UF UNIVERSITY of FLORIDA

Institute of Food and Agricultural Sciences
Northeast Extension District
Northeast Florida Livestcok Agents Working Group

Dear Producer:

Welcome to our Annual Livestock & Forages Field Day, hosted by UF/IFAS Extension Agents representing 13 north Florida Counties! We hope you will enjoy the educational activities planned for you today and that you take away new knowledge, new ideas and new plans to improve your livestock and forage production. Our goal is to help you be more informed and better able to remain sustainable and profitable in all your agricultural endeavors.

I want to take a moment and ask you to help us thank all our industry supporters. Please visit their displays and when the time comes for a new purchase, perhaps one of them may be able to help. I want to also thank you again for supporting our efforts, not just today but throughout the year. Whether you attend this event or any of our local programs, we appreciate your support and look forward to hearing from you about how we can better meet your educational needs.

Two of our biggest supporters that also need to be thanked are:

Alan Hitchcock & his Family for providing us with this beautiful ranch as a venue each year – Thank you Alan and crew.

Farm Credit of Florida for always being there for this event to provide us a great meal.

Thank you all for your generosity and support.

Again, on behalf of all of us in the North Florida Livestock Agents Group (NFLAG), we appreciate you coming, please let us know if we can help in any way. There are plenty of us!

Sincerely,

Cassidy Dossin

Cassidy Dossin
NFLAG - Chair

UF/IFAS EXTENSION

LIVESTOCK & FORAGE FIELD DAY

Tuesday, October 29th, 2024

Agenda

8:30 **Registration and Trade Show Opens**

9:00 **Welcome & Introductions**

9:10 **Herd Vaccination Protocols**
Dr. Joao Bittar, DVM
Assistant Professor of Beef Cattle Extension

9:45 **Concurrent Rotating Sessions**
Session 1: 9:45-10:15
Session 2: 10:20-10:50
Session 3: 10:55-11:25

11:30 **Tradeshow**

12:30 **Lunch**
Provided by Farm Credit

1:00 *Lunch Presentation:*
Cattle Market Outlook & Opportunities
Hannah Baker
State Specialized Extension Agent

1:30 **Evaluations and Close**
Tradeshow exhibits open until 2pm.

Guest Speaker:
Hannah Baker
Beef Cattle and Forage Economics State Specialized Extension Agent

Presented by:
NORTH FLORIDA LIVESTOCK AGENTS GROUP

Hosted by:
Santa Fe River Ranch

Concurrent Session Topics

- Cool Season Forages
- Bull Selection
- Pasture Weed ID and Herbicide Application

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NORTH FLORIDA LIVESTOCK AGENTS GROUP

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NORTH FLORIDA
LIVESTOCK AGENTS GROUP

2024 Livestock and Forage Field Day

1. Registration
2. Covered Barn (Sponsors and Vendors)
3. Inside Main Hall (Lunch and Keynote Speaker)
4. Pasture Weed ID & Herbicide
5. Bull Selection and EPDs
6. Cool Season Forages
7. Equipment Dealer Displays

Beef Cattle Vaccination Protocols

UF/IFAS Extension Fact Sheet

Cassidy Dossin, Agriculture and Natural Resources Agent, Clay County Extension,
João Bittar, DVM, PhD., Assistant Professor of Beef Cattle Extension

Introduction

Vaccination protocols are an important piece to herd health management to protect animals from routine disease threats. Disease threats vary greatly from operation to operation depending on a multitude of factors such as environment, genetics, and operation type. Work with a veterinarian to identify which diseases are consequential to your herd and to develop a protocol that best fits your operation.

Integrating a vaccination protocol into a beef cattle operation involves the added labor of working cattle at least two times per year and the use of cattle working facilities and health products. However, a properly designed and executed vaccination protocol will reduce herd mortality due to illness, improve animal performance, and improve reproductive efficiency through the reduction in diseases with reproductive repercussions such as infertility and abortion.

To implement a vaccination protocol, cattle will need to be routinely worked at least twice a year. Time vaccinations with other reasons for cattle working such as calf processing and deworming. UF/IFAS photo by Cat Wofford.

Types of Vaccines

Cattle vaccines are designed to improve immunity to diseases caused by viruses, bacteria, and protozoans. Vaccines come in different forms and usually contain either modified live, killed, chemically altered organisms, or a combination of these. Vaccine types influence the way the products are used.

Modified Live Vaccines (MLV)

Advantages	*Disadvantages*
• Typically cause more rapid, stronger immunity • Allergic reactions and lumps less likely • May not require boosters • Less expensive	• Risk of causing abortion or transient infertility • Must be mixed on-farm, kept cool, and used within roughly 90 min.

Killed Vaccines (KV)

Advantages	*Disadvantages*
• Available for many diseases • No risk of the organism spreading between animals • Minimal abortion risk • No on-farm mixing required	• Allergic reactions and lumps at vaccination site more likely • Two initial doses needed • Slower onset of immunity; weaker, shorter-lasting immunity • More expensive

Chemically Altered Vaccines (CAV)

Advantages	*Disadvantages*
• Share many advantages of MLVs • Safety similar to KV products • Minimal abortion risk	• Two initial doses needed • Slower onset of immunity, not as strong or long-lasting as MLVs • Must be mixed on-farm

Vaccination Timing

Timing is crucial to developing an effective vaccination protocol and using vaccines effectively. The right time to vaccinate an animal is dependent on the type of vaccine, animal age, as well as breeding and calving seasons.

Calves should typically be vaccinated for the first time from 3 to 5 months of age, when the temporary immunity from the dam has declined.

To protect cows and bulls against reproductive diseases, vaccinate 6 to 8 weeks ahead of the breeding season. However, some cow vaccines increase colostrum antibodies for the calf and should be administered roughly 1 to 3 months prior to calving. Always check and follow the label to maximize vaccine efficacy.

Example Vaccination Protocols

The following vaccination protocol examples can be used as a starting point for developing and customizing an effective vaccination protocol for your herd.

Calves 3-5 months of age

- 8-way clostridial (blackleg)
- IBR/PI3/BVDV-1 and -2/BRSV
  - IBR (infectious bovine rhinotracheitis)
  - PI3 (parainfluenza3)
  - BVDV (bovine viral diarrhea virus)
  - BRSV (bovine respiratory syncytial virus)
- Pasteurella vaccine
- Optional: Brucellosis vaccine for heifers (must be given by a veterinarian)
- Optional: Leptospirosis 5-way vaccine (replacement heifers and bulls)

Calves should be vaccinated for the first time before weaning and after immunity from the dam has begun to decline, from 3-5 months of age. UF/IFAS photo by Cat Wofford.

Breeding Cattle

- IBR/PI3/BVDV-1 and -2/BRSV
- Leptospirosis 5-way vaccine
- Vibriosis vaccine (also known as Campylobacteriosis)
- Optional: Haemophilus vaccine
- Optional: scour vaccine (provides passive immunity for calves of pregnant females)
- Optional: Tritrichomonas foetus vaccine (females only)

Conclusion

Vaccination is a herd health tool to help reduce the incidence of disease in the cow herd and growing calves as they enter the beef supply chain. Many vaccination programs include the products outlined in the example protocols, however these examples should be used as a basis to customize to the producer's needs. Cattle producers are encouraged to work with their herd veterinarian to develop a protocol that best fits their operation. Vaccines should always be used and stored in accordance with the label to result in the best impact on the animal's immunity. Following Beef Quality Assurance (BQA) guidelines for administering vaccines is advised.

References

Campos Krauer, Juan M., & Bittar, Joao H. J. 2024. "Livestock Vaccines: Principles, Types, and Important Factors to Consider." *EDIS*. University of Florida IFAS Extension. https://edis.ifas.ufl.edu/publication/VM258.

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Livestock Vaccines: Principles, Types, and Important Factors to Consider[1]

Juan M. Campos Krauer and João H. J. Bittar[2]

Having healthy animals is the wish of every farmer, but keeping animals healthy requires a good herd health management plan. All animals have various defense mechanisms to prevent or deal with infections. Age, nutrition, or management practices can directly affect these defense mechanisms. Additionally, stress due to heat, weaning, malnutrition, infection, transport, and other factors can impact how the immune system reacts to a pathogen attack.

A critical component of any herd health plan is a vaccination protocol. There are many vaccine options available for common livestock; however, few vaccines are explicitly developed for small ruminants or exotic livestock such as deer. While vaccines designed for cattle, horses, sheep, and goats are frequently employed, the efficacy of these vaccines in specialty livestock like deer is scarcely studied. Anecdotal data is the only information available for most livestock vaccines.

How do vaccines work?

Most vaccines induce protection by priming the system to mount an antibody response. When an animal has not been exposed to a specific pathogen or comes in contact for the first time, it can be slow to develop antibodies. Most vaccines work by introducing the body's system to pathogen-specific proteins. Often, without this "sneak preview" from the vaccine, the animal cannot generate an immune response quickly enough to clear or destroy the pathogen. However, if the animal has a robust immune system or has been vaccinated, it will suppress the pathogen and, in time, clear or significantly reduce the infection.

When an animal recovers from disease or has been vaccinated (Figure 1), specific cells from the immune system will acquire the ability to remember and recognize the pathogens (virus, bacteria, toxin, or parasite) or parts of the pathogen known as antigens. The next time the immune system recognizes these antigens, it will immediately trigger the production of specific antibodies by specialized cells, which will work to destroy the pathogen. An antibody is a protein component of the immune system that circulates in the blood, recognizes foreign substances such as bacteria and viruses, and neutralizes them.

Vaccines expose the animal to parts of pathogens and challenge the immune system to react to a possible pathogen invasion by creating memory cells for the antigens belonging to that specific pathogen. In the future, if the animal is exposed to the same pathogen, the immune system will quickly generate a response before the pathogen can cause disease. Each antibody is usually specific for only one antigen. Because of this, the immune system keeps a supply of millions of different antibodies on hand to be prepared

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2. Juan M. Campos Krauer, assistant professor, Department of Large Animal Clinical Sciences, UF College of Veterinary Medicine, and research and Extension veterinarian, Department of Wildlife Ecology and Conservation, Cervidae Health Research Initiative; and João H. J. Bittar, assistant professor and beef cattle Extension specialist, DVM, MSc., Ph.D., Department of Large Animal Clinical Sciences, UF College of Veterinary Medicine; UF/IFAS Extension, Gainesville, FL 32611.

for any infectious agent. For a naïve animal (an animal that never was exposed to the pathogen), it may take 7 to 14 days after exposure to a pathogen for the body to develop immunity to an antigen. Unfortunately, this is plenty of time for some pathogens to wreak havoc on the body. It often takes only 48 hours for a vaccinated animal to mount an immune response to the same antigen.

Figure 1. Administration of vaccine subcutaneously (SQ) in a naïve calf using a disposable single-dose syringe.
Credits: João Bittar

There are several types of vaccines used in humans and animals. Most of the licensed veterinary vaccines currently in use are inactivated (i.e., killed) vaccines, live-attenuated vaccines, or toxoids. Each vaccine type uses different strategies to reduce the risk of illness while retaining the ability to induce a beneficial immune response.

Types of Vaccines

- **Attenuated vaccine:** Some vaccines contain live, attenuated microorganisms. An attenuated virus is an active virus cultivated under conditions that disable their virulent properties or use closely related but less dangerous organisms to produce a broad immune response. Although most attenuated vaccines are viral, some are bacterial. Attenuated vaccines have some advantages and disadvantages. Attenuated (i.e., live, weakened) vaccines typically provoke more durable immunological responses, but they may not be safe for use in immunocompromised individuals. Examples of attenuated livestock vaccines include those for Bluetongue virus, lumpy skin disease virus, and foot-and-mouth virus.
- **Inactivated vaccine:** Vaccines that use the killed germ of a previously virulent microorganism that has been destroyed with chemicals, heat, or radiation. Inactivated vaccines may require multiple doses (booster shots) for ongoing immunity against diseases because their protection is not as strong as that of live vaccines. Examples include IPV (polio vaccine), the hepatitis A vaccine, the rabies vaccine, and most influenza vaccines.
- **Toxoid vaccines:** Some microorganisms can create toxins that harm cells and play a role in causing diseases. Toxoids are made from inactivated harmful substances produced by these microorganisms. Vaccines using toxoids create an immune response targeted to the toxin instead of the whole microorganism. Some toxoid vaccines include ones for tetanus and *Clostridium*. It is worth noting that not all toxoids come from microorganism toxins. For instance, the *Crotalus atrox* snake toxoid is used to vaccinate against rattlesnake bites.
- **Subunit vaccines:** Subunit vaccines employ specific portions of pathogens, such as isolated proteins, to trigger the immune system. This approach can also involve genetic engineering, where a gene coding for a vaccine protein is inserted into a different virus or producer cells. This yields a recombinant vaccine, such as the hepatitis B vaccine or the human papillomavirus (HPV) vaccine. For the HPV vaccine, viral proteins are expressed, forming virus-like particles (VLPs) that prompt immune responses without causing illness.
- **Conjugate vaccine:** Similar to recombinant vaccines, these consist of two components. They combine fragments from bacterial polysaccharide outer coats with carrier proteins, enhancing the immune response. These pieces of bacteria would be less effective alone, but when linked to a carrier protein, they generate immunity against potential infections. Conjugate vaccines are used, for instance, to protect children against pneumococcal bacterial infections.
- **Outer membrane vesicles (OMVs) vaccines:** OMVs are released spontaneously during growth by many groups of bacteria. They have the ability to naturally provoke an immune response in the body of a human or animal and can be manipulated to produce potent vaccines. The best-known OMVs vaccines are those developed for serotype B meningococcal disease.
- **Heterologous vaccines:** These are also known as "Jennerian vaccines." The heterologous vaccines contain pathogens from other animals that either do not cause disease or cause mild illness in the organism being treated. The classic example is Jenner's use of cowpox to protect against smallpox. A current example is using the vaccine made from *Mycobacterium bovis* to protect against tuberculosis in humans.

