrass is adapted to a variety of soils types, pH, temperatures and can be selected for disease resistance. Through plant breeding and selection, annual ryegrass has become a highly valued and productive cool-season forage (Blount and Prine, 2000).

Two species of ryegrass grow in the United States: perennials and annuals. Annual ryegrass has a height of 2 to 5 feet. Grass can be identify by the deep root system, erect culm and glabrous leaves and spike inflorescence (See picture). The inflorescence could have over 40 sessile spikelets arranged alternately, with over ten

fertile per spikelet. Various cultivars respond differently to their environments which affects the nutrient uptake, growth and disease resistance.

Table 1. Ryegrass Characteristics	
Digestibility	**High over 65%**
Crude Protein	**High**
Palatability	**High**
Grazing	**Tolerant**
Uses	**Grazing, haylage, silage**
Pounds per acre	**20-30**
pH Requirement	**5.5-6.0**
Harvest	**every 30 days**
Tons per acre	**2-4**
Germination time	**7 days**

Cultivars

There are diploids and tetraploid cultivars. Tetraploid cultivars and may have some yield advantage to diploids. Two high yielding tetraploid ryegrass cultivars are "Big Daddy" (1995) and "Jumbo" (2000), recently released by the UF/IFAS Ryegrass Breeding Program.

UF/IFAS Recommended Varieties in 2017

Attain (released by UF/IFAS), **Big Boss** (released by UF/ IFAS), **Diamond T, Earlyploid** (released by UF/IFAS), **Flying A, Jumbo** (released by UF/IFAS), **Marshall** (susceptible to rust and gray leaf spot), **Maximus, Nelson, Prine** (released by UF/ IFAS), **TAMTBO, and Tetrastar**.

Hardee County Trial Results

Eight ryegrass cultivars were evaluated in Hardee County to determine suitability for farmers in Central Florida. The results are available in Table 2. The varieties with a score of A had the best performance in growth, appearance, health, vigor, and height

and are a suggested alternative to grow in Central Florida during the cold season when summer forage is going dormant. This forage may be planted in the fall (October to November) and needs to be established before the temperature drops. The cultivars of ryegrass Earlyploid and Big Boss get the highest plant height and health vigor.

Table 2. Cool Season Ryegrass Forages Evaluation in Hardee County

Cultivar	Health and vigor Score (A Excellent, B Fair, C Not Recommended)	Plant Height Mowed Inches	Plant Height Mowed (cm)	Plant Height Not Mowed Inches	Plant Height Not Mowed (cm)
Earlyploid Ryegrass	A	12.5	31.75	9.5	24.13
Big Boss Ryegrass	A	11	27.94	10.5	26.67
Prine RyeGrass	A	11.5	29.21	7	17.78
Tamtbo Ryegrass	A	5.5	13.97	8.5	21.59
Jumbo Ryegrass	B	7	17.78	7	17.78
Attain Ryegrass	A	9.5	24.13	9.5	24.13
Florilina Ryegrass	A	7	17.78	9.5	24.13
Common Gulf Annnual Rye Grass	C	3	7.62	3	7.62

References

A. R. Blount and G. M. Prine (2000). Annual Ryegrass. http://edis.ifas.ufl.edu/pdffiles/AG/AG10400.pdf

A. R. Blount, M. Wallau, E. Rios, J. M. B. Vendramini, J. C. B. Dubeux, Md. A. Babar, K. E. Kenworthy, and K. H. (2017) Cool-Season Forage Variety Recommendations for Florida
D. L. Wright, C. Mackowiak, and A.Blount (2017). Cover Crops http://edis.ifas.ufl.edu/pdffiles/AA/AA21700.pdf
Y.C. Newman, D.W. Wright, C. Mackowiak, J.M.S. Scholberg, and C.M. Cherr (2014). Benefits of Cover Crops for Soil Health. http://edis.ifas.ufl.edu/pdffiles/AG/AG27700.pdf

Triticale as a Forage Crop for the Southeastern United States[1]

A. R. Blount, Bob Myer, Cheryl Mackowiak, and Ron Barnett[2]

Triticale (*X Triticosecole* Wittmack) is a man-made cereal developed by crossing wheat and rye. This robust cereal is grown worldwide for its grain and forage. Triticale has considerable potential either as a grain crop or forage crop for the southeastern United States. Triticale is well suited to the multi-cropping systems common in this region.

