Forage Physiology and Soil Management for Small Farms

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Objectives

- Learn about the differences in forage species.
- Understand the basic anatomy of grasses.
- Learn about the life cycle of forages.
- Discuss how we can negatively or positively impact our forage base when implementing our grazing strategies.
- Discuss how basic soil analysis can help improve forage management.

Forages

- Many plants are used around the world as forages.
- These include:
  - Grasses
  - Legumes
  - Forbs
  - Shrubs

Not all forages are created equal

Forages can be:

- Annual
- Biennial
- Perennial
- Sod-forming
- Bunchgrasses
- Warm season
- Cool season
- C3
- C4

Not all forages are created equal

Annual

- Plants with annual life cycles complete their growth cycle in a single growing season (which is not usually an entire year), and are perpetuated by seed.
- The major row crop plants of the world:
  - Millet
  - Rice
  - Wheat
  - Barley

Not all forages are created equal

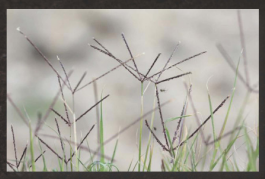
Biennials

- Plants that take two seasons or years to complete their growth cycle.
  - 1st season – Accumulate food reserves in storage organs.
  - 2nd season – Produces reproductive flowers and seed.
- Some of the root crops, such as beets, carrots, and parsnips, some shrubs, and some vegetables like onions and cabbage are biennials. There are no common biennial grasses, but there are some weeds that fall on this category.

Not all forages are created equal

Perennial

- Plants that continue to grow indefinitely. Some may die back to the ground each winter (herbaceous perennials), but revive from the roots in the next spring.
  - Bermudagrass, Bahiagrass, bluestem, switchgrass, and indiangrass, perennial peanut



Growth Habit

Sod-forming


Bahiagrass pasture

- Strong, creeping rhizomes that extend through the soil or have stolons that grow above ground, producing new plants when they root at the nodes.
- New plants (shoots) develop either from buds in crown tissue of rhizomes and/or stolons.

Bunching

- Grow from tillering at or near the soil surface without rhizomes or stolons.
- New plants (shoots) arise from within the plant forming distinct clumps or tufts of vegetation.

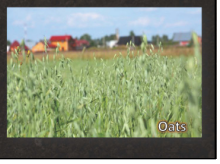

Indiangrass

C3 vs. C4

- Although animals eat all year round, there is no "all season" plant to use as forage.

C_3 (cool season, temperate)

- Cool-season grasses are productive in the spring and fall because of the cooler temperatures during the day and night, shorter photoperiod, and often higher soil moisture. During the summer, growth is reduced and dormancy is induced by high temperatures.
  - C_3 grasses in the rumen of an animal is often digest faster than C_4 grasses because of the thin cell walls and leaf tissue and are therefore often of higher forage quality.


Oats

C3 vs. C4

- Although animals eat all year round, there is no "all season" plant to use as forage.

C_4 (warm season, tropical)

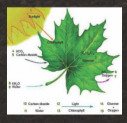
- They are most productive during the warmer summer months. In Central Florida, cool-season and warm-season are both used to provide forage throughout much of the year.
- C_4 plants can be annual or perennial. Annual C_4 plants include corn, Sudangrass and Pearl millet. Perennial C_4: Big Bluestem, Guineagrass, Bermudagrass, Brachiaria (Mulato).

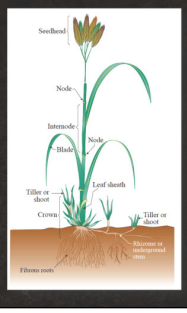

Mulato II Brachiaria

Plant Anatomy

Structures

- **Leaves**
  - Carbohydrate factory – organ that traps light and manufactures CHOs used for:
    - Energy
    - Structure
    - Plant compounds
- Shoot
- Roots
- Reproductive organs

