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Hay Production in Florida[1]

C. G. Chambliss, M. B. Adjei, J. Arthington, W. E. Kunkle, and R. P. Cromwell[2]

Even though Florida has a relatively warm climate, pastures do not grow year-round. Cattle, horses, and other domestic grazers need some type of conserved forage during the late fall, winter, and early spring when growth of warm season pastures is greatly reduced due to short days, cool temperatures, and possibly drought. In many areas of Florida, especially in northern Florida, the need for conserved or stored forage can best be met with hay. Some ranchers in southern Florida with a relatively low stocking rate can accumulate or stockpile late summer pasture growth for grazing during the fall and winter and thus do not feed hay.

Florida, with its high humidity and frequent rainfall during the growing season, is not the easiest place to dry a hay crop, yet hay is often the best choice as a means of conserving forage. With modern harvesting equipment, the haying process is largely mechanized and therefore requires little hand labor. If the hay crop can be harvested at an immature stage of growth, dried, and stored without excessive rain damage, it will provide a feed of good nutritional value. Besides the hay that is used by beef and dairy operations, there is a large market for horse-quality bermudagrass hay that can be grown in the state. The total production of all types of hay in Florida ranges from 600,000 to 800,000 tons per year.

Forages For Hay: Perennial forage plants are recommended for hay instead of annuals in order to avoid the repeated cost of establishment. Several perennial grasses are used for hay in Florida. In northern Florida the improved hybrid bermudagrasses are the most popular. These grasses are highly productive and generally dry faster than most other grasses. Bahiagrass can be harvested for hay but is mainly used for grazing. In southern Florida, stargrass, bermudagrass, limpograss (hemarthria), and Mulato grass (*Brachiaria* hybrid) can also be used for hay.

Perennial peanut can be grown to produce a high quality legume hay. The summer annual legume alyceclover can be planted following watermelons or a spring vegetable crop to produce one or two cuttings of hay.

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2. C. G. Chambliss (deceased), associate professor, Agronomy Department; M. B. Adjei, associate professor, Agronomy Department, Range Cattle Research and Education Center--Ona, FL; J. Arthington, associate professor, Range Cattle Research and Education Center--Ona, FL; W. E. Kunkle (deceased), professor, Animal Sciences Department; R. P. Cromwell, professor emeritus, Department of Agricultural and Biological Engineering; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

Certain cool-season forages such as the small grains (especially oats), ryegrass, red clover, and alfalfa can be grown and harvested as hay. Alfalfa acts mostly as an annual in Florida but may persist for two years or more on some of the clay soils of northern Florida. Since alfalfa must be harvested on a 28 to 30 day schedule, a producer desiring to grow alfalfa must be prepared to take some harvests as silage or haylage, because rain will likely prevent drying of one or more cuttings. The economics and risk involved in growing alfalfa in Florida have generally not been favorable.

Other Hay Crops: The summer annual grasses pearl millet and sorghum-sudangrass are better suited for grazing or green chop than for hay. Their large stems make drying difficult, and therefore are not generally recommended for hay. When planted with the intention of harvesting for hay, these grasses should be planted at a higher than normal seeding rate in order to decrease stem size. Also, the cut stems should be crushed with a hay conditioner to speed drying. Naturally-occurring stands of crabgrass can be harvested for hay. This grass makes an excellent quality hay, but drying takes longer than for bermudagrass.

Cowpeas, soybeans, and other legumes have been used for hay. Legumes usually produce a higher-quality hay than grasses; however, growing legumes for hay involves greater risk. Legumes are more likely than grasses to lose their leaves from shattering if the crop is not handled properly. If the crop, when almost dry enough to bale, is rained on and then allowed to redry, the probability of leaf-loss during baling is increased. If the crop is rained on in the swath and stays wet for several days, it may rot.