Triticale as a Grain Crop in the Southeastern United States

Initially, the thrust of triticale breeding programs in the Southeast focused on development of grain varieties. Several cultivars were developed and released in the 1980s (Blount et al. 2006), and this promoted some triticale grain production in the southeastern United States. These varieties were spring types, but were planted in the fall in the Southeast. Back-to-back abnormally cold winters in the 1980s resulted in considerable winter kill. This led to decreased production and interest in triticale as a grain crop.

Triticale as a Forage Crop in the Southeastern United States

In the Southeast, summers are hot and humid, and winters are typically mild. Small grain cereals (mostly oat and rye) and annual ryegrass are commonly planted in the autumn to provide forage for grazing, green chop, silage, or hay during the cool season. Typically, these annuals are planted in October through December. Depending on weather and rainfall, they are grazed or green chopped from late autumn/early winter to mid/late spring. For silage or hay, harvest is typically in April. Triticale for forage fits the same growing period as the other cool-season annual forages used in the southeastern United States.

Initially, triticale cultivars that were developed for grain were used in cool-season forage programs with unsatisfactory results in the southeastern United States. Recent releases of forage-type triticale cultivars have resulted in a surge in acreage, especially on dairy farms. Acreage today is estimated at 400,000 acres in 2012. Acreage is expected to continue to increase significantly in the future.

Results of Forage Yield Trials

Cool-season forage variety tests conducted in the southeastern United States by Auburn University, University of Georgia, and University of Florida are summarized in Tables 1, 2, and 3. The Auburn test summary is an average of results from eight locations over three consecutive years; the Georgia summary is an average of three locations over two years. The Florida test is from one location for one year. In each test, the triticale forage varieties either ranked at the top or near the top for seasonal forage dry matter yield.

1. This document is AN223, one of a series of the Animal Sciences Department, UF/IFAS Extension. Original publication date August 2009. Revised September 2013. Reviewed January 2017. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. A. R. Blount, professor; Bob Myer, emeritus professor; Cheryl Mackowiak, associate professor; and Ron Barnett, emeritus professor; UF/IFAS North Florida Research and Education Center, Quincy, FL 32351.

Present Status of Triticale Forage

For the United States as a whole, triticale for forage is a minor crop. Presently there are two main production regions: 1) the southern Great Plains and 2) the West Coast, especially California. In the Great Plains, triticale forage acreage is estimated at 50,000 acres (2008; Resource Seeds Inc. estimate). In this region, triticale forage is grown to provide grazing for stocker beef cattle and, more recently, for silage on dairy farms. On the West Coast, triticale forage is produced on about 200,000 acres (2008) and is grown primarily by dairy farmers for silage and green chop.

In the southeastern United States, dairy farmers are the primary growers of triticale forage. Triticale fits well in the common rotation of maize for silage during the warm season and an annual forage such as triticale for green chop and/or silage during the cool season. Yields of up to 18 ton of triticale forage per acre (about 3–4 tons of dry forage) are common. Most of these dairy farms pump manure effluent through the irrigation system to the forage crop fields as the primary means of nutrient fertilization. Thus, these farmers are interested in crops that not only yield a high amount of nutritious forage, but also use nutrients provided by the effluent (wastes). Dairy farmers have noted that forage triticale is an effective crop to capture and use the effluent. Recent research conducted by the University of Florida has shown that triticale grown for forage was very effective in using a relatively large amount of N and P (Mackowiak, Blount, and Myer 2008). Further trials using forage triticale for nutrient mitigation are under way.

Nutritional Value of Triticale Forage

There is limited data on the nutritional value of triticale forage grown in the southeastern United States for cattle. Compositional data collected so far indicates that triticale forage has similar nutritional value to other small grain cereal forages and annual ryegrass (Table 4; Myer, Mackowiak, and Blount, 2008). The average values in Table 4 are from samples harvested every four weeks during the cool season. The samples were harvested just before or at jointing in the plant. Samples harvested at a later maturity (e.g., boot stage, dough stage) would have less crude protein and soluble carbohydrate, and higher fiber concentrations.