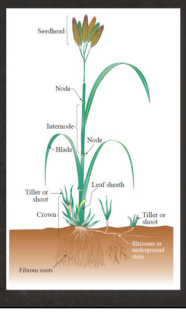




Plant Anatomy

Structures

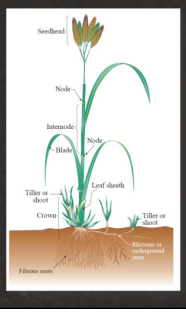
- Leaves
- **Shoots**
  - A grass plant is a collection of tillers that grow buds at the base of the plant.
    - Tillers – units of the plant that repeat themselves (branches).
      - Tiller parts: leaf, stem node, stem internode, bud.
- Roots
- Reproductive organs



Plant Anatomy

Structures

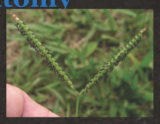
- Leaves
- Shoot
- **Roots**
  - Storage facility – CHOs produced in the leaves and green matter are stored underground on the roots.
    - If the plant's leaves are harvested, CHOs in the roots will be spent until the plant regrows its leaves.
  - Nutrient Scavengers
  - Plant anchor
- Reproductive organs



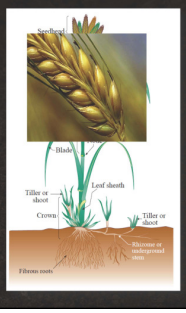
Plant Anatomy

Structures

- Leaves
- Shoot
- Roots



- **Reproductive organs**
  - Seedheads – They appear when the plant is mature enough to reproduce itself.
    - Some of our forages do not produce viable seed.
  - Rhizomes – underground branches that will develop into new plants.
  - Stolons – Above ground runners that will develop into new plants.



Forage Lifecycle

- Grass develops through a sequence of stages.
- There are 4 primary developmental stages in grasses that you should be able to recognize for grazing management.

Stages

1. Seedling
2. Vegetative
3. Jointing (Elongation)
4. Anthesis

Forage Lifecycle

Stages

1. Seedling

The grass plant has just emerged from the soil as a monocotyledon (one leaf-type structure). Legumes emerge with two leaf-like structures (dicotyledon).

- Grass leaves may whorl and erect a "false stem", but the true stem has not yet formed.
- Establishment period for seeded types: At this stage, enough leaf must be maintained to conduct photosynthesis for rapid growth, regrowth and root system development.

Forage Lifecycle

Stages

2. Vegetative:
   - Leaves continue to develop, emerge, unfurl, and die (senescence).
   - The main function of the plant is photosynthesis.
   - This stage of development yields the best livestock feed and managers should maintain this stage for as long as possible
   - Environmental conditions will induce the next stage.

Forage Lifecycle

Stages

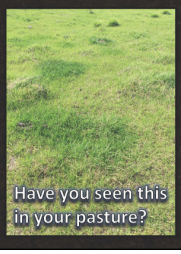
3. Jointing (internode elongation):
   - Internodes commence elongation producing a true stem (culm). This elongation is preparation for seed development.
   - The stem is producing a peduncle that will anchor the seedhead. The elongation elevates the growing point (shoot primordium including the rudimentary seed head) to a vulnerable height.
   - Removing the growing point late in this stage – advantageous for some grasses
     - Stops the plant from spending so much energy on seedhead production.

Forage Lifecycle

Stages

4. Anthesis: (Reproductive Stage):
   - In this stage, the flowers are formed and the anthers are shedding pollen.
   - The plant's work to produce the flower has resulted in decline of other functions, such as leaf production.
   - The stem (culm) is more fibrous and plant palatability and digestibility declines.
   - The grass plant is ready for harvesting seed at this stage (and before) but is not desirable for livestock feed.

Forages Need Nutrients



Macronutrients

N – Essential element of chlorophyll (plant growth), and amino acid structure (crude protein, enzymes, etc…)

P – Metabolism (photosynthesis, respiration, cell enlargement, energy storage, etc…), root development, flower development.

K – Temperature regulation, plant energy conversion from storage, plant immunity

Secondary Nutrients

Ca – cell wall strength

Mg – photosynthesis

S – protein creation

Micronutrients

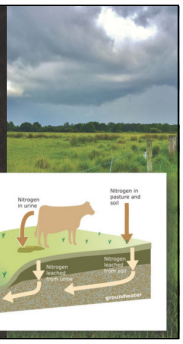
B, Cu, Fe, Cl, Mn, Mo, Zn.