Fertilization: Management of bermudagrass and other perennial grasses for hay production is similar. For established stands of grass, take soil samples in November to December, and submit to the soil testing laboratory in order to determine soil pH and soil levels of phosphorus, potassium, and magnesium. The initial spring application of fertilizer (based on soil test recommendations) should be applied as soon as the grass starts growing (February to April). Apply 80 lb/A and all of the recommended P_2O_5 and K_2O in early spring. Apply an additional 80 lb N and 40 lb K_2O/A after each cutting, except the last in the fall. Include 20 lb of P_2O_5 in the supplemental fertilizer if the soil tested low or medium in P. Sulfur, although not generally recommended, may be deficient in some areas. Unfortunately, there is not a good test for sulfur, but it may be wise to supply some sulfur at the initial spring application by using ammonium sulfate as the nitrogen source.

Weed Control: There are excellent broadleaf weed control programs for grass hay crops. Also, Pensacola bahiagrass can be removed from bermudagrass hay fields with the herbicide Cimmaron®. Other weedy grasses such as vaseygrass or maidencane can be a problem for producers who are attempting to produce pure bermudagrass for the horse hay market. It has always been difficult to find a herbicide that will control one grass but leave another. A new herbicide, Journey®, will control crabgrass, sandbur, vaseygrass, Pensacola bahiagrass, nutsedge, and certain broad leaves in bermudagrass. See the publication SS-AGR-08 *Weed Management in Pastures and Rangeland* for details. Except for alfalfa, good herbicide programs are not available to remove broadleaf weeds from legume hay crops. Occasionally, a poisonous plant such as sickle-pod will infest a planting of alyceclover to such an extent that the crop must be abandoned. If a height differential exists, such that the weed is taller than the hay crop, then it may be possible to use a non-selective herbicide in a wipe-on application to remove the weed.

When to Make Hay: In northern Florida, hay can be harvested throughout the growing season in most years. In southern Florida, hay can be harvested in the spring if there is sufficient growth before the summer rains start, and in the fall after the summer rains stop. In southern Florida, summer showers occur almost every day and most of the grass is grown on flatwoods sites which tend to stay wet throughout the summer. Both of these factors practically eliminate the possibility of getting a hay crop dry during the summer. Therefore, many producers will apply fertilizer in September to extra pasture areas or hay fields of stargrass or limpograss and harvest these areas in October or November, after the rainy season has ended. South Florida dairymen are harvesting their grass as silage and therefore are able to harvest through the summer. Some hay

producers may be interested in considering the "roll-bale or tube silage system". For more information, visit the University of Florida's Animal Science Department's website at: http://www.animal.ufl.edu/.

Most of the hay made in Florida is made from perennial grasses such as bermudagrass and stargrass. The first growth of these grasses in the spring can be harvested when the grass reaches a height of 14 to 18", or when there is enough growth to justify use of the harvesting equipment. Try to take at least one harvest before the summer rains start. A few producers use recycled wastewater from adjourning municipalities for irrigating their hayfields in order to overcome spring drought. After the first harvest, plan to harvest on a 4-to 5-week schedule. Harvesting well-fertilized bermudagrass or stargrass at 4 to 5 weeks of regrowth produces acceptable yields of good quality grass hay. If the weather cooperates, harvest at 4 weeks. This will produce relatively high-quality hay. If harvest is delayed beyond 4 weeks, try not to go beyond 6 weeks, because there is usually no increase in yield for bermudagrass (bottom leaves begin to die) and quality continues to decrease. In general, all of the perennial grasses decrease in quality as they mature (Figure 1 and Figure 2).