Studies done in other parts of the world have generally reported that the nutritional value of triticale forage for ruminant animals was similar to that for other small-grain cereal forages at similar stages of maturity (for a review see Myer and Lozano, 2004). However, much variation has also been reported in both composition and feeding value among triticale varieties (Myer and Lozano 2004; Emile et al. 2007). Field reports indicate no drop in milk production when dairy cows are switched from a maize silage-based total mixed ration to a triticale silage-based total mixed ration.

Recommended Triticale Forage Varieties

For best results, only triticale forage varieties specially developed for and/or adapted to the southeastern United States should be planted. Variety recommendations for the southeastern United States include TriCal 342, TriCal 2700, and Monarch triticale. Both TriCal 342 and Monarch were developed by the University of Florida and University of Georgia. TriCal 2700 was bred and released by Resource Seeds, Inc. (Gilroy, CA) and is now marketed by Syngenta. These three forage-type cultivars are well adapted to the growing conditions in the Southeast. More forage-type triticale varieties adapted to the Southeast are expected to be released in the future.

Planting and management of triticale is much like that of other small grain cereals grown for forage in the Southeast (e.g., wheat and rye). Further information can be found in the EDIS publication SS-AGR-161 *Forage Planting and Establishment Methods* (http://edis.ifas.ufl.edu/ag107).

Summary

Triticale has been available in the southeastern United States for more than 30 years but it never developed into a significant grain crop in this region. The recent development of high-yielding forage varieties has renewed interest in it as a forage and has increased triticale acreage. This interest is particularly apparent with dairy farmers; however, triticale forage may also be suitable pasture forage for beef cattle grazing.

References

Blount, A. R., R. D. Barnett, P. L. Pfahler, J. W. Johnson, G. D. Buntin, and B. M. Cunfer. 2006. *Rye and Triticale Breeding in the South*. SS-AGR-42. Gainesville: University of Florida Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/ag147.

Day, J. L., A. E. Coy, and J. D. Gasset. 2008. *Georgia 2007-08 Small Grain Performance Tests*. Crop and Soil Sciences Res. Rep. no. 715. Athens, GA: Georgia Agricultural Experiment Station, University of Georgia.

Emile, J. C., C. C. Joblin, F. Surault, and Y. Barriere. 2007. "Genetic Variations in the Digestibility in Sheep of Selected Whole-Crop Cereals Used as Silages." *Animal* 1 (8): 1122–1125.

Glass, G. M., and E. van Santen. 2008. *Performance of Small Grain Varieties for Forage in Alabama*. Agronomy and Soils Series no. 293. Auburn, AL: Alabama Agricultural Experiment Station, Auburn University.

Mackowiak, C., A. R. Blount, and R. O. Myer. 2008. "Seasonal Productivity and Nutrient Uptake Comparisons among Cool-Season Annual Forage." ASA CSSA SSSA joint meeting abstracts CD-ROM (no. 569-12), ASA CSSA SSSA, Madison, WI (abstract).

Myer, R. O., and A. J. Lozano. 2004. "Triticale in Livestock Production." In *Triticale Improvement and Production*, edited by M. Mergoum, 49–58. Rome, Italy: FAO.

Myer, R. O., C. Mackowiak, and A. R. Blount. 2008. "Water Soluble and Ethanol Soluble Carbohydrate Concentrations in Cool-Season Annual Forages in the Southeastern USA." ASA CSSA SSSA joint meeting abstracts CD-ROM (no.568-9), ASA CSSA SSSA, Madison, WI (abstract).