- **Viral vector vaccines:** This vaccine works by using a harmless virus to put certain genes from a harmful germ into the body. These genes help the body create specific parts of the germ, such as surface proteins. These parts then trigger the immune system to respond and protect against the germ. For instance, a recently approved experimental vaccine for deer's epizootic hemorrhagic disease uses this method along with subunit vaccine technology.
- **RNA vaccine:** This is a novel type of vaccine composed of nucleic acid RNA packaged within a unique delivery system such as lipid nanoparticles. The vaccine works by introducing a small piece of viral protein into the body through a piece of messenger RNA (mRNA), which prompts the immune system to produce specialized antibodies. This process does not expose individuals to the virus or result in infection. Instead, it prepares the immune system to respond quickly and effectively if the individual is exposed to the virus in the future. By providing this protection, mRNA vaccines are an important tool in the fight against disease.

Important Factors to Consider When Using Vaccines

While vaccination is an important tool in preventing disease, it cannot be relied upon solely to protect animals on the farm. It is important to understand that vaccination does not guarantee immediate immunity or resistance against all diseases. It takes time for the animal's immune system to respond to the vaccine, and several other factors will determine the level of protection provided. These include the animal's overall health, the match between the vaccine and the pathogen, and the proper administration of the vaccine. Additionally, vaccines are delicate products that must be handled and administered correctly to ensure their effectiveness. Therefore, vaccination should be viewed as just one part of a comprehensive disease prevention plan on the farm.

- **Order vaccines from a trusted source.** Order directly from a trusted veterinary supplier or the company producing the vaccine.
- **Order an adequate amount of vaccine.** Be sure to include an additional 10% when placing your order to accommodate for potential vaccine losses that might occur during the handling of animals. If feasible, opt for bottles with a lower number of doses. Keep in mind that the shelf life of each vaccine differs. While some vaccines remain effective for several hours after being mixed, others retain their efficacy for a longer duration. Avoid using a vaccine that has been open and kept in the refrigerator for extended periods. Opting for bottles with fewer doses aids in determining the necessary quantity for the day.
- **Maintain correct storage conditions.** Review the guidelines regarding the proper storage of the vaccine. Most animal vaccines need refrigeration within the range of 35˚F–45˚F (2˚C–7˚C). Verify the optimal functioning of your storage refrigerator, position a thermometer inside, and regularly monitor the temperature. Keep in mind that refrigerators situated in barns or open sheds may experience temperature fluctuations during the day, which can impact the vaccine's temperature. Prevent freezing or excessive warming of the vaccine at all times. Additionally, ensure that direct sunlight does not reach the vaccine.
- **Observe expiration dates.** Always check expiration dates, and always start using the oldest first. Once opened, make sure to mark it with the date, especially if you plan on storing it for future use.
- **Follow directions for proper preparation and maintenance of vaccine shelf life after mixing.** Follow the instructions provided on the bottle to guarantee the vaccine's effectiveness. This step is of the utmost importance, because certain vaccines may need reconstitution with sterile water or the blending of components. It is essential to meticulously follow the given directions and ensure a gentle mixing process. Keep in mind that vaccines are fragile organic substances and should be shielded from temperature fluctuations. Avoid sudden temperature changes; handling a cold vaccine bottle with warm hands can swiftly alter the container's temperature and potentially impact its effectiveness.
- **Avoid exposure to UV light.** Do not expose vaccines to ultraviolet light from the sun. Some vaccines can be rapidly deactivated if exposed to UV light.
- **Use proper injection techniques.** Always inject the vaccine according to the manufacturer's directions. In animals, most vaccines are injected under the skin (subcutaneously, or SQ), intramuscular (IM), intranasally (IN; Figure 2), or intravenously (IV). Using the correct technique and location according to the species is essential. Use the right needle size and avoid reusing the same needle on another animal to reduce the risk of disease transmission. For deer, darts can be used for intramuscular (IM) injections, even though they are not ideal. When using darts, there are many variables that you need to consider. Common mistakes include missing, hitting the wrong spot, darting the same animal twice, or an incomplete dose discharge. If you are unsure whether the animal received the full dose, a second full

dose is recommended. There are guidelines regarding vaccine management and administration in the livestock industry presented by the Beef Quality Assurance (BQA) program (for more information, visit https://edis.ifas.ufl.edu/an170). These best practices for vaccine management can be applied to all species, with the goal of successful vaccination and food safety.

- **Keep good records.** Always record dates, animal ID, and vaccine lot number. Keeping good records is critical to improving herd health over time and may be necessary for importing or exporting animals.
- **Follow regulations for correct disposal of vaccine containers.** Some vaccines have products that need special disposal and that you do not want on your farm. Read the instructions for proper disposal of used containers. Regulations can vary by state.
- **Maintain access to emergency information.** In case of an accidental human injection or exposure to the vaccine, have the emergency number at hand for everyone working on the farm.

Figure 2. Intranasal (IN) vaccination of a calf.
Credits: João Bittar

Conclusion

This Extension publication presented information on the basic mechanisms and types of vaccines available, as well as a few best practices for vaccine management. This information can help improve your herd health and success in your next herd vaccination. As a note, in the United States, animal vaccines are regulated by the United States Department of Agriculture (USDA, APHIS), and further information about licensed vaccines can be found on their website (https://www.aphis.usda.gov/aphis/home/).

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BULL MANAGEMENT & CRITERIA

Did you know the bull is 50% of your herd's genetics? Superior genetics in a bull will spread through your herd faster and are a necessary investment.

To maintain your bull's health, maintain a relationship with your veterinarian and vaccinate at least 30 days before breeding season.

THINGS TO CONSIDER WHEN SELECTING A BULL:

Genetic Performance

Can be evaluated through the use of Expected progeny differences (EPDs). EPD's predict the difference that can be expected in the performance of the progeny.

Visual Appraisal

Structural correctness, muscle composition, angles, sheath score, and functionality can be determined by looking at the bull.

Acclimation to the Environment

Find a bull that will adjust to your ranch's climate and management conditions. Evaluate the need of the bull for additional feed and supplements during the breeding season.

EXPECTED PROGENY DIFFERENCES (EPDS)

EPDs provide an estimation of the performance in progeny based on their parents data. Growth EPDs provide information on topics such as weaning and yearling weight while carcass EPDs include information on topics like marbling, backfat thickness, and ribeye area. This data gives producers the ability to select bulls based on their production goals.

EPD Values associated with; Top 25% of Sires in the Breed, Breed Average, Top 75% (bottom 25%) of Sires in the Breed

Lot #	CED	Lot #	BW	Lot #	WW	Lot #	YW	Lot #	Milk	Lot #	$API	Lot #	$TSI
1	16.3	20	-1.5	4	86	4	138	48	29	5	152	5	88
48	15.3	48	-1.4	13	83	13	130	5	28	20	148	4	81
5	14.8	25%	-0.5	3	78	5	121	50	28	1	145	21	80
46	14.7	46	-0.3	15	78	21	121	46	27	48	138	20	79
25%	13.7	5	0.2	29	78	3	120	54	27	25%	135.13	1	77
20	12.3	1	0.3	5	76	15	117	12	26	21	135	65	77
AVG	11.7	54	0.4	11	76	65	116	15	26	46	134	3	76
4	11.5	AVG	0.6	21	75	29	115	65	26	65	133	48	76
11	11	38	0.9	44	75	38	115	25%	24.6	12	130	12	75
38	11	65	0.9	12	74	11	113	3	24	54	129	25%	74.68
44	11	8	1.1	58	74	12	113	11	24	8	128	13	73
65	10.6	10	1.1	38	73	44	110	4	23	4	126	29	73
13	10.5	44	1.1	65	73	58	110	8	23	3	125	11	72
21	10.2	21	1.2	61	72	25%	109.6	10	23	AVG	123.83	38	72
12	9.9	29	1.2	25%	71.1	50	108	13	23	50	123	46	71
54	9.9	50	1.3	48	69	61	107	29	23	13	121	50	70
75%	9.7	75%	1.6	1	68	48	104	58	23	29	119	AVG	69.24
29	9.6	4	1.6	50	68	1	102	38	22	38	115	8	69
8	9.5	11	1.7	46	67	8	100	AVG	21.7	11	114	44	69
61	9.5	15	2.3	8	65	46	100	20	21	44	114	58	69
10	9.2	3	2.4	AVG	64.5	10	99	21	21	58	113	15	67
50	9.2	13	2.4	20	63	20	99	44	21	75%	112.05	61	67
58	8.7	12	2.5	10	62	AVG	98.5	75%	19	61	111	54	66
15	7.9	61	2.7	54	58	54	91	61	19	10	107	75%	63.55
3	7.2	58	2.9	75%	57.9	75%	86.3	1	13	15	102	10	62

BREEDING SOUNDNESS EXAM (BSE)

A BSE is a physical exam of both internal and external reproductive organs and is performed by a veterinarian. It includes a semen collection and measuring of the scrotal circumference.

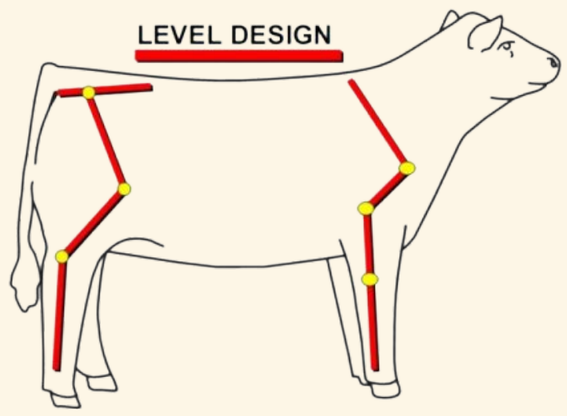
In order to pass, the bull must:

- Have at least 70% normal sperm
- Pass a physical exam
- Meet the minimum requirement for scrotal circumference
- Palpation of internal organs
- Conduct a yearly BSE before the breeding season

Performing a visual appraisal of a bull can tell you a lot about its structure, desirability, and ability to breed.

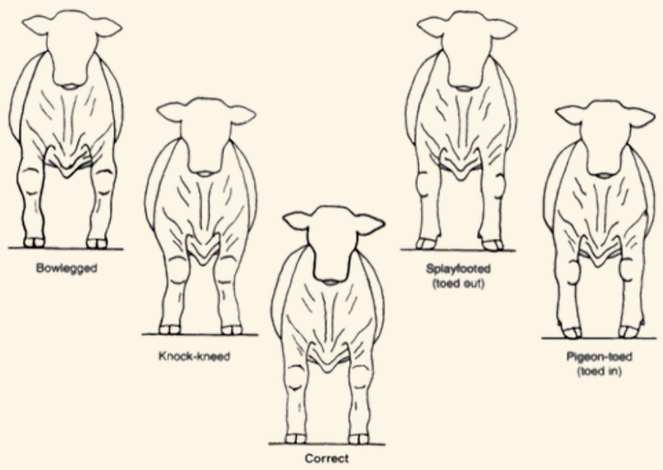
A FUNCTIONAL BULL:

- **Deep and big bodied**
- **Easy fleshing**
- **Correct angle to joints**
- **Correct foot size and heel structure**
- **Moderate frame score**



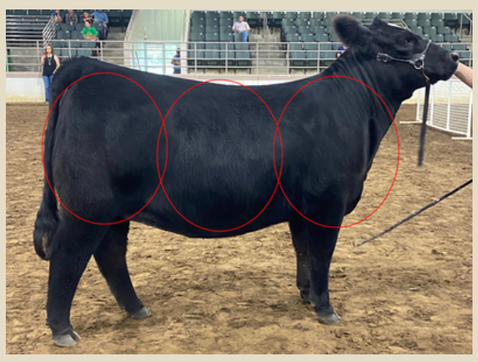
A bull's structure impacts their overall health, ability to breed, and reflects the traits that they will pass down to future progeny.