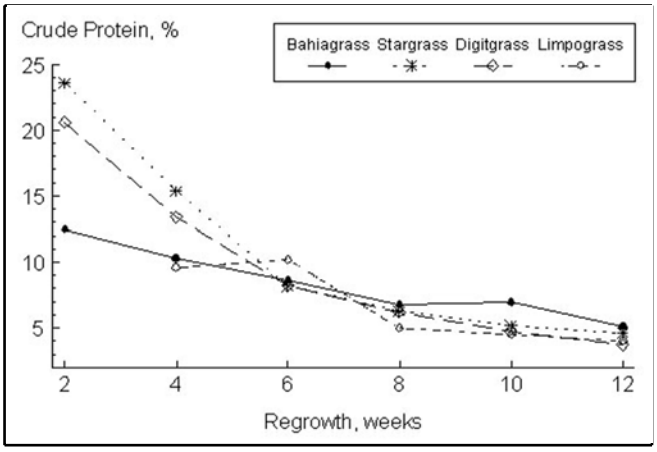

Figure 1. Effects of maturity on forage protein.

Always be ready to harvest at 4 weeks of regrowth or even sooner if there is enough growth and prospects for good drying weather. Waiting a few more days to meet the calendar schedule might be waiting for bad weather. "Make hay while the sun shines." All other perennial grasses should follow a similar harvest schedule. Floralta or Bigalta limpograss (hemarthria) can be harvested on a 6-week schedule without a serious loss in digestibility. A suggested harvest schedule for hay crops is given in Table 1.

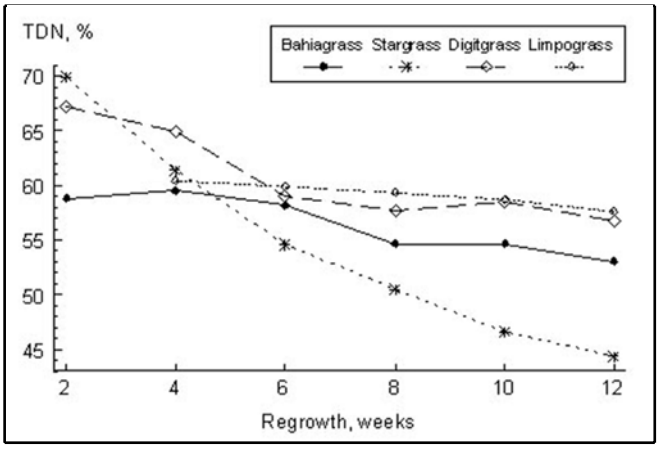

Figure 2. Effect of maturity on forage TDN.

Hay-making techniques

Equipment Needed: The individual making hay should have good, reliable equipment. When the crop is ready to harvest and the weather is suitable, the equipment should be ready to start working with little fear of breakdown. Equipment breakdown can result in the loss of a hay crop.

Basic equipment needed is a mower, rake, tedder, and baler. Other equipment such as a conditioner, inverter, and equipment to load and transport bales may be useful at times. Advice on how to use or operate the equipment can be obtained from the equipment manuals. Two types of balers are commonly used: one makes a small rectangular bale weighing 50 to 60 lb, and the other makes a large roll bale weighing 600 to 1100 lb.

The Weather and Drying Time: The most difficult variable to deal with when making hay in Florida is the weather. At certain times of the year (spring and fall) cold fronts pass over the state bringing rain. As soon as these fronts have passed there are usually several days of dry weather suitable for making hay. During the summer the rainfall comes from thundershowers which may appear daily and the chances for obtaining 3 to 4 days without rain are greatly reduced.

Table 1. Harvest schedule for various hay crops.

Crop	Growth stage or height	Harvest interval, weeks
Bermudagrass	14 - 18"	4 - 5
Stargrass	14 - 18"	4 - 5
Mulato grass	14 - 18"	4 - 5
Bahiagrass	10 - 12"	4 - 5
Pangola	14 - 18"	4 - 5
Limpograss	16 - 24"	5 - 6
Perennial Peanut	(12 plus inches)	6 - 8
Alyceclover	(just before flowering)	---
Oats, Wheat, Rye	Boot to early head	---
Ryegrass	Boot to early head	---
Red, Crimson, Arrowleaf Clovers	Early flowering	---
Alfalfa	(1st harvest at bud stage, later harvest at 1/10 bloom)	
Sorghum-sudan	30 to 40"	---
Pearl millet	30 to 40"	---
Soybean or Cowpea	Mid-to full bloom	---