UF | IFAS Extension
UNIVERSITY of FLORIDA

LIVESTOCK

COVER CROPS

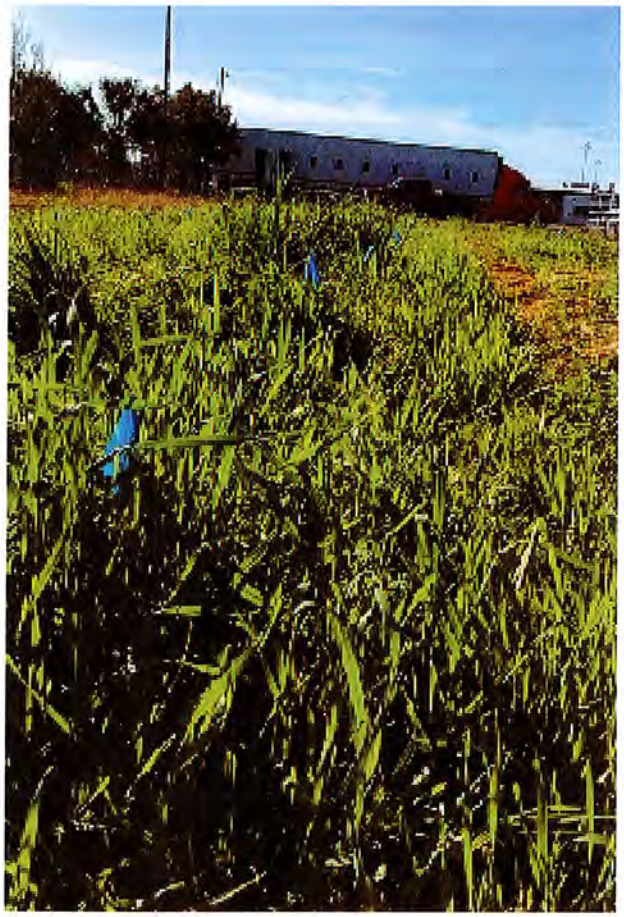
Francisco P. Rivera Meléndez, UF/IFAS Extension Hillsborough County

Florida Soil Characteristics

The extremely sandy soils of Florida make it difficult to establish crop stands and to attain deep rooting and other factors associated with crop vigor, yield and quality. Appropriate use of cover crops may partially replace chemical fertilizer usage and result in less soil erosion and increased yields, thus reducing dependence on fossil fuels and foreign oil.

Cover crops

These are plants that help to protect the soil from wind, rainfall, and sunlight. Cover crops provide improvement of the soil composition, soil structure and organic matter content, water infiltration, root penetration and nutrient recycling. Additional benefits include reducing erosion, water runoff and nutrient leaching. Cover crops enhance soil fertility via improved nutrient retention, organic matter and cycling, while leguminous cover crops add nitrogen from the atmosphere.



Cover crops Classification

There are cover crops that have a life cycle of one year and others that can endure for several years. Annual crops can be categorized in two classes: cool season and warm season. Also we can classify type of cover crops by grass, grain and legumes. Grass crops tend to grow faster and produce more biomass but don't have the ability to fix nitrogen in the soil (around 200 pounds per acre per growing season).

Summer cover crops tend to generate more biomass than cool season leguminous crops but require adequate soil moisture, fertility (especially phosphorus), and a suitably high (6.0–6.5) soil pH to perform well. Cool season legumes often do not perform well in sandy soils during the first years of cultivation. In contrast, many of the warm season annual leguminous crops listed in Table 1 tend to be a little more vigorous and require additional management.

Reference:

A. R. Blount, Bob Myer, Cheryl Mackowiak, and Ron Barnett (2009).Triticale as a Forage Crop for the Southeastern United States. http://edis.ifas.ufl.edu/pdffiles/AN/AN22300.pdf

A. R. Blount and G. M. Prine (2000). Annual Ryegrass. http://edis.ifas.ufl.edu/pdffiles/AG/AG10400.pdf

A. R. Blount, M. Wallau, E. Rios, J. M. B. Vendramini, J. C. B. Dubeux, Md. A. Babar, K. E. Kenworthy, and K. H. (2017) Cool-Season Forage Variety Recommendations for Florida

D. L. Wright, C. Mackowiak, and A.Blount (2017). Cover Crops http://edis.ifas.ufl.edu/pdffiles/AA/AA21700.pdf

Y.C. Newman, D.W. Wright, C. Mackowiak, J.M.S. Scholberg, and C.M. Cherr (2014). Benefits of Cover Crops for Soil Health. http://edis.ifas.ufl.edu/pdffiles/AG/AG27700.pdf

Table 1. Cover crops for use in Florida.