A Dynamic Relationship

Our Soil:

- Anchors our crops.
- Holds limited amounts of nutrients.
- Holds limited amounts of water.

- Is affected by management
  - Plant:Soil interaction
  - Plant:Animal interaction

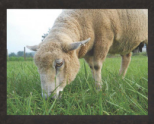


Soil Health = Plant Health

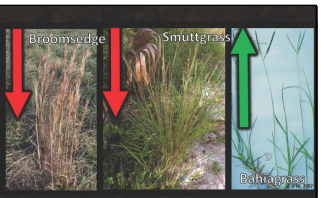
As livestock owners we should view ourselves as grass farmers.

Good soil management practices include:

- Appropriate stocking rate.
- Appropriate use of nutrients.
- Timely soil monitoring.
- Proactive approaches to balance the interaction:
  - Animals:Plant
  - Plant:soil



Grazing Impact



Proper grazing

- Diminishes the competitive ability of plants like Broomsedge and Smuttgrass and improves the competitiveness of Bermudagrass, Bahiagrass and even clovers.

Grazing Impact

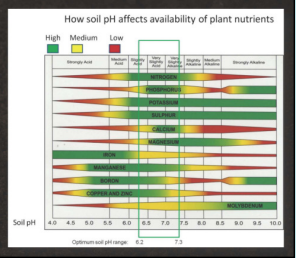
Improper grazing

- Can decrease the competitiveness of desirable species and encourage undesirable weedy species.

Grazing Impact

Appropriate Management:
Routine Soil Monitoring

- Nutrient amounts in the soil matches plant needs.
- Future nutrient applications match and do not exceed the needs of the plants.
- Monitor and correct soil acidity levels (pH) to ensure nutrient uptake.



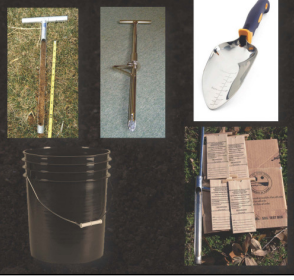
Taking a soil sample

Fall sampling

- Lab results and nutrient recommendations may be returned more quickly because fewer samples are submitted.
- Allows you to apply the fertilizer when prices are generally lower.
- A field should always be resampled at the same time of the year so you can make historical comparisons.

Tools Needed

1. Soil Probe or trowel
2. Plastic Bucket
3. Soil Sample Kit

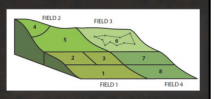


Pasture Sampling

An individual sample should represent no more than 10 acres.

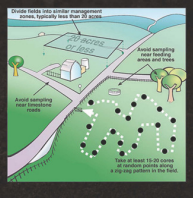
- Considerations for sampling specific areas:
  - Past management
  - Cropping history

- Individually sample areas that have received different management or vary in soil type, have suffered erosion or that are different in topography.



Pasture Soil Analysis Protocol

- Soil sampling areas that are visually different can help you troubleshoot these areas and get information on the soil composition variations.
- Collect at least 20 soil cores for small areas and up to 30 cores for larger fields.
- Randomly take the soil cores throughout the sampling area and place them in a plastic bucket.



Pasture Soil Analysis Protocol

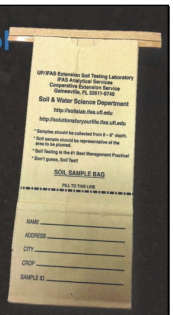
- Do not sample:
- Dung piles
- Old fencerows or under trees
- Areas used for manure or hay storage
- Livestock feeding areas where lime was previously stockpiled

Pasture Soil Analysis Protocol

- Forages on average will utilize the first four (4) to six (6) inches of depth in our soil
- Take a core sample that is comprised of equal amounts of soil from zero (0) to six (6) inches in depth.

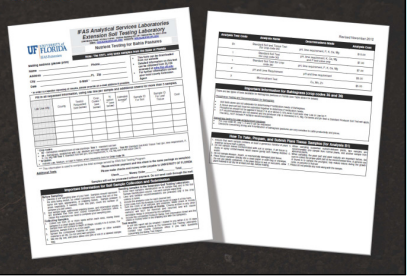
Pasture Soil Analysis Protocol

- Mix your cores together and remove all plant material and stones.
- Collect about a quart bag of soil and let it dry off completely.
- Fill in your information on the bag BEFORE putting the soil in it.
- Match the information on your bag and the submittal form.