Drying (curing) time is affected by the type of crop, the quantity or bulk put on the ground and weather conditions (temperature, humidity, cloud cover, daylength, soil moisture, etc.). Bermudagrass and Mulato grass dry faster than Floralta limpograss. Grasses with large-diameter stems such as sorghum-sudan take longer to dry than grasses with small stems. It is usually recommended that grasses with large stems be processed through a conditioner in order to crush the stems and speed up drying. All cut hay crops should be laid out in as wide a swath as possible. This will maximize exposure of the crop to wind and sunlight, therefore reducing drying time. Legume crops should be put into a windrow in 3 to 4 hours after cutting or before the plants are dry enough that the leaves start to shatter when raked (before plant moisture falls below 40%). If the crop gets too dry before windrowing, wait and rake in the morning just as the surface dew begins to dry.

Ideally the hay crop should be at 12 to 15% moisture before baling. Grasses put up in the large rolls have been baled when the moisture drops below 20%, but 18 to 20% moisture will likely result in some heating and molding. A hay producer should have an electronic moisture tester to help in deciding when it is safe to bale.

If the hay crop is on the ground and almost dry enough to bale, but is rained on, it may still be salvaged if the rain stops after one or two days. Grass can be turned or fluffed with a tedder. Material that has been matted down by the rain is raised by the tedder in order to expose more surface area to the air or wind. Legumes are more difficult to deal with, whether rained on or not, since their leaves have a greater tendency to shatter. To reduce leaf shattering, a legume hay crop should be raked into a windrow or tedded before moisture in the plant drops below 40%. An inverter may be useful in handling a legume since it appears to be less aggressive than a tedder and less likely to knock the leaves off. When a hay crop is rained on, the producer should avoid (if possible) the tendency to rush the baling of the crop after the second drying attempt. This often results in bales that have too high a moisture content and therefore will mold or rot.

Hay preservatives: Hay producers may often have their hay crop almost dry enough to bale when the rain comes. If they could add something to the hay that would allow them to bale at 20 to 25% moisture, this would permit them to bale sooner and perhaps ahead of a rain. A hay preservative consisting primarily of propionic acid has been used for this purpose. It is usually sprayed on the hay as it enters the throat of the baler. This organic acid can be used on hay that contains 20 to 25% moisture. It will suppress the growth of molds and other microorganisms. In the past the product was quite

caustic to both the skin of the operator and the paint and metal of the baler. Newer formulations are less corrosive to equipment, but it is probably still a good idea to wash the baler after each use. The product will not suppress mold growth indefinitely. How long the mold growth will be suppressed is unclear--perhaps as long as 4 to 6 months.

Another product for preserving "high moisture" hay is the hay inoculant. Certain types of "good bacteria" are spread on the hay with the idea that they will overwhelm and suppress the growth of molds and other undesirable organisms that cause heating or rotting of the hay. Whether or not these inoculants will work on Florida hay is unclear. Research studies in other states have not always been positive.

Making quality hay: A good quality hay is one that has a relatively high level of total digestible nutrients (TDN), and is palatable. Some hay producers are mainly concerned with the quantity of hay produced per acre, when the focus should be on the quantity of TDN harvested per acre. Several factors can influence the amount of hay produced and its quality; these are stage of growth or age of the plants when harvested, forage species, fertilization, weed control, and the weather.

Stage of growth or maturity when the hay is harvested is the single most important factor affecting hay quality. Harvesting at the correct stage of maturity is the best way that producers can improve hay quality. Stage of maturity at which the hay is harvested influences not only the protein content (Figure 1) and level of digestibility (Figure 2), but also how well animals eat the hay, especially bermudagrass hay . See Table 1 for appropriate maturity to harvest various hay crops for the best combination of quantity and quality.