Front Leg Structure

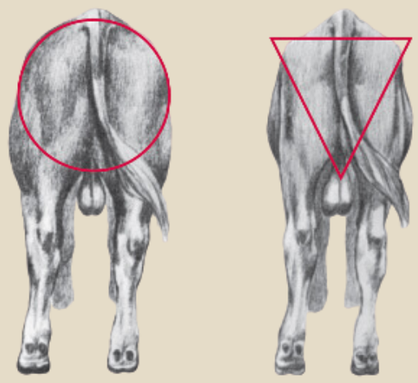


EVALUATING MUSCLE

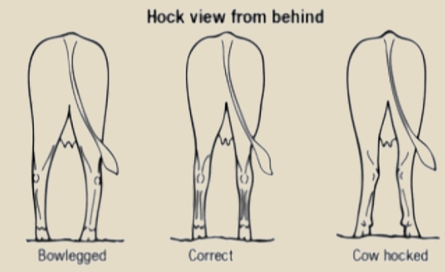
Side:
Forearm
Topline
Rear Quarter



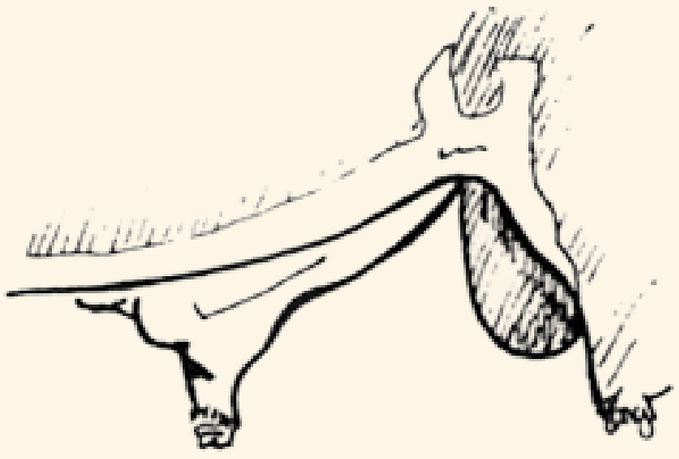
Behind:
Evaluate Muscle Up High
Width of Stance at the Ground



Rear Leg Structure




Desirable sheath


Loose, undesirable sheath

SHEATH SCORING

A bull's sheath can impact their ability to breed. Having a relatively high and tight sheath is ideal for breeding purposes. A looser, lower sheath can prevent the bull from breeding cows naturally.

BULL TO COW RATIO

When breeding naturally, it is important to have a proper bull:cow ratio to ensure that you have enough bulls to service your herd.

Bull age	Bull to Cow Ration
12-18 Months	1:15-20
2 years	1:30-35
3+ years	1:35-40

FOR MORE INFORMATION:

Lizzie Whitehead, Agriculture & Natural Resources Agent I
UF/IFAS Extension Bradford County
liz.whitehead@ufl.edu

Bradford County Florida
EVERYTHING IS BETTER IN BRADFORD

Considerations for Selecting a Bull[1]

Martha Thomas and Matt Hersom[2]

Introduction

Limited land resources are increasingly putting pressure on beef cattle producers to optimize and even maximize production on a given land resource. Because of limited land access, many cattle ranches are deciding to produce terminal calves and buy pregnant replacement heifers to maintain the cow herd. As a result of this decision, producers need to consider utilizing bulls that will produce calves that will meet industry carcass standards. Opportunities to capture increased value and revenue may be missed if beef cattle producers do not routinely examine their production system with an eye towards improving the uniformity and marketability of the calves they produce. The goal of every cattle rancher should be to generate a profit from their cattle, which means increasing the marketable pounds in the annual calf crop.

Factors to Consider

There are a number of considerations when selecting a bull to purchase. The differential emphasis on any of the following criteria is dependent upon the needs and opportunities that a producer may experience on their individual operations.

1. Structural Soundness

Structural soundness and conformation is an important factor because the bull must be physically able to service cows during breeding. Therefore sound feet and legs, particularly hind legs, are critical for a long service life of the bull.

2. Performance Records/Pedigree

If the bull is purchased through a bull test sale, how well did he perform? What is the performance or record of the bull's siblings or half-siblings? This information can be gathered by examining his pedigree.

3. Expected Progeny Differences

Expected Progeny Differences (EPD) predicts the differences expected in performance of future progeny of two or more sires of the same breed when mated to animals of the same genetic potential. Many cattle producers routinely use EPDs to select sires to meet their production goals. The EPD's that should be considered most highly when selecting a bull to produce terminal calves are calf growth and potential carcass traits. Growth trait EPDs include calf weaning and yearling weight. Carcass trait EPDs that are often considered are carcass weight, backfat thickness, ribeye area, marbling, and retail yield. Carcass traits are important because they are used to determine the value of a carcass. Growth traits are important because in many situations beef cattle producers' revenue is based upon the pounds of calf weaned and marketed or pounds of calf marketed after some extended growth phase. Likewise the ability to produce a calf crop that is capable of garnering a greater price per pound would be an important consideration when purchasing a bull. For beef cattle producers that

1. This document is AN218, one of a series of the Animal Sciences Department, UF/IFAS Extension. Original publication date June 2009. Reviewed June 2018. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Martha Thomas, former Extension agent, UF/IFAS Extension Lake County; and Matt Hersom, associate professor, Department of Animal Sciences; UF/IFAS Extension, Gainesville, FL 32611.

are retaining ownership, growth traits are important during the post-weaning phase. Similarly carcass traits, primarily carcass weight, but also marbling and yield grade potential are important considerations. When selecting a bull look for a breeder that measures carcass traits in his herd and selects cattle with superior growth and carcass traits.

4. Acclimation to the Environment

Find a bull that is acclimated to your ranch's climate and management conditions. Often bulls that are brought to Florida from other states do not tolerate the hot, humid weather and lower-quality forage. The lack of adaptation leads to poor performance of bulls both physically and during the breeding season. Evaluate the need of the bull for additional feed supplemental feed prior to breeding season. However during the off-season they should be able to maintain their condition without additional supplementation. Bull nutrient requirements and feeding recommendations can be found in the EDIS publications Nutritional Management of Bulls http://edis.ifas.ufl.edu/AN211, and Feedstuff Considerations for Feeding Bulls http://edis.ifas.ufl.edu/AN210.

5. Other Selection Considerations

Temperament is also an important trait because it can be a highly heritable trait. Calves should be calm and even tempered so that they will not be concerned with human interaction or equipment in their environment. Nervous cattle become stressed, eat less, are more prone to sickness, and perform poorer.

It is important to consider the cow's mature bodyweight and frame size and the desired calf characteristics when selecting a bull. The bull needs to compliment the cow herd to produce calves with a sensible frame size and still maintain acceptable growth attributes and carcass characteristics.

Breed type is an important consideration for the bull and the resulting mating with the cow herd. One way to produce heavier calves with improved carcass traits is through hybrid vigor. Hybrid vigor is the increased performance or expression of a trait that results from cross-breeding. The F1 (Brahman x Angus) cows mated to a terminal sire-type bull are the most productive cattle breeding programs in terms of cattle reproduction and calf weaning weight (Cross Breeding Systems in Beef Cattle, AN165).

Planning for the Breeding Season

When planning a breeding program it is critical to make sure you have enough bulls to service all of the cows in the herd. An important step is to evaluate the bull's potential to get a cow pregnant. This assessment is accomplished by a breeding soundness evaluation (BSE). A BSE is a quick and relativity inexpensive way of assessing a bulls fertility potential. A BSE should be conducted on a yearly basis by a qualified veterinarian. Bulls should be examined at least 60 days prior to the beginning of the breeding season. This allows for re-testing and replacement of bulls failing the examination. All purchased bulls should have passed a BSE prior to sale.

A BSE consists of four basic steps:

1. Visual assessment of the feet, legs, eyes, teeth and external genitalia;

2. Palpation of the accessory sex glands (prostrate and seminal vesicles);

3. Measurement of the scrotum as well as palpation of the testis and epididymis; and

4. Collection and microscopic evaluation of a semen sample.

If the bull scores very low or fails the BSE, the bull should be re-checked in 60 to 80 days. This time period allows adequate time for the process of new sperm creation, which takes approximately 70 days. A number of issues could cause a bull to fail a BSE including injury to the testes or illness which can cause abnormal or low sperm formation.

In order to know how many bulls a beef producer will need for a breeding season, the service capacity of the bull needs to be considered. Service capacity is the number of cows a bull can adequately detect in estrus and potentially breed during the defined breeding season. The general service capacity or bull to cow ratio is based on the age of the bull. Table 1 provides guidelines for service capacity of bulls.

Table 1. Relationship of bull age to service capacity during the breeding season.

Bull Age	Bull to Cow Ratio
12- 18 months	1:15-20
2 years	1:30-35
3- Aged (7 plus years)	1:35-40

Conclusion

When cattle producers purchase and turn the bull out, they have made one of the largest decisions dictating carcass merit for the subsequent calves. Carcass merit and the genetic change associated with improving carcass merit are not single trait characteristics, so bull selection needs to be made to optimize all growth and carcass merit characteristics. Cattle producers can pursue genetic change for particular carcass characteristics by selecting and utilizing the appropriate genetic sources. Therefore, selecting and implementing a genetic program with specific goals is important. All management processes performed after the genetic choices are done to optimize the genetic potential of the resulting calf.

References

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Understanding the Basics of EPDs[1]

Fernanda M. Rezende, Caitlin L. Bainum, Joseph H. Walter, and Timothy W. Wilson[2]

When selecting herd sires, producers often give consideration to color, soundness, structure, body condition, temperament, and genetics. Although expected progeny differences (EPDs) provide an excellent genetic description of a bull, many producers have difficulty understanding what EPDs mean and how to use them to drive the genetic advancement of the herd. The purpose of this publication is to provide basic concepts and practical examples to help beef producers and their advisors make informed selection decisions using EPD information.

What does expected progeny difference (EPD) mean?

Expected progeny difference is the genetic description of a bull derived from data from its calves (progeny), its ancestors, and full and half siblings. The EPD represents the average genetic contribution of a specific bull to its progeny (i.e., what is transmitted from an individual to its progeny) and is expressed in the form of deviations from a reference population.

Half of the genetic material is passed on from parent to progeny through gametes (i.e., sperm and egg cells). Hence, only half of the independent effects of all genes affecting one trait are inherited. However, each offspring receives a random sample of its parent's genes, and some samples are better than others. EPDs are a representation of the average value of an individual's gametes for a specific trait. Therefore, EPDs can also be interpreted as the average value of an individual's contribution to its offspring's performance.

EPD values provide an estimate of how a bull's progeny are expected to perform relative to the progeny performance of a group of animals used as a point of reference in the genetic evaluation. This group of animals, formally called genetic base, has the average of their EPDs set as zero for all traits. Thus, all other EDPs are expressed as deviation from this average, explaining positive and negative EPD values that are reported. For instance, if a particular bull has an EPD of +1.6 lb for birth weight, and we are careful to randomly mate him to a cross section of cows, not just those with especially heavy or light birth weight, we can expect the birth weight of its progeny to average 1.6 lb heavier than the average birth weight of the progeny from the genetic base. The genetic base can broadly be explained as a historic group of animals, such as all evaluated animals born at the onset of a 5- or 10-year period, used as a baseline.

Traits reported by a breed association may vary in number, with new traits added periodically. Typically, EPDs for growth traits such as birth weight (BW), weaning weight (WW), yearling weight (YW), and milk are often reported for beef cattle. Depending on breed, additional traits related to carcass and ultrasound data may also have estimated EPDs.

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2. Fernanda M. Rezende, assistant professor, Department of Animal Sciences; Caitlin L. Bainum, livestock agent, UF/IFAS Extension Marion County; Joseph H. Walter, livestock agent, UF/IFAS Extension Brevard County; and Timothy W. Wilson, production agriculture agent, UF/IFAS Extension St. Johns County; UF/IFAS Extension, Gainesville, FL 32611.

EPDs indicate if a bull's progeny are expected to perform above or below compared to the progeny performance of the average bull in that breed. Breed averages can be expressed as the average of the EPDs of current sires (e.g., registered animals with at least one calf record in the herd book), main sires (e.g., sires with at least 35 yearling progeny weights), and non-parents (e.g., registered animals with no current progeny in the genetic evaluation). They are published by various breed associations at least semiannually.

Notably, EPDs are exceptional tools for comparing and ranking candidates for selection, because the difference between the EPDs of two animals is an estimate of the difference expected to be observed in the performance of their progeny.

How reliable is EPD?

The EPD values are always accompanied by an associated measure of reliability named accuracy. The accuracy value, expressed numerically between zero and one, is a function of heritability and is impacted by the number of progeny and ancestral records available. Therefore, a specific bull has a more reliable EPD for birth weight than for calving ease because birth weight has higher heritability. Likewise, an individual with many progeny has more reliable EPD for any given trait than an individual with few or no progeny. As the number of progeny reported to a breed association increases, the accuracy values will move closer to one.