Crop	Yield-Biomass[1] (lbs/acre)	Yield-N[1] (lbs/acre)	Seeding Rate(lbs/acre)	Seeding Date
ANNUAL SUMMER COVER CROPS				
Leguminous Crops				
Aeschynomene	2000–4000	50–100	6–8[2]	Mar. 1–June 30
Alyce clover	1500–3500	20–65	15–20	Mid April to late June
Cowpeas	4000–6000	50–90	30–50[2]	April to August
Hairy Indigo	7 to 10 tons of greenchop/acre	80–150	6–10	Middle of March to May/June
Sesbania	2000–8000	35–80	25–30	Mar. 1–July 15
Sunhemp	4500–10,000	90–180	30–50	Mar. 1–June 30
Velvetbeans	2200–4000	50–85	30–50	Mar. 1–June 30
Grain Crops				
Pearlmillet	6000–8000	55–70	12 to 15 lb/acre in rows, of 30 to 40 lbs/acre if broadcast	Mid March to June in North Florida, earliest planting is April 1st.
Sorghum-sudan	6500–9500	55–80	24–30	Mar. 1–June 30
ANNUAL WINTER COVER CROPS				
Leguminous Cropos				
Crimson Clover	1500–5000	35–120	20–25	Oct. 1–Nov. 15
Hairy Vetch	2000–4000	35–150	20–30	Oct. 1–Nov. 15
Lupine	2000–4500	45–120	30–45	Oct. 1–Nov. 15
Grain crops				
Black oats	1500–3500	20–40	80–100	Oct. 1–Nov. 15
Winter rye	3000–6000	30–50	80–100	Oct. 15–Nov. 15
PERENNIAL COVER CROPS				
Leguminous Crops				
Rhizoma Peanut (living mulch)	2000–10000 (12-months)	50–130	80–100bu of rhizomes/acre[3] (1 bu=1.25 cubic ft.)	Dec. to March
Perennial Grasses				
Bahiagrass	3000–8000	55–140	15–20	Junt to August (if rainfed)
Pangola digitgrass	4000–9000	60–135	500–1000[3]	Mar. 1–Aug. 15

[1] Lower productivity reflects poor growing conditions (water stress, poor inherent soil poor inherent soil fertility/inoculation) while higher values are indicative of crop performance under optimal conditions.
[2] Dehulled seed (naked).
[3] Planted vegetatively.
For additional information, please visit the 'Forages of Florida' website at: http://agronomy.ifas.ufl.edu/ForagesofFlorida

NOTES

Spring Ranchers Forum
Held at Yarborough Ranch
Central Florida Livestock Agents Group
March 15, 2018

Individual Topic Evaluation: Please rate value for knowledge gained.	Very Valuable	Valuable	Somewhat Valuable	Not Valuable	Not Applicable
Field Demonstration: Tools of the Trade					
Poisonous Plant Common Sense					
Pasture Weed Control					
Tack and Gear for Handling Cattle on Horseback					
UF Cool Season Demonstration Plot					
Calibrating Your Sprayer					
CFLAG Agent Panel Discussion: Cool Season Forage Choices					
Was this the first time you attended a UF Extension Program?	☐ **Yes**			☐ **No**	

How many Spring Ranchers Forums have you attended? (circle one)	1 2 3 4 5 10 15 20	
Overall Program Evaluation. Answer below ONLY if you attended the Spring Ranchers Forum Last Year.	**YES**	**NO**
Did you share last year's information with anyone?	**YES**	**NO**
Did you improve your animal science skills because of last year's program?	**YES**	**NO**
Did you experience an improved economic return because of last year's program?	**YES**	**NO**
If yes, how much would you estimate is the value? (circle one)	$1,000 $5,000 $10,000 $25,000 or $_____ (fill in)	
Poisonous plant education saves farm animals lives. Have you experienced saving an animal from toxic plants education received at Spring Ranchers Forum?	**YES**	**NO**
If yes, please estimate number of animals you have saved. (circle one)	1 5 10 25 50 100 or _____ (fill in)	

Which livestock do you raise?

How did you hear about this year's Spring Ranchers Forum?