Submittal Forms

- **Nutrient Testing for Bahia Pastures form.**



Submittal Forms

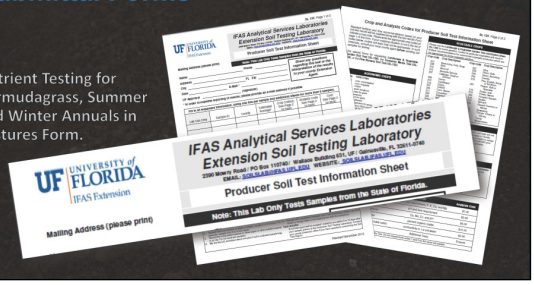
What should I test for?

Revised November 2012

Analysis Test Code	Analysis Name	Determinations Made	Analysis Cost
B1	Standard Soil and Tissue Test (for crop code 36)	pH, lime requirement, P, K, Ca, Mg	$15.00
1	(for crop code 36)	and P test value only	$7.00
1	Standard Soil Test (for crop code 35)	pH, lime requirement, P, K, Ca, Mg	$7.00
2	pH and Lime Requirement	pH and lime requirement	$3.00
3	Micronutrient Test	Cu, Mn, Zn	$5.00

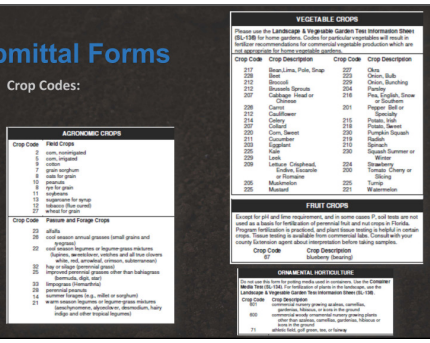
Submittal Forms

Nutrient Testing for Bermudagrass, Summer and Winter Annuals in Pastures Form.



Submittal Forms

Crop Codes:



AGRONOMIC CROPS

Crop Code	Field Crops
2	corn, nonirrigated
5	corn, irrigated
9	cotton
7	grain sorghum
8	oats for grain
10	peanuts
6	rye for grain
11	soybeans
13	sugarcane for syrup
12	tobacco (flue cured)
27	wheat for grain

Crop Code	Pasture and Forage Crops
23	alfalfa
26	cool season annual grasses (small grains and ryegrass)
22	cool season legumes or legume-grass mixtures (alfalfa, arrowleaf clover, crimson, subterranean)
32	hay or silage (perennial grass)
25	improved perennial grasses other than bahiagrass (bermuda, digit, star)
33	limpograss (Hemarthria)
29	perennial peanuts
14	warm season annuals (e.g., millet or sorghum)
21	warm season legumes or legume-grass mixtures (lespedeza, alyceclover, desmodium, hairy indigo and other tropical legumes)

VEGETABLE CROPS

Please use the Landscape & Vegetable Garden Tree Information Sheets (SL-138) for home gardens. Codes for particular vegetables will result in fertilizer recommendations for commercial vegetable production which are not appropriate for home vegetable gardens.

Crop Code	Crop Description	Crop Code	Crop Description
217	Bean,Lima, Pole, Snap	227	Okra
228	Beet	223	Onion, Bulb
212	Broccoli	229	Onion, Bunching
212	Brussels Sprouts	204	Parsley
207	Cabbage Head or Chinese	216	Pea, English, Snow or Southern
208	Carrot	201	Pepper Bell or Non-Bell
213	Cauliflower		
214	Celery	215	Potato, Irish
207	Collard	218	Potato, Sweet
220	Corn, Sweet	230	Pumpkin Squash
211	Cucumber	219	Radish
203	Eggplant	210	Spinach
225	Kale	230	Squash Summer or Winter
209	Leek		
	Lettuce Crisphead, Iceberg, Escarole	224	Strawberry
	Lettuce Romaine	200	Tomato Cherry or Tabasco
206	Mushroom	225	Turnip
205	Mustard	221	Watermelon

FRUIT CROPS

Except for pH and lime requirement, and in some cases P, soil tests are not used as a basis for fertilization of perennial fruit and nut crops in Florida. Program fertilization is practiced, and plant tissue testing is helpful in certain crops. Tissue testing is available from commercial labs. Consult with your county Extension agent about interpretation before taking samples.