The accuracy values can be viewed as a percentage. For example, a value of 0.39 could be seen as 39% accurate while a value of 0.98 could be viewed as 98% accurate. A low accuracy value indicates that a sire may be young, or that few calves have been reported to the breed association. As the EPD value is adjusted to more accurately define the genetic capabilities ("true" progeny difference) of the bull, the accuracy values increase. In other words, as additional calves are registered each year, EPD values for a bull are adjusted and the accuracy value increases, which reflects in lower expected change or potential deviation between the EPD and the "true" progeny difference.

Selection must be based on EPD values, and accuracy should be used as a guide to decide how intensively an individual animal should be used in the case of change (up or down) in its EPD value. If accuracy is low (e.g., young bull with few or no progeny), the producer assumes more risk that the animal's EPD is not a perfectly accurate prediction of genetic merit. Nevertheless, good reasons for using young bulls include their higher EPD values and lower cost of the bull or semen from the bull when compared to proven bulls. When selecting young bulls, producers can mitigate the risk by using a larger number of sires and setting a more stringent threshold (e.g., purchasing bulls or semen from bulls in the top 10% of available young bulls). This approach ensures higher accuracy of the EPDs of the group of young bulls than the accuracy of any one of these young bulls' EPDs. In addition, if one young bull is worse than the others, that young bull will sire a smaller fraction of calves. Fine-tuning the selection based on morphological and functional attributes of individuals selected by EPDs is still possible.

How do I use expected progeny difference?

Individual EPD values are negligible, but they are a powerful selection tool when used to compare an individual to its breed average EPDs and to rank candidates for selection. For example, if the EPDs listed in Table 1 for bull A were for an Angus bull, how would it compare to its breed average (Table 2) for birth weight (BW)? How would calves from bulls A, B, and C be expected to perform for birth weight?

Bull A has a BW EPD of +0.6 with 98% accuracy. When comparing the BW EPD of +0.6 to the breed average of +1.2, bull A would be expected to produce calves with lower birth weights than the average bull in the Angus breed (0.6 - 1.2 = -0.6, or 0.6 lb lower than the breed average). Compared to its counterparts B and C, bull A would be expected to produce the heaviest calves at birth. Indeed, bull A is expected to produce calves 1.4 lb and 3.4 lb heavier at birth than bull B [0.6 - (-0.8) = 1.4 lb heavier than bull B] and bull C [0.6 - (-2.8) = 3.4 lb heavier than bull C], respectively.

It is also important to consider the accuracy value, especially when selecting a sire that will breed heifers, since little or no information may be available on the female genetic contribution to the progeny. Bull A has the highest accuracy value for BW, 0.98 or 98%, so it can be anticipated that this bull's progeny will have birth weight differences close to the expected value.

If bull A was a Charolais rather than Angus, the results would differ from those in the first example. Using the same +0.6 BW EPD, which is higher than the Charolais breed average of -0.4, would result in calves from bull A weighing 1 lb more than the mean birth weight of calves from an average bull in the Charolais breed [0.6 - (-0.4) = 1 lb heavier than the breed average].

Genomic-Enhanced EPDs

Proven bulls have more reliable EPDs than young genomic-tested bulls due to a higher number of available progeny records. However, the latter tend to have greater EPD values due to genetic progress over generations. Genomic-enhanced EDPs have become available to the beef industry and provide for unproven bulls the same amount of accuracy as if they had on average 20 progeny records, depending on the trait of interest. This is possible through the incorporation of genomic or DNA test information in the traditional genetic evaluation that uses pedigree and performance records. When evaluating young bulls with low accuracy values and no available genomic EPDs, an alternative is to include EPD information from their sire, dam, and grandsire in the decision-making process with an understanding that ancestral EPDs are not as accurate of a selection tool as genomic EPDs. If available, genomic EPDs provide a more accurate estimate of a young bull's genetic potential as a sire than ancestral EPDs and should be used for animal selection. It is also advised to use a group of young bulls, as the accuracy of the group EPD is greater than the accuracy of each individual bull's EPD. The accuracy of a group of young genomic-tested bulls is given by $Acc = 1 - (1 - average\ acc_i)/n$, where acc_i is the average accuracy of individual bulls and n is the number of bulls in the group. For example, if the average accuracy of individual young bulls is 50%, the accuracy of EPD for a group of 3 bulls is about 83% [1 - (1 - 0.5)/3 = 0.83].

Across-Breed EPD Comparisons

In many operations, producers opt for a crossbreeding program to take advantage of heterosis: performance advantages of the resulting crossbred calf crop compared to the average of the parental breeds. This can present a challenge when utilizing within-breed estimated EPDs for genetic merit comparison of bulls from different breeds because breed associations often use different national evaluation programs and differences exist in the genetic base across breeds. In crossbred operations, producers must be capable of comparing sires across breeds by adding appropriate adjustment factors to the EPD produced in the genetic evaluations for each breed. Across-breed EPD (AB-EPD) adjustment factors were developed to help producers select a sire for their goals with crossbred cattle.

AB-EPD factors are published yearly for 18 different breeds by the U.S. Meat Animal Research Center (MARC) in Clay Center, NE, and made available on the BIF website (www.beefimprovement.org). If the three bulls listed above (Table 1) are Angus, Brahman, and Charolais, respectively, the across-breed adjustment factors (Table 3) can be used to convert noncomparable within-breed EPDs to comparable across-breed EPDs (Table 4).

Remember that EPDs are not perfect when comparing bulls even within a breed; therefore, AB-EPDs are less accurate when comparing animals of different breeds. Many breed associations have adopted an alternative: the implementation of multibreed genetic evaluations, which combines records from purebred and crossbred animals and accounts for direct and maternal heterosis and breed effects. Multibreed genetic evaluations yield more accurate EPD predictions by virtue of data volume and permit direct comparison of EPDs from animals of different breed and breed composition. When EPDs from multibreed evaluations are available, they are the most effective to commercial producers who are comparing and purchasing bulls of more than one breed to use in the crossbreeding system.

Take-Home Message

In summary, EPDs are an excellent means to evaluate the expected genetic potential of a sire. Thus, EPDs are exceptional tools for comparing and ranking candidates for selection. Producers who use EPDs must consider that they are designed to predict expected progeny differences in performance and not actual bull performance. The adjustment factors may serve as a valuable tool for producers to more appropriately compare within-breed EPDs of bulls from different breeds for a crossbreeding program. Multibreed EPDs are the most effective and accurate alternative for comparing the genetic merit of bulls from different breeds or breed combinations.

Table 1. Estimates of EPD and accuracy values.

Animal	BW acc	WW acc	YW acc	Milk acc
Bull A	+0.6 0.98	+60 0.97	+109 0.96	+27 0.95
Bull B	-0.8 0.83	-1 0.85	+1 0.73	+10 0.78
Bull C	-2.8 0.68	+56 0.63	+118 0.58	+38 0.31

BW: Birth weight.
WW: Weaning weight.
YW: Yearling weight.
acc: Accuracy.

Table 2. Breed average EPDs for Angus and Charolais.

Breed	BW	WW	YW	Milk
Angus	+1.2	+59	+105	+26
Charolais	-0.4	+57	+104	+23

BW: Birth weight.
WW: Weaning weight.
YW: Yearling weight.

Table 3. MARC adjustment factors to estimate across-breed EPDs.

Breed	BW	WW	YW	Milk
Angus	0.0	0.0	0.0	0.0
Brahman	9.0	60.2	24.0	12.4
Charolais	6.4	5.5	-23.9	-1.8

Table 4. Example of using across-breed adjustment factors to convert noncomparable within-breed EPDs to comparable across-breed EPDs.

Animal	Breed		BW	WW	YW	Milk
Bull A	Angus	AB adj. factors[1]	0.0	0.0	0.0	0.0
		EPD[2]	+0.6	+60	+109	+27
		AB-EPD[3]	+0.6	+60	+109	+27
Bull B	Brahman	AB adj. factors[1]	9.0	60.2	24.0	12.4
		EPD[2]	-0.8	-1	+1	+10
		AB-EPD[3]	+8.2	+59.2	+25.0	+22.4
Bull C	Charolais	AB adj. factors[1]	6.4	5.5	-23.9	-1.8
		EPD[2]	-2.8	+56	+118	+38
		AB-EPD[3]	+3.6	+61.5	+94.1	+36.2

[1] AB adj. factors are the MARC across-breed adjustment factors from Table 3.
[2] EPDs are the EPD values from within-breed genetic evaluation.
[3] AB-EPDs are the across-breed EPDs after adjustment factors are applied to within-breed EPDs.

Micah Gallagher 2024

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Common Weeds in North Florida Pastures

Thistle

Cirsium horridulum

https://edis.ifas.ufl.edu/publication/AG253

ID Factors

- 9 different thistles in Florida
- Thorny plant with spiny leaves, thick stems
- large purple flowers (sometimes yellowish white)

Life Cycle

Biennial

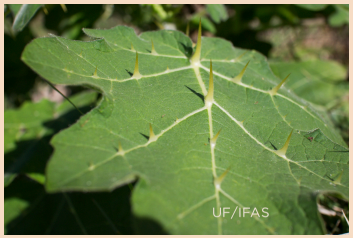
- Rosette: Taproot with leaves above ground (November to January)
- Bolting: Tall stalk from rosette (April August)
- Flowering: Purple/pink flowers, seeds out, and dies (April to August)

Control

- Mechanical
  - By hand or mowing
- Chemical
  - 2,4-D or GrazonNext

Tropical Soda Apple

Solanum viarum Dunal



https://edis.ifas.ufl.edu/publication/UW097

ID Factors

- Yellow fruit when mature
  - Contains 200–400 seeds per fruit
- Stems + leaves have white/yellow thorns
- Flowers are white with yellow middle

Life Cycle

Perennial

- Flowers (September to May)
- Yearly fruit production
  - Mature plants have green immature fruit + yellow mature fruit
- New plants emerge from seed or perennial roots
  - Root system extending 3–6 feet from the crown of the plant

Control

- Chemical
  - Herbicides containing Aminopyralid
    - Milestone, GrazonNext HL, Chaparral, DuraCor

Night Shade

Solanum americanum

https://extadmin.ifas.ufl.edu/media/extadminifasufledu/cflag/image/docs/pdfs/central-florida-pasture-weeds/2020/February.pdf

ID Factors

- *TOXIC*
- White star shaped flowers with yellow center
- Black mature berries
  - Contains 50-110 seeds per fruit
- 1.5 - 3 feet tall

Life Cycle

Annual/short-lived Perennial

- Flowers (March to October)
- Smooth or hairy stems
- Young leaves are smooth, mature leaves are wavy on edges
- Fruit production
  - Green immature berries + black mature berries
- Paraquat resistance

Control

- Mechanical
  - By hand
- Chemical
  - 2,4-D + dicamba, GrazonNext HL, Milestone, Pastureguard, Triclopyr

Sickle Pod + Coffee Senna

Senna obtusifolia

Senna Occidentalis

Sickle Pod

Coffee Senna

ID Factors

- *TOXIC*
- Yellow flowers
- Seed pods are rounded, curved down
- 1-6 feet tall

- *TOXIC*
- Yellow flowers
- Seed pods are flat, curve up
- Has odor when crushed
- 1-10 feet tall

Life Cycle

Annual

- Control during summer months
- Semi-woody legume with branched stems
- Rounded leaves, egg shaped

Annual

- Found in soil that is disrupted often
- Pointed leaf tips, clustered flowers

Mowing both of these plants can spread the seeds

Control

- Mechanical
  - By hand
- Chemical
  - 2,4-D or GrazonNext HL

https://nwdistrict.ifas.ufl.edu/phag/2017/08/25/weed-of-the-week-sicklepod/
https://nwdistrict.ifas.ufl.edu/phag/2017/09/15/weed-of-the-weed-coffee-senna/

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Common Weeds in North Florida Pastures

Dogfennel

Eupatorium capillifolium

https://edis.ifas.ufl.edu/publication/AG233

ID Factors

- Vibrant green color
- Can grow in a single plant and in small clusters, 1-8 feet tall
- Can cause dehydration in cattle if consumed

Life Cycle

Perennial

- Grows during spring and summer (April-October)
- Single stem/shoot from taproot and have rootstocks
- Small, fluffy leaves
- Leaves have strong odor when crushed/mowed
- Seeds easily dispersed by wind

Control

- Mechanical
  - By hand
- Chemical
  - 2,4-D, WeedMaster, Pasturegard HL, GrazonNext HL

Fire Weed

Urtica chamaedryoides

https://edis.ifas.ufl.edu/publication/AG252

ID Factors

- Also known as stinging nettles
  - Pictured is the heartleaf nettle
- Small green flower clusters under leaves on main stalk
- Deep serrated edges on leaves

Life Cycle

Annual

- Grows during winter (November to March)
- Stinging hairs
  - Equine tend to show more symptoms related to these plants compared to other livestock
- Stinging hairs are on stems and leaves

Control

- Chemical
  - GrazonNext HL, Remedy Ultra, and Pasturegard HL

Arrow Leaf Sida

Sida rhombifolia

https://nwdistrict.ifas.ufl.edu/phag/2018/02/02/weed-of-the-week-arrowleaf-sida-teaweed/

ID Factors

- Also known as Teaweed
- Yellow to yellow-orange flowers
- Slightly serrated edges on leaves
- 1-4 feet tall

Life Cycle

Annual or Perennial

- Grows during spring and summer (April-October)
- Smooth, woody type stems
- Deep tap root
- Known to reduce yield in production fields but is food source for wildlife
- Drought resistant

Control

- Chemical
  - GrazonNext HL, Pastureguard HL, Chaparral, Cimarron Plus or Xtra, Banvel, Metsulfuron, Remedy

Smuttgrass

Sporobolus indicus

https://edis.ifas.ufl.edu/publication/AA261

ID Factors

- Two types in Florida, small (8-10in) and giant (12-18in)
- Small smuttgrass have compact seedheads, giant have open seedheads
  - Giant seedheads look “fluffy”

Life Cycle

Perennial

- Red/orange seeds
- Seeds can remain dormant in soil for at least two year
- Mowing and burning does not kill smuttgrass
- Not palatable to livestock

Control

- Chemical
  - Hexazinone, Velpar/Tide Hexazinone, Velossa

Cool-Season Forages

Emily Beach, UF/IFAS Extension Lafayette County and Keith Wynn, UF/IFAS Extension Hamilton County

Introduction

Each year producers are faced with the decision to depend on hay as the sole winter forage for livestock or to plant a cool-season forage to get through those winter months when warm-season grasses are dormant. If producers choose to plant cool-season forages things to consider are: soil type, previous crop history, irrigation availability, timing of grazing, and variety selection.