Annual grasses such as oats or sorghum-sudan are usually higher in quality than warm season perennial grasses. Legumes, especially cool season legumes, are usually higher in protein and digestibility (higher quality) than perennial grass hay. This may not always hold true, especially if the grass is highly fertilized and harvested at an immature stage of growth, while the legume hay crop is harvested at a very mature stage and contains a certain percentage of grass that will also be very mature (see SS-AGR-63 *Forage Testing*). Fertilization can affect quality. Increasing the rate of nitrogen applied to grasses will not only increase yield but will also increase percent protein if the grass is harvested at an immature stage of growth. Digestibility may also increase slightly.

Quality will be lowered if a hay crop is rained on after it has been cut and dried but not yet baled and removed from the field. Soluble sugars and some protein can be leached from the plant tissue, thus lowering quality. The extent of loss will depend on how dry the hay is when the rain comes and how much rain falls. The drier the hay and the greater the rainfall, the greater the loss.

Hay Storage: Hay harvested in the spring, any legume hay harvested in Florida, and small rectangular bales should be stored in a shelter. A permanent shelter would be desirable, but if this is not available, there are tarps made specifically for covering hay (Figure 3).

Figure 3. Hay tarp.

Ordinarly hay that is to be stored under a shelter should be picked up and moved to the shelter as soon after baling as possible to prevent the hay from getting wet from rain; however, if the moisture level in the bale is on the high side (18 to 20%) then it may be wise to let the bales stand in the field for a day before stacking them under a shelter. If the inside of the bale is hot it should be left in the field until it cools. This will help prevent spontaneous combustion and fire which may occur in a stack or barn when hay that has too high a moisture content is placed there.

Grass hay, put up in large rolls, is often stored outside. If hay is left outside in the open, there will be a certain amount of loss. The loss would be expected to be greater on a high-quality grass hay than it would be on a low-quality, more mature hay and on spring-harvested hay that would be outside through the entire rainy season. If large round bales are stored outside, the bales should be placed in an area that is well-drained, or on rock or some other structure that will prevent water from wicking up from the bottom of the bale. Do not stack bales, but place them end to end in single rows with enough space between rows so that the rounded sides of the bales do not touch. Round bales wrapped tight and with enough string to form a smooth, even surface usually have less water penetration and spoilage than bales with a looser and less-uniform surface. Recent experiences indicate that net wrap on round bales may also reduce surface spoilage, especially for hay stored outside during the summer.

Feeding Hay: When feeding hay, the livestock producer should try to keep feeding losses to a minimum. Feeding losses are mainly due to trampling and refusal. Leaf shatter from legume hay also may produce significant loss. Although labor intensive, feeding a one day supply in a feed bunk is a sure way to minimize loss. Feeding a one day supply on sod, and rotating feeding areas has also been used effectively. When feeding the large roll bales, losses can be excessive if feeding is not done properly. Use a feeding panel or hay ring to restrict access to the hay (Figure 4). This will reduce trampling loss. If hay rings are not available, feed only as much hay as the animals can consume in one or two days. Also, make sure animals do not enter the hay storage area.

Using Forage Testing: The nutritional value of a hay can be determined by taking a sample of the hay and sending it to a forage testing laboratory. These labs usually test for total digestible nutrients, neutral detergent fiber, and protein. Some labs may also test for minerals. The producer feeding hay can use the results of a forage test to determine whether supplemental nutrients are needed and if so how much. The producer selling hay may use the forage test to help sell the hay (see SS-AGR-63 *Forage Testing*). It is important to collect a representative sample of hay to submit for testing. Do not collect surface samples from weathered baled hay, instead use a commercial hay core sampler or reach inside the bale to collect a sample from the interior.

Figure 4. Hay feeding ring.