Crop Code	Crop Description
67	Blueberry (bearing)

ORNAMENTAL HORTICULTURE

Do not use this form for potting media used in containers. Use the Container Media Test (SL-154). For fertilization of plants in the landscape, use the Landscape & Vegetable Garden Tree Information Sheet (SL-138).

Crop Code	Crop Description
801	commercial nursery growing azaleas, camellias, gardenias, hibiscus or other acid loving plants
800	commercial woody ornamental nursery growing plants other than azaleas, camellias, gardenias, hibiscus or other acid loving plants
71	athletic field, golf green, sod, or turfgrass

Submittal Forms

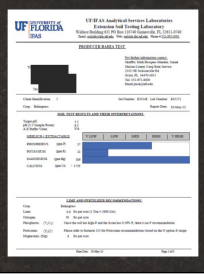
What should I test for?

Analysis Code	Analysis Name	Determinations Made	Analysis Cost
1	Standard Soil Fertility Test	pH, lime requirement, P, K, Ca, and Mg	$7.00
2*	Soil pH and Lime Requirement	pH and lime requirement	$3.00
3	Soil Micronutrients	Cu, Mn, Zn, and pH	$5.00
4	Organic Matter	percent organic matter	$10.00
5	Electrical Conductivity (soluble salts)	conductivity in 1:2 soil:water	$2.00
5A	Other	Additional Tests	Enquire

* Included in Standard Soil Fertility Test. Do not request both codes 1 and 2 for the same soil sample.

Basic Soil Test Report (Analysis code 1)

1. **Soil Test Results and their Interpretations**
   - Soil acidity (pH)
   - Nutrient levels
     - ✓ Phosphorus (P)
     - ✓ Potassium (K)
     - ✓ Magnesium (Mg)
     - ✓ Calcium (Ca)
2. **Lime and Fertilizer Recommendations**



UF IFAS Analytical Services Laboratories
Extension Soil Testing Laboratory

Summary

- Understanding our forages will promote make us better grass farmers.
- It is important to appropriately graze our pastures allowing time for our grasses to re-grow.
- Watch out for improper grazing. Pay close attention to the amount of time and intensity you graze your forages to ensure that our forages can come back year after year.
- Invest in regular soil analysis.

Upcoming UF/IFAS CFLAG Program

UF IFAS Extension
UNIVERSITY of FLORIDA

CENTRAL FLORIDA LIVESTOCK AGENTS GROUP

2018 Small Ruminant Production Conference

Join University of Florida Faculty Members and local experts for a day of learning and networking.

Topics to be covered Include:

- Common Diseases
- Sheep and Goat Marketing
- Parasite Management Tools
- Pasture Weeds Management
- Live Demonstrations

$30/person
Includes written materials & lunch

Pre-Registration on-line is required

April 20th 8am – 4pm
UF/IFAS Extension Osceola County
1921 Kissimmee Valley Ln • Kissimmee, FL
https://2018srconferencecflag.eventbrite.com

CENTRAL FLORIDA LIVESTOCK AGENTS GROUP

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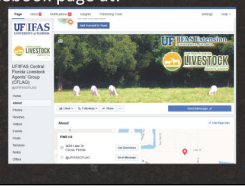

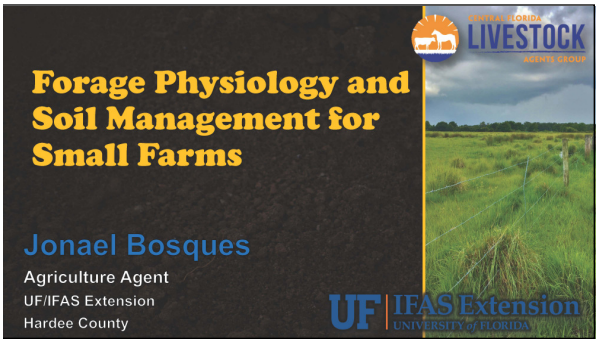
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