Cool-season forages recommended for the climate conditions in North Florida include oat, rye, ryegrass, triticale, and wheat.

Oat

Oat can be planted and grazed earlier than all other cool-season crops if an early option is needed. Oat is very palatable but may be injured under freezing conditions and is not recommended for wetter soils.

Rye

Rye is the most widely used grain for winter grazing because of its drought tolerance and cold hardy character. It is considered a mid-season crop which produces more forage than oat or wheat.

Ryegrass

Ryegrass is considered a mid to late season grazing crop which is a useful way to bridge the gap between oat/rye and warm-season forages. One note about ryegrass is that it requires a heavier soil for optimal results.

Triticale

Triticale is a cross between wheat and rye and is well adapted to peninsular Florida due to its quality and disease resistance. Alone, triticale is recommended for haylage or silage. If grazed, consider blending with ryegrass for a longer growing season.

Wheat

Wheat is a winter hardy forage that is well-suited for grazing, silage, and grain. Its forage productivity, however, is generally lower than all other small grains in Florida.

The use of certified seed is always recommended to enhance good pasture establishment. For detailed information about possible disease and insect threats, please refer to the 2024 Cool-Season Forage Variety Recommendations for Florida EDIS Publication SS-AGR-84.

Management

Taking a soil sample 6-8 weeks prior to planting is recommended to determine soil pH and fertility recommendations.

UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops EDIS Publication SL 129 recommends when planting on a prepared seed bed, apply 30 lb. nitrogen (N) per acre. Additionally, based off the soil sample recommendation apply 50% of the potassium (K_2O) and all the phosphorus (P_2O_5) fertilizer. These recommendations are for an at-planting application. Apply 50 lb. N per acre and the remaining K_2O after the first grazing period then an additional 50 lb. N after each subsequent grazing period.

When overseeding a pasture apply 50 lb. N plus all the soil sample recommended K_2O and P_2O_5 after emergence. Apply 50 lb. N after each grazing period.

Crop	Planting Dates	Tillage Seeding Rate (lb/A)	Broadcast Seeding Rate (lb/A)	Grazing Height Begin (in)	Grazing Height End (in)	Rest Period (days)	Seed Cost *Based on variety & planting method ($/A)	Recommended Varieties (Check for availability)
Oat	Sept. 15- Nov. 15	80-100	100-120	8-10	3-5	7-15	32-60	Juggernaut, Horizon 306, Horizon 578, Horizon 720, Legend 567, RAM FLLA11019, TriCal Cadillac
Rye	Oct. 15- Nov. 15	80-100	90-120	8-12	3-4	7-15	32-67	FL 401, Kelly Grazer III, Wrens Abruzzi
Ryegrass	Oct. 1- Nov. 15	15-20	20-30	6-12	3-4	7-15	11-24	Attain, Big Boss, Diamond T, Double Diamond, Earlyploid, Fria, Frostproof, Grits, Nelson, Prine, TAMTBO, Triangle T
Triticale	Oct. 15- Nov. 15	80-100	90-120	8-12	3-5	7-15	40-60	TriCal 342, TriCal 1143, TriCal Surge, Hybrid Surge
Wheat	Oct. 15- Nov. 15	80-100	90-120	8-12	3-5	7-15	26-58	AGS 2024, AGS 4323, AGS 4043, Johnson, Dyna-Gro Plantation

Credits:

Wallau, M. et al. EDIS Publication SS-AGR-84. 2024 Cool Season Forage Variety Recommendations for Florida.

Mackowiak, C.L. et al. EDIS Publication SS-AGR-43. Tillage and Overseeding Pastures for Winter Forage Production in North Florida.

Mylavarapu, R. et al. EDIS Publication SL 129. UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops.

UF IFAS Extension UNIVERSITY of FLORIDA

SS-AGR-84

2024 Cool-Season Forage Variety Recommendations for Florida[1]

M. Wallau, A. R. Blount, E. Rios, J. M. B. Vendramini, J. C. B. Dubeux, M. A. Babar, K. E. Kenworthy, C. H. de Souza, 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, translating into greater animal performance (Dubeux et al. 2016). Planting and growing these forage crops can involve considerable expense and are 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.

Many cool-season forages are also grown as silage crops and/or cover crops. Cool-season legumes such as vetch and lupine can produce a significant amount of biomass and fix 40 lb N/A to 80 lb N/A. Similar characteristics in terms of productivity and disease resistance should be considered when planting those species as silage or cover crops. For those uses, delaying planting is sometimes recommended to avoid the need for irrigation early in the fall. However, that decision depends on intended use. If multiple silage cuttings are desired, planting may occur at the same time as normally recommended planting dates for grazing; however, harvesting must occur when plants are still in the vegetative stage to avoid potential freeze damage or winter kill of the stand. In some years, early planting for silage or cover cropping has made stands susceptible to diseases, insect pests, freeze damage, and lodging.

Many producers cut back on seeding rates and use "brown bag" seeds when planting cover crops, which frequently results in weak or thin stand establishment and lower productivity. A fast soil cover is desirable for weed management (competition) and erosion control. The use of **certified seeds is always recommended** to guarantee proper seed quality and purity, and to enhance good pasture establishment. When planting legumes, seed can be purchased already inoculated with rhizobia (specific bacterial strains for nitrogen fixation). However, fresh rhizobium inoculation applied prior to planting helps to ensure viability of inoculum. There are specific rhizobium strain inoculants for some groups of legumes. More information can be found in Ask IFAS publication SS-AGR-154, "*Inoculation of*

1. This document is SS-AGR-84, one of a series of the Department of Agronomy, UF/IFAS Extension. Original publication date September 2003. Revised June 2010, October 2011, December 2012, September 2013, September 2014, September 2017, September 2018, August 2019, September 2020, August 2021, September 2022, August 2023, and August 2024. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

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

Agronomic and Forage Crop Legumes" (https://edis.ifas.ufl.edu/publication/AA126).

This publication provides the most up-to-date information on adapted cool-season forage varieties for our growing season. The recommendation of varieties is based on multi-location, multi-year cultivar evaluation experiments that may include trials in Florida (https://programs.ifas.ufl.edu/forage/technical-information/), Georgia (https://georgiaforages.caes.uga.edu/species-and-varieties/variety-trials/forage-variety-trial-information.html), Alabama (https://aaes.auburn.edu/blog/2024/06/05/winter-forage-summary-tables-2023-2024/), and other states. Table 1 includes information about planting dates, seeding rates, and other considerations. Other resources that provide more in-depth discussion of each of the species or group of species are available at Ask IFAS. For a list of publications, access our "Technical Publications" section of the UF/IFAS Forage Team website (https://programs.ifas.ufl.edu/forage/technical-information/). If you have questions about a particular variety, contact your local UF/IFAS Extension agent for additional information (https://sfyl.ifas.ufl.edu/find-your-local-office/).

Recommended Cultivars (Varieties)

Alfalfa

Alfalfa is usually grown as a winter short-term perennial (less than 2 years) in Florida and is typically used for haylage, green chopping, or hay. This species is not widely cultivated in the state; it is normally restricted to the Panhandle and drier (higher) areas in north Florida. It requires good management practices for establishment and maintenance as well as high fertility levels, and it is not tolerant to flooding or soils with high water tables. Soil pH of 6.5 or greater is needed for alfalfa production. 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 to tolerate a certain amount of grazing, but they are not as grazing tolerant as other legume species, such as most of the clovers. When planted in the fall, it is expected to have a first hay cut around early spring, then monthly afterwards. However, subsequent cuts might be challenging given Florida's humid conditions and competition with weeds.

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 grows later in the 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 and Grazer's Select.

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 stubble height of 3–4 inches.

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, AU-Robin and AU-Sunrise.

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, and we recommend non-dormant types for early forage production.

RECOMMENDED VARIETIES

Barduro (mid-dormant, released by UF/IFAS), Red Ace, Southern Belle (non-dormant, released by UF/IFAS), and Q Medium (recent release 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 and Q are mid-dormant types. Q has natural (i.e., non-GMO) tolerance to 2,4-D herbicide. Bulldog Red is also marketed in the southeastern United States, but data are limited on its performance in Florida.

Clover, White

White clover is usually a winter perennial but may function 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, has lower initial forage yields and has a very aggressive growth habit.

Fescue, Tall

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

RECOMMENDED VARIETIES

None.

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 and availability of these lupine varieties have been limited.

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.

Oat

Oat is very palatable and grows well as cool-season grass, but it may be injured under hard freezing conditions depending on growth stage and not well-adapted to wet soil. Oat may be planted and grazed earlier than rye. We have observed an increase in crown rust on Legend 567 and Horizon 720 oats, two of our most popular and earliest varieties of oat that were previously listed as resistant. We are still recommending the use of those, especially Legend 567 because of its precocity, but we advise scouting and potentially using fungicides to prevent losses in production and quality when harvesting for silage. In grazing systems, crown rust resistance is less critical because rust inoculum is reduced by grazing. Other commercially available varieties of oat are often very productive, although susceptible to crown rust. Early planting of susceptible varieties is not recommended. Few fungicides are labeled for use in grazing systems, and many have hay use limitations. Oat as a cover crop is underutilized but can be a great alternative to rye, and can be used for hay, silage, and grazing if needed. Horizon 306 and RAM LA 99016 are excellent forage types that exhibit winter hardiness and good grain production but are late-producing and susceptible to prevalent crown rust strains. Susceptible oat plantings may need to be scouted for rust and treated with legal fungicides, particularly if grown for silage or grain. Barley yellow dwarf virus (BYDV) is an aphid-transmitted virus that may injure some varieties, especially Coker 227. Improved varieties have better field resistance to BYDV, but all can show some level of incidence of the disease. Typically, early planted oat varieties grown for grazing are not sprayed with insecticides for aphid control. Grazing reduces populations of aphids but may not prevent early infection of BYDV in early planted situations where warm fall weather prevails.

RECOMMENDED VARIETIES

Juggernaut, Horizon 306 (late variety), Horizon 578, Horizon 720 (early variety), Legend 567 (early), RAM FLLA11019 (early) and TriCal Cadillac (early).

Note: All oat varieties listed above have shown moderate to high incidence of crown rust. Rust races can change, and previously resistant cultivars, such as Horizon 720 and

Legend 567, can show symptoms of disease. Rust incidence is also related to management (planting date, fertility management, etc.). Horizon 306 is considered a late type and more cold tolerant, but are still less productive and more disease prone than other options.

Peas, Austrian Winter (Common)

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

RECOMMENDED VARIETIES

Austrian (common).

Other varieties on the SE market are Icicle and Keystone. They performed well in some of our trials but have not been broadly tested at this time.

Rye

Rye is the small grain most widely used for winter grazing. Rye is more cold-tolerant than oat 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 northwestern states produce little forage in late fall or early winter and tends to be severely damaged by leaf rust. Therefore, only plant varieties recommended for the southeastern United States. FL 401 is one of the earliest and most productive cool-season varieties, but it is generally used more as an early planted forage used in mixtures with other winter forages, or for cover cropping rather than for grazing because of the low leaf-to-stem ratio. It matures very fast and is frequently rejected by cattle afterwards. FL 405 is a new variety that will be available in the market in 2025.

RECOMMENDED VARIETIES

FL 401 (for early grazing and cover cropping, or use in blends), Kelly Grazer III (FL 104, full-season forage variety) and Wrens Abruzzi (late, full season). Late-forage season producers developed in Oklahoma such as Bates RS4, Elbon, Oklon, Maton, and Maton II have performed well in the past, but have not been evaluated in recent trials.

Ryegrass

Ryegrass is a valuable mid- to late-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.

EARLY RECOMMENDED VARIETIES

Attain, Big Boss, Diamond T, Earlyploid, Flying A, Fria, Frostproof, Grits, Prine, Rapido, TAMTBO, and Winterhawk.

LATE RECOMMENDED VARIETIES

Attain, Big Boss, Double Diamond, Earlyploid, Jackson*, Marshall*, Nelson, Prine, TAMTBO, Triangle T, and Ranahan.

SEASON-LONG RECOMMENDED VARIETIES

Attain, Big Boss, Diamond T, Double Diamond, Earlyploid, Fria, Frostproof, Grits, Nelson, Prine, TAMTBO, and Triangle T.

Note: These varieties were selected based on their recent three-year, multi-location performance. Other ryegrass varieties have also performed well in regional trials but have not been recently tested. New varieties available on the commercial market may be suitable but have not been adequately evaluated in Florida, or seed is unavailable.

*Susceptible to rust and/or gray leaf spot.

Rapido is a new variety that has very early flowering and could be considered for overseeding on bahiagrass or bermudagrass pastures (with early termination), although it has lower productivity compared to many of the other recommended varieties.

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.

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. Use recommended varieties because there are triticale varieties sold in the state that are not adapted to Florida growing

conditions and will not perform well. TriCal 342 is an early variety, while Surge is late.

RECOMMENDED VARIETIES

TriCal 342 and TriCal 1143* (short supply) are early varieties. TriCal Surge (short supply) and Hybrid Surge may be considered for late-season forage production. Sprinter is a new variety coming to the market in 2025.

*Awnless varieties recommended for wildlife food plots.

Vetch (*Vicia sativa*)

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

RECOMMENDED VARIETIES

Cahaba White and common.

Notes: Commercial seed production of most vetch varieties is limited. It may be necessary to special order seed. Hairy vetches (*Vicia villosa*) such as AU Merit and Patagonia perform well in our environment but are not recommended given their invasive potential.

Wheat

Wheat is less susceptible to freeze injury than oat, but its forage productivity is generally lower than that of all other small grains in Florida. The main advantage of wheat is the possibility of dual-purpose use (i.e., grazing and grain), but grain production might be reduced when grazed, and grain quality is generally lower for wheat grown in Florida. Wheat should not be planted for grazing before October 15. Hessian fly-resistant wheat varieties are recommended, especially if wheat is grown for grazing, silage, as a cover crop or for hay production, otherwise insecticide treatments may be necessary. For varieties with moderate tolerance to Hessian fly, consider insecticide management on seed (neonicotinoid) and labeled pesticides during the growing season.

RECOMMENDED VARIETIES

AGS 2024 (moderate tolerance to Hessian fly), AGS4323, AGS 4043 (tolerant to Hessian fly), Johnson and Dyna-Gro Plantation.

Important Considerations

- Planting cool-season forages on a clean-tilled seedbed results in earlier and higher 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.
- Unless irrigated, 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. An application of herbicide to induce dormancy is recommended. Consult your local UF/IFAS Extension agent for recommendations.
- Look for opportunities to plant on a clean-till seedbed (e.g., after 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. Moisture is the most limiting factor, given the recommended timing of planting is generally dry. If soil moisture is available, same-day disking (turning the sod) and planting can be done. In the event that soil moisture is limited, then it may be best to turn the sod, disk in early to mid-October, and wait for adequate rainfall (generally in December) 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 compared to purchasing raw seed and inoculant separately and mixing just prior to planting. Be aware of proper storage for pre-inoculated seeds or inoculants; excess heat can kill bacteria.

Reference

Dubeux, J. C. B., N. DiLorenzo, A. Blount, C. Mackowiak, E. R. S. Santos, H. M. S. Silva, M. Ruiz-Moreno, and T. Schulmeister. 2016. "Animal Performance and Pasture Characteristics on Cool-Season Annual Grass Mixtures in North Florida." *Crop Sci.* 56(5): 2841–2852. https://doi.org/10.2135/cropsci2016.03.0141

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 (days)
				Begin	End	
Alfalfa	Oct. 1–Nov. 15	15–20	¼–½	10–16	3–4	Hay: 35–40 Grazing: 15–30
Clover, Arrowleaf	Oct. 1–Nov. 15	8–12	0–½	8–10	3–5	10–20
Clover, Ball	Oct. 1–Nov. 15	2–3	0–¼	6–8	1–3	7–15
Clover, Berseem	Oct. 1–Nov. 15	15–20	¼–½	8–10	3–5	10–20
Clover, Crimson	Oct. 1–Nov. 15	20–25	¼–½	8–10	3–5	10–20
Clover, Red	Oct. 1–Nov. 15	10–15	¼–½	8–10	3–5	10–20
Clover, Subterranean	Oct. 1–Nov. 15	15–20	¼–½	6–8	1–3	7–15
Clover, White	Oct. 1–Nov. 15	3–4	0–¼	6–8	1–3	7–15
Fescue, Tall	Nov. 1–Dec. 15	20–25	¼–½	4–8	2–3	15–30
Medic	Oct. 1–Nov. 15	10–15 rates differ	0–¼	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	½–1	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	0–½	6–12	3–4	7–15
Sweetclover	Oct. 1–Nov. 15	10–15	¼–½	8–10	3–5	10–20
Turnips	Oct. 1–Nov. 15	5–6	¼–½	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.

Table 2. List of species and recommended cool-season forage varieties for Florida, based on three-year, multi-location trials in partnership with the University of Georgia and Auburn University.

Species	Recommended Varieties for Florida[1]	Observation[2]
Alfalfa	Alfagraze 600RR, Bulldog 805	
Arrowleaf Clover	Blackhawk, Apache	
Ball Clover	Don, Grazer's Select	
Berseem Clover	Bigbee, Frosty	
Crimson Clover	Dixie, AU-Robin, AU-Sunrise	
Red Clover	Barduro, Red Ace, Southern Belle, FL24D	
White Clover	Louisiana S-1, Ocoee, Osceola, Regal Ladino, Regalgraze	
Lupine	Tifblue, Frost, and Tifwhite	
Medic	Armadillo burr and Devine little burr	
Oat	Juggernaut, Horizon 306†, Horizon 578, Horizon 720, Legend 567, Forage Oat, RAM FLLA11019, and TriCal Cadillac	†Late varieties. All varieties are susceptible to crown rust.
Rye	FL401, Kelly Grazer III*, and Wrens Abruzzi*	*Late varieties.
Ryegrass (early-season)	Attain, Big Boss, Diamond T, Earlyploid, Flying A, Fria, Frostproof, Grits, Prine, Rapido, TAMTBO, and Winterhawk	
Ryegrass (late-season)	Attain, Big Boss, Double Diamond, Earlyploid, Jackson*, Marshall*, Nelson, Prine, TAMTBO, Triangle T, and Ranahan	*Susceptible to rust and/or gray leaf spot.
Ryegrass (long-season)	Attain, Big Boss, Diamond T, Double Diamond, Earlyploid, Fria, Frostproof, Grits, Nelson, Prine, TAMTBO, and Triangle T	*Susceptible to rust and/or gray leaf spot.
Triticale	TriCal 342, Trical 1143, Surge (late variety)	
Vetch	Cahaba White and common	
Wheat	AGS 2024*, AGS 4043*, Johnson and Dyna-Gro Plantation	*Moderate tolerance to Hessian flies. Consider insecticide management for all other varieties.

[1] Varieties selected based on their recent three-year, multi-location performance. Other varieties that have not been tested may perform well in Florida.
[2] See text for more information.

Soil Sampling

Ensure Adequate and Appropriate Fertilizer Application

UF/IFAS Extension Fact Sheet
Stephen Jennewein, Small Farms & Alternative Enterprises Agent, Duval County Extension

Who?

Anyone who plans to cultivate plants on soil

- Farmers
- Ranchers
- Landscapers
- Gardeners

What?

Soil sampling is the act of removing a representative sample of soil for analysis to aid in management decisions. Analysis of soil samples provides data on the concentration and availability of essential nutrients. Proper soil management can lead to more efficient production and increased yields. Data includes:

- Soil pH and liming rate if applicable
- macronutrient concentrations and recommend application rates
- micronutrient concentrations and application thresholds

When?

Soil sampling should be done once per year. In Florida this is best performed at the end of the rainy season from August through October.

Why?

Without soil sampling, your operation is leaving money on the table!

How?

While some tools are easier for collecting samples than others, any tool that can excavate soil will work (Figure 1). These can include a soil core, auger, shovel, electric drill, and a bucket. After you have broken up your management zones, traverse your locations and collece 15-20 cores from each zone. These should be mixed in a bucket and placed into the sample bag. The process of taking multiple cores and mixing them is called taking a composite sample, and it is important for collecting a representative sample (Figure 2).

Where?

It is imperative to retrieve a representative sample of your soil or the recommendations may be inadequate or inaccurate. The exact sampling design (Figure 3) you utilize is up to you and should be decided based on knowledge of your land. Landscape position, drainage, past and current management, and soil series should all be considered. Develop management zones based on which locations are similar. Sampling should be performed from the top 6" (15cm) of soil, avoiding roads, trees, and other obstacles that can influence soil chemistry. Management zones can be yards, pastures, raised planters, or any unit that can be seperated.

Figure 1. Equipment used for taking soil samples

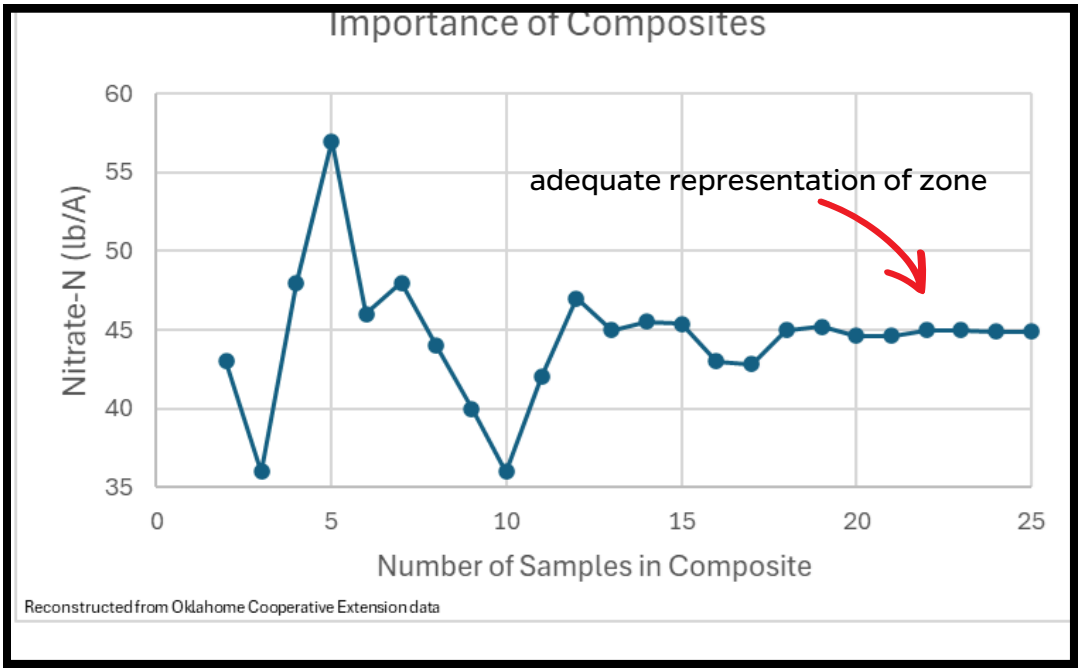

Figure 2. Typical field data variability and the importance of collecting composites

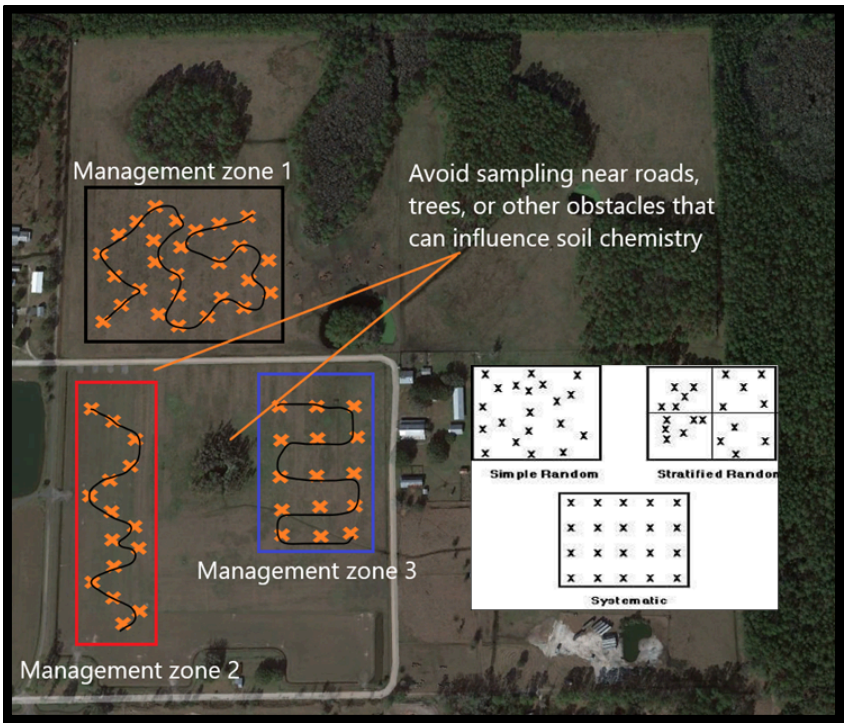

Figure 3. Examples of sampling design for effective soil sampling

Additional Resources

Analytical Services Laboratories (ANSERV Labs)

Soil Sampling Procedures

Taking a Soil Sample (video)

Soil Sampling and Testing for the Home Landscape or Vegetable Garden

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Legume Forages

David Hébert david.hebert@ufl.edu, Ag/NR Extension Agent I
Lizzie Whitehead liz.whitehead@ufl.edu, Ag/NR Extension Agent I

Examples

Cool: Aust. winter pea, clovers, hairy vetch

Warm: Cowpea, sunnhemp, alyce clover

Nutritional Benefits

- Legumes are usually higher in Total Digestible Nutrients and Crude Protein than summer perennial grasses or hay.
- Increased forage nutritive value when legumes are incorporated in your pastures.
- Legumes extend the grazing period in your pastures.
- Very palatable for grazing livestock

Nitrogen fixation

Symbiosis

Hairy vetch roots with nitrogen-fixing nodules. Plant roots feed symbiotic soil bacteria by providing sugar exudates. In exchange, the bacteria create nodules that provide the plant with ammonia fertilizer internally.

Nodules

Cowpea roots with symbiotic bacteria. Nodules tend to be green/pink inside and fall off easily when disturbed.

RKN galls

Cowpea roots with Root knot nematode (RKN) galls. These tumor-like growths are white/beige inside and can not easily be scraped off.

Inoculation

- For best results, inoculate before or at planting. Scan the QR code to learn more →

Ecosystem services

- Attract wildlife, pollinators, and beneficial insects
- Use for “green-chopping” to add nutrients to the soil
- Increase plant biomass by growing with other plants
- Legumes fix nitrogen from the atmosphere.

Minute pirate bug (*Orius tristicolor*)

Crimson clover harbors the minute pirate bug, a predator of thrips

Austrian winter pea blended with cool season annual grasses

References:
UF/IFAS Publications #SS-AGR-49; #SL501; SS-AGR-423
Young-Mathews, A. 2013. Plant guide for crimson clover (Trifolium incarnatum). USDA-Natural Resources Conservation Service, Plant Materials Center, Corvallis, OR.

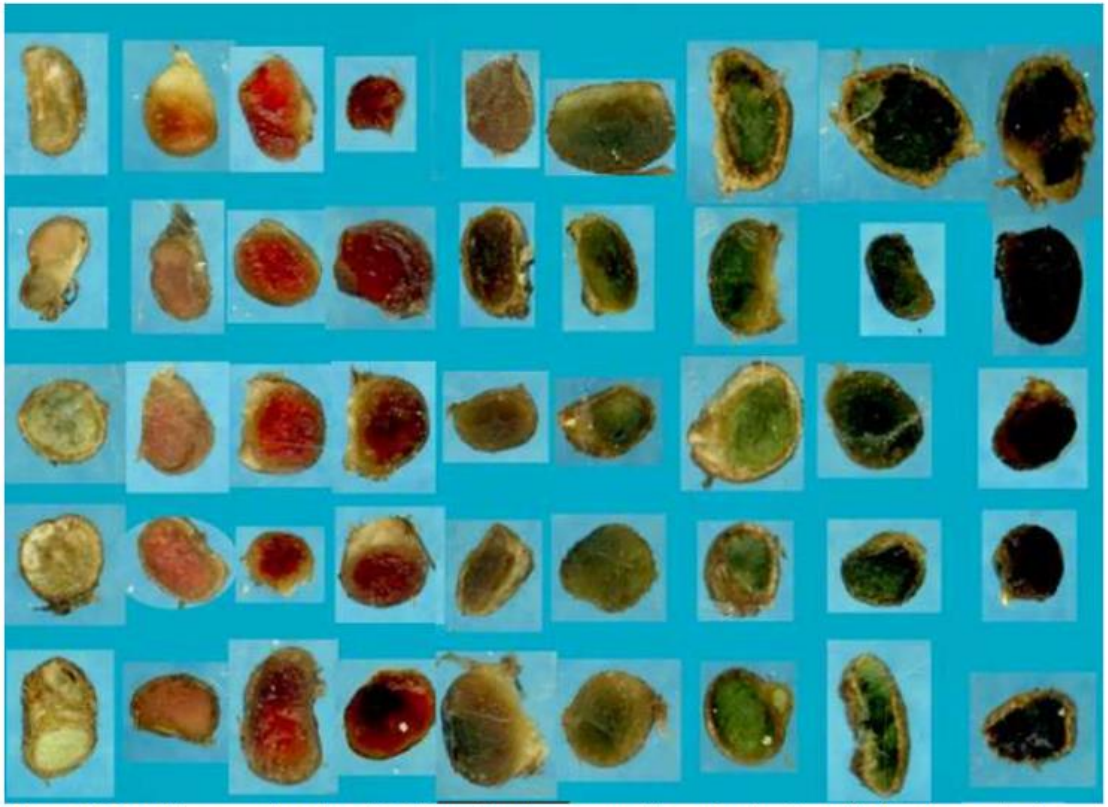
Photos: UF IFAS

Assessing Nodulation

- Pink and red
  - Active fixation
- Green and brown
  - Inactive fixation
- Black
  - Nodule decay

Color

Mint ➡ Pink ➡ Red ➡ Scarlet ➡ Rust ➡ Greenish-brown ➡ Greenish-black



From left to right, examples of nodule internal color representing not yet active rhizobia, increasingly active, fully active, and darkening to green and black, representing senescence and decay. These individual nodules are only a few millimeters wide and are taken from scanned images used in UF/IFAS digital color analysis. (Source: *Hensley and Rowland, 2017*)

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The Economics of Raising Replacement Heifers: Estimating Direct Costs Using the Replacement Heifer Calculator[1]

Hannah Baker[2]

The purpose of this publication is to provide a guideline of what direct costs cattle producers should be estimating when considering the option of developing yearling heifers as replacements to be bred at 14 months of age. While other important external factors should be considered, the purpose of this publication is to specifically address how to estimate the direct costs associated with developing yearling heifers as replacements. In doing so, the publication highlights and walks through how to use the Replacement Heifer Cost Estimation Tool.

A common question asked each year by cattle producers is, "What should I do with my heifers?" Heifers can be sold at weaning each year, or they can be raised as replacement heifers to be bred at 14 months of age. When the goal is to build or rebuild a herd, raising replacement heifers becomes a possible answer to the question about what to do with heifers. However, there are underlying questions within the question of what to do with heifers that should be addressed when considering expanding a herd. "Can high-quality heifers be found outside of my herd?" "Would outside heifers cause setbacks or improvements in the genetics of the herd?" "How severe are the biosecurity risks of bringing in new heifers?" and "What are the costs associated with developing my own replacements?" are some of the common ones. These questions are crucial to consider when making the decision on how to rebuild a herd. Whether bringing in outside heifers or raising replacements, the long-term success and profitability of the herd will be affected.

While each of these questions are of equal importance, this publication is solely focusing on the last question, "What are the direct costs associated with developing replacement heifers?" These direct costs include the current value of weaned heifers (opportunity cost), variable costs, breeding costs, fixed costs, and absorption costs. The Replacement Heifer Cost Estimation Tool discussed in this publication aims to serve as a guide in organizing each of these costs. It can be used as an estimation tool to calculate what it may cost to develop heifers on a specific operation and whether it is economical to do so. The calculator includes estimations for the costs enumerated below.

1. **Opportunity costs**. "What revenue will I lose if I decide to raise these weaned heifers rather than selling them now?" Understanding the opportunity costs allows for comparisons at the end of the estimation process to see which option is the most economical for an operation.

1. This document is FE1153, a publication of the Food and Resource Economics Department, UF/IFAS Extension. Original publication date August 2024. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

2. Hannah Baker, state specialized Extension agent for beef cattle and forage economics, UF/IFAS Range Cattle Research and Education Center; UF/IFAS Extension, Gainesville, Florida 32611.

Table 1. Opportunity Cost of Raising Replacement Heifers.

Opportunity Cost	Unit	Quantity	$/Unit	$/Heifer
Current value of weaned heifer	**pounds**	500	$ 2.70	$ 1,350.00
TOTAL				**$ 1,350.00**

2. **Variable and fixed expenses.** Variable expenses such as mineral, supplement, and pasture management costs and fixed expenses such as land rent, labor, and interest costs, are important for calculating what each heifer needs so that she will be 65%–70% of her mature body weight at the time of breeding. A way to remember what costs will go into these sections is to ask: "What is needed for the health and nutrition of the heifer?" Variable expenses (Table 2) will vary across operations and from year to year due to fluctuating input costs. Fixed costs (Table 3) should remain roughly the same year to year but will vary across different operations. Interest is included to account for the time between the opportunity to sell cattle as weaned heifers until they are developed. Land and labor quantity should be entered on a per-heifer basis when using the tool.

Weaning weights and ages will vary across operations, but the example in Table 2 estimates the costs for supplementing weaned heifers weighing 600 pounds and of 270 days of age (nine months). The concentrate supplement (90% DM, 75% TDN, 22% CP) is fed daily at 1.5 percent of the heifer's body weight for 180 days, starting at weaning up until 15 months of age. For more information on supplementing beef heifers, see *Effects of Post-Weaning Growth Rate and Puberty Induction Protocol on Reproductive Performance of Bos indicus-Influenced Beef Heifers* (Moriel et al. 2017); and *Supplementation Frequency and Amount Modulate Post-Weaning Growth and Reproductive Performance of Bos indicus-Influenced Beef Heifers* (Moriel et al. 2020).

Pasture management is highly important for heifers to receive the proper nutrients from grazing forage. Soil and tissue testing should be performed for proper fertilizer recommendations. For more information on soil and tissue sampling, contact your local county Extension agent and/or see the Ask IFAS publications SS186, *Producer Soil Test Form*; SS597, *Nutrient Testing Form for Bahia Pastures;* and SS475, *Tissue Analysis as a Nutrient Management Tool for Bahiagrass Pastures*. For more information on fertilizing Bahiagrass, see the Ask IFAS publication AG342, *Bahiagrass (Paspalum Notatum Flugge): Overview and Pasture Management*. Weed management is crucial because weed growth can diminish forage availability for heifers to graze. For more information on weed management, see the Ask IFAS publication WG006, *Weed Management in Pastures and Rangelands–2023*.

In this example of using the Replacement Heifer Cost Estimation Tool, the cost of fertilizing and spraying Bahiagrass is estimated in the "Grazing" section. This cost for each heifer is calculated based on each heifer grazing two acres. Fertilizing Bahiagrass twice a year using urea at $534 per ton at a rate of 50 pounds of nitrogen (N) per acre is used ($58/acre). The cost of using chemicals to control weeds is estimated using the price of paraquat at $35 per gallon at a rate of 2 pints per acre ($8.74/acre).

Table 2. Variable Expenses of Raising Replacement Heifers.

Variable Expenses	Unit	Quantity	$/Unit	$/Heifer
Mineral (intake per heifer)[1]	**bag**	.90	$ 45.00	$ 40.50
Supplement[2]	**ton**	0.90	$ 325.00	$ 292.50
Hay (if applicable)	**bale**		$	$
Grazing[3]	**acre**	2	$ 66.74	$ 133.48
TOTAL				**$ 466.48**

[1] 4oz/hd/day for 180 days = 720 oz (45 lbs)/heifer at $45 per 50 lb bag
[2] 1.5% x 600 lbs = 9 lbs of daily DMI / 90% DM = 10 lbs/hd/day for 180 days = 1,800 lbs or 0.9 tons at $325/ton
[3] fertilizer and herbicide cost for pasture that heifers will be grazing

Table 3. Fixed Expenses of Raising Replacement Heifers.

Fixed Expenses	Unit	Quantity	$/Unit	$/Heifer
Land rent or payment	**acre**	2	$ 21.00	$ 42.00
Labor[9]	**hour**	2	$ 12.50	$ 25.00
Interest	**dollars**	$ 1,350.00	5%	$ 67.50
Other			$	$
TOTAL				**$ 134.50**

[9] Only includes labor dedicated to heifer development.

3. **Breeding costs**. "What is it going to cost to breed each heifer?" Bulls and artificial insemination (AI) each have associated costs, and determining which of the two is the most feasible is not as straightforward as it may seem. If a producer intends to use AI, a clean-up bull is recommended, if it is feasible to maintain the bull. If the producer does not own a bull already, they will use the purchase cost of a bull or bulls to calculate the bull's depreciation cost, which is the annual cost of owning the bull. If the producer does own a bull, then the bull's depreciation cost should already be calculated. The depreciation cost is determined using the following formula: (purchase cost – useful years in the herd)/value at culling. When using the Replacement Heifer Cost Estimation Tool, the annual bull cost is automatically calculated after inserting the bull's purchase price, production expectancy

of the bull, and his expected cull revenue. A bull's maintenance cost is his total variable costs, which is similar to a heifer's variable cost: "What are the costs associated with maintaining the health of a bull?" The depreciation cost plus the maintenance cost is the bull's total cost. After entering the number of bulls owned, the total cost per bull is then automatically multiplied by the number of bulls owned, and then divided by total number of heifers to calculate the breeding cost of each heifer.

Table 4. Breeding Expenses of Raising Replacement Heifers: Bulls.

Breeding Cost: Natural Service (Bull)[4a]	Unit	Quantity	$/Unit	$/Heifer
Bull purchase price	**head**	1	$ 5,000.00	
Production expectancy of bull	**years**	5		
Heifers serviced per bull per year	**head**	20		
Cull revenue	**head**	1	$ 2,400.00	
Annual bull cost	**head**	1	$ 520.00	
Maintenance cost per bull[5]	**head**	1	$ 600.00	
Total per bull	**head**	1	$ 1,120.00	$ 56.00
TOTAL[6]		**1**	**$ 1,120.00**	**$ 56.00**

[4a] Insert zeros for breeding cost of alternative method if not used.
[5] Feed, grazing, mineral, vet, etc.
[6] For "TOTAL (for all bulls needed)," insert the number of bulls owned in the quantity column.

If a producer will be using AI, breeding expenses include the cost of semen straws, costs associated with the synchronization protocol, and the service cost. If the producer is performing the insemination, the cost of the labor should be included where the vet costs would be. There are different synchronization protocols that can be used, but this publication uses the costs associated with using the Select Synch + CIDR & TAI protocol. For more information on protocols, visit the Ask IFAS publication AN365, *Calculating Reproductive Performance in Beef Operations: The University of Florida Beef Herds' 2019 Breeding Season*(Binelli et al. 2024);and *Protocols for Synchronization of Estrus and Ovulation* (Johnson et al. 2010). When inserting values in the "Breeding Cost: Artificial Insemination" section of the tool, insert only the number needed for one heifer as seen in the example in Table 5. Totals for all heifers will automatically be calculated.

4. **Absorption costs**. These represent the cost of developing open heifers and can be estimated after opportunity costs, variable and fixed expenses, and breeding costs are totaled. The costs of developing open heifers are absorbed by the bred heifers that remain in the operation. However, absorbed costs can be offset by the revenue from selling those open heifers. Table 6 shows an example of how this is calculated in the Replacement Heifer Cost Estimation Tool based on having ten open heifers and 90 bred heifers after using AI and one clean-up bull for breeding. After totaling all expenses, the total cost to develop each heifer is $2,061.98. Insert the number of open heifers. The cost to develop each heifer will automatically be multiplied by the number of open heifers (10) and then divided by the number of bred heifers (90) to assign an additional development cost to each bred heifer (cost absorbed). The total revenue received from the sale of open heifers is $21,600 ($2,160 x 10). The total revenue received by the sale of all open heifers is then divided by the number of bred heifers. After absorption cost and revenue are automatically calculated, the example in Table 6 shows that the total cost to develop a yearling heifer to be bred at 14 months of age decreased to $2,051.09.

Table 7 combines all expense sections to serve as an example of using the Replacement Heifer Cost Estimation Tool to estimate the total direct cost of raising 100 replacement heifers with a 90 percent pregnancy rate using artificial insemination (AI) with one clean-up bull. Understanding the direct costs of developing replacement heifers allows for a way to answer one of the many questions involved with making the decision between selling weaned heifers and buying replacements or developing replacements. Even though the price for selling weaned heifers may seem higher than the cost of development in the short-term, the long-term outcome must be considered when trying to

Table 6. Absorption Costs/Revenue from Open Heifers.

Total Cost to Develop Each Heifer				**$ 2,061.98**
Absorption Cost/ Revenue[10]	**Unit**	**Quantity**	**$/Unit**	**$/Heifer**
Open heifers	**head**	10		
Bred heifers	**head**	90		
Cost absorbed by bred heifers	**head**	90		$ 229.11
Value of open heifers	**pounds**	900	$ 2.40	$ 2,160.00
Revenue absorbed by bred heifers	**head**	90		$ 240.00
Total Cost to Develop Bred Heifers				**$ 2,051.09**

[10] Bred heifers absorb the cost of developing open heifers and revenue gained from sale of open heifers.

build or rebuild a herd. If the price of bred heifers is greater than the total cost to develop bred heifers, then raising replacement heifers is a potentially profitable investment.

As previously mentioned, it is equally important to assess the economics risks involved in the decision. The accessibility of replacements for purchase, the progress of genetic development, and the biosecurity of the herd are all in play, and all involve a degree of risk. These risks must be estimated and assessed alongside the direct development costs of raising replacements. These decisions are all about the goals and risk-management strategies of each operation. Expenses can be overwhelming when looked at as a short-term lump sum, but a too-cautious approach may not take into account the potential long-term rewards. It is thus important to look at them as long-term investments when possible.

The Replacement Heifer Cost Estimation Tool is available on the author's profile page on the Range Cattle Research and Education Center website. Search for it under "calculators."

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Table 7. Raising Yearling Replacement Heifers in Florida. Example Scenario: developing 100 replacement heifers using AI with one clean-up bull.

	Number of Heifers Intended for Replacement				100
Opportunity Cost	**Unit**	**Quantity**	**$/Unit**	**$/Heifer**	**$/All Heifers**
Current Value of Weaned Heifer	**pounds**	500	$ 2.70	$ 1,350.00	$ 135,000.00
TOTAL				**$ 1,350.00**	**$ 135,000.00**
Variable Expenses					
Mineral (intake per heifer)[1]	**bag**	0.9	$45.00	$40.50	$4,050.00
Supplement[2]	**ton**	0.9	$ 300.00	$ 270.00	$ 27,000.00
Hay (if applicable)	**bale**		$ 0.00	$ -	$ -
Grazing (number of acres/heifer)[3]	**acre**	2	$ 66.74	$ 133.48	$ 13,348.00
TOTAL				**$ 443.48**	**$46,648.00**
Breeding Cost: Natural Service (Bull)[4a]					
Bull Purchase Price	**head**	1	$ 5,000.00		
Production Expectancy of Bull	**years**	5			
Heifers Serviced per Bull per Year	**head**	20			
Cull Revenue	**head**	1	$ 2,400.00		
Annual Bull Cost	**head**	1	$ 520.00		
Maintenance Cost per Bull[5]	**head**	1	$ 600.00		
Total per Bull	**head**	1	$ 1,120.00	**$ 56.00**	**$ 5,600.00**
TOTAL (for all bulls needed)[6]		1	$ 1,120.00	**$ 56.00**	**$ 5,600.00**
Breeding Cost: Artificial Insemination (AI)[4b]					
Semen Straws	**straw**	1	$ 25.00	$ 25.00	$ 2,500.00
Synchronization Costs[7]	**head**	1	$ 20.00	$ 20.00	$ 2,000.00
Costs to Perform AI[8]	**head**	1	$ 10.00	$ 10.00	$ 1,000.00
TOTAL				**$ 55.00**	**$ 5,500.00**
Fixed Expenses					
Land Rent (number of acres/heifer)	**acre**	2	$ 21.00	$ 42.00	$ 4,200.00
Labor[9]	**hour**	2	$ 12.50	$ 25.00	$ 2,500.00
Interest	**dollars**	$1,350.00	5%	$ 67.50	$ 6,750.00
Other				$ -	$ -
TOTAL				**$ 134.50**	**$ 13,450.00**
Total Cost to Develop All Heifers				**$ 2,061.98**	**$ 206,198.00**
Absorption Cost/Revenue[10]					
Open Heifers	**head**	10			
Bred Heifers	**head**	90			
Cost Absorbed by Bred Heifers	**head**	90		$ 226.55	
Value of Open Heifers	**pounds**	900	$ 2.40	$ 2,160.00	$ 21,600.00
Revenue Absorbed by Bred Heifers	**head**	90		$ 240.00	$ 21,600.00
Total Cost to Develop Bred Heifers				**$2,051.09**	**$184,598.00**

	Number of Heifers Intended for Replacement				100
Opportunity Cost	**Unit**	**Quantity**	**$/Unit**	**$/Heifer**	**$/All Heifers**

*All costs do NOT include costs before weaning.
[1] 4oz/hd/day for 180 days = 720 oz (45 lbs)/heifer at $45 per 50 lb bag
[2] 1.5% x 600 lbs = 9 lbs of daily DMI / 90% DM = 10 lbs/hd/day for 180 days = 1,800 lbs or 0.9 tons at $325/ton
[3] fertilizer and herbicide cost for pasture that heifers will be grazing
[4a] insert zeros for breeding cost of alternative method if not used
[4b] insert zeros for breeding cost of method not used; does not include cost of liquid nitrogen and semen tank
[5] feed, grazing, mineral, vet, etc.
[6] for "TOTAL (for all bulls needed)," insert the number of bulls owned in the quantity column.
[7] costs for AI: PG - $2.00/dose, GNRH - $1.50/dose x 2 doses, and $15/CIDR
[8] includes trip fee and per-head cost; prices will vary based on number of head and labor/trip fees from the provider used
[9] only includes labor dedicated to heifer development
[10] bred heifers absorb the cost of developing open heifers and revenue gained from sale of open heifers

The Costs of Keeping an Open Cow

Hannah Baker, State Specialized Agent – Beef & Forage Economics
UF/IFAS Range Cattle Research and Education Center

One decision that has to be made every year by cattle producers is what to do with open cows. After calves are weaned and shipped off, cows are evaluated on if they should be culled or not. The goal of every producer should be to have each cow have a calf every year (365 days). If she is not fulfilling this goal, she is costing more money than she is making by not providing a calf to sell. The purpose of this article is to show the economic impact of keeping an open cow by estimating her annual return over a seven-year period.

After investing labor, time, and money into keeping a cow healthy and getting her bred, it is expected that she will have a calf each year. But if she doesn't, is she still worth keeping after all that has been invested in her? How long would it take for her to start providing a positive return (profit) after missing just one year?

The annual costs in 2024 for a cow-calf operation can range from $600 -$1,100 per head based on the structure and fixed costs (land, equipment depreciation, taxes, etc.) of each operation. In this example, the only fixed costs estimated are labor and the average rental rate of pastureland in Florida. Variable costs include minerals, feed, pasture, breeding, health, fuel, equipment repairs, and interest. Total annual costs are estimated at $915 per cow. Revenue is estimated at $1,300 per cow for a 500-pound calf with a sale price of $2.60 per pound.

When deciding to keep an open cow, annual costs are added to the previous year's costs from having to "house" her for another year with no revenue to offset this extra year of costs. Using 2024 calf prices, even if she has a calf every year after that missed year (year three in Table 1), it is estimated that it will take about three years (years four–six) for her to start providing the same return she was before missing a calving season. Lower calf prices, higher input costs, and the additional fixed costs would cause it to potentially take even longer. The same applies to keeping an open replacement heifer. When including the cost of developing her, if she comes up open after the first breeding, it is estimated that it would take 7-12 years for her to pay for herself and start returning a profit.

Table 1. Number of Years for a Return to Be Made from an Open Cow After Missing One Year

Year	Expenses Description	Expenses	Revenue	Return to Expenses (Profit)
1	annual expenses	$(915)	$1,300	$385
2	annual expenses	$(915)	$1,300	$385
3	annual expenses	$(915)	$0	$(915)
4	annual expenses + previous year's expenses	$(1,830)	$1,300	$(530)
5	annual expenses + previous year's expenses	$(1.445)	$1,300	$(145)
6	annual expenses + previous year's expenses	$(1,060)	$1,300	$240
7	annual expenses	$(915)	$1,300	$385

**These estimates do not include the initial purchase price of the cow*

If a cow does not have a calf every 365 days, she is incurring extra costs and not providing a consistent stream of revenue. This will have a short and long-term negative effect on profit. However, she could still provide a source of revenue that year if sold as a cull cow or even as a replacement depending on her age and body condition. Culling an open cow could potentially mitigate or ease the loss of not selling a calf from her. A producer should strive to always apply the three "E's" when trying to make profitable decisions about investing, managing, and marketing cattle: "Is this decision efficient, effective, and economical?"

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QUESTIONS? CONTACT MEGAN GREENWOOD AT MPG023@TAMU.EDU

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