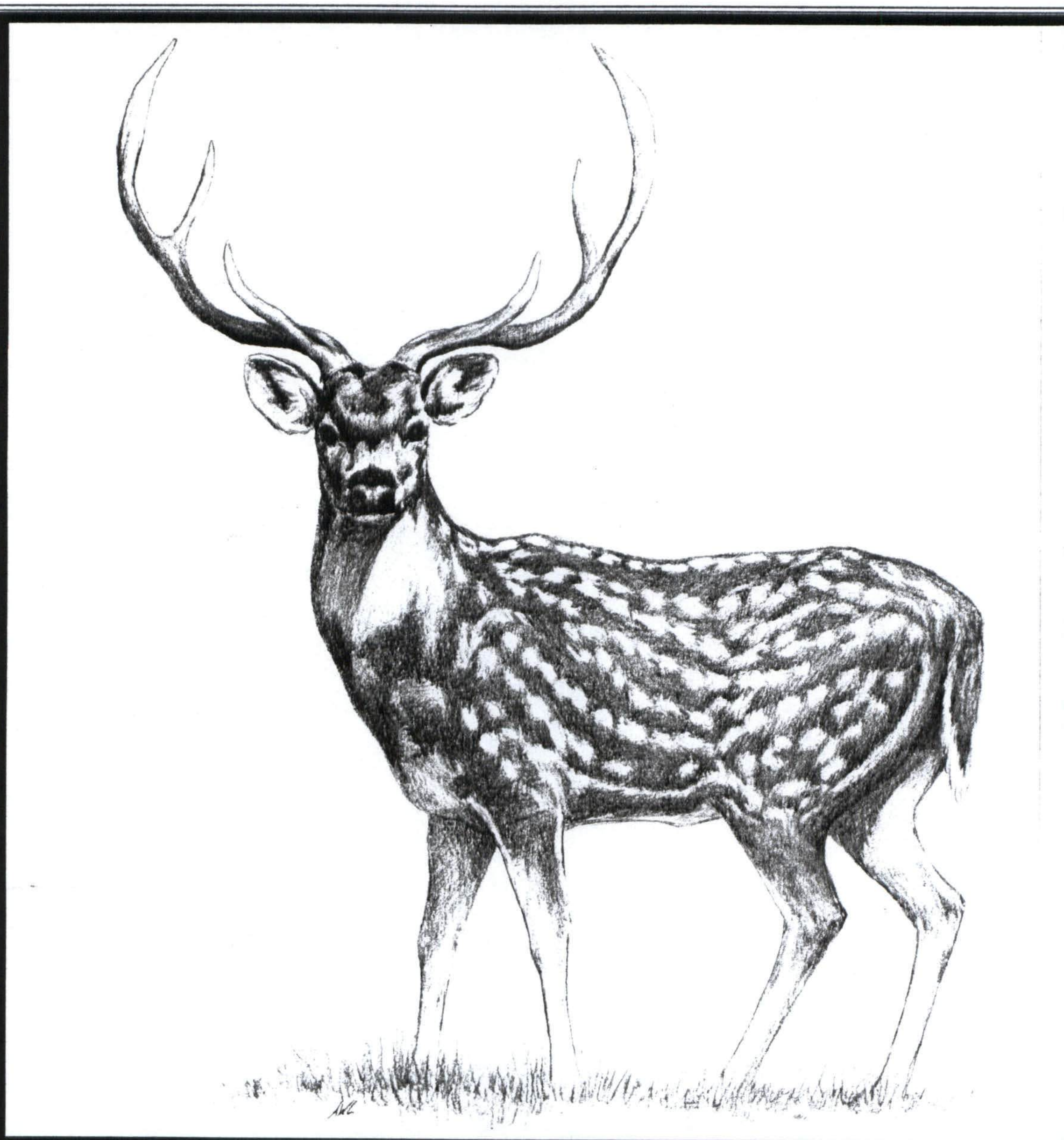
PUBLICATIONS

1999

Texas Agricultural Experiment Station
Texas Agricultural Extension Service
The Texas A&M University System

Non-Native Deer Farming Symposium



1999 Research Center Technical Report No. 99-1

Texas Agricultural Experiment Station • Edward A. Hiler, Director
The Texas A&M University System • College Station, Texas

CHAPTER 5

GROWING FORAGES FOR DEER

Gerald W. Evers[1]

Profitability of deer farming, as with other livestock operations, is enhanced when adapted forages (grasses and legumes) are utilized to meet as much of the nutrient requirements of the animal as possible. Feeding of protein, energy (grain), and mineral supplements is costly and requires additional labor if hand feeding is necessary. A knowledge of how forages grow, the various classes of forages, the nutritive value of forages, and the nutritional requirements of the different physiological stages of the deer is needed. Supplementation will be necessary at times when the nutrient level of the available forage will not meet the animal's requirements. Exact nutrient requirements for the different growth stages for all introduced deer species and elk are not known. However, general recommendations can be made from the nutrition research with fallow and red deer in New Zealand and elk in Canada.

Forages are a means of capturing free solar energy from the sun and incorporating natural resources of soil and rainfall to meet the nutritional needs of livestock and other herbivores (plant eating animals). Understanding the growth and development of forage plants is helpful for maintaining a productive pasture stand, maximizing efficient use of water, nutrients, and light, and harvesting a forage with high nutritive value by grazing or as stored forage. Grain and fiber crops are managed for optimum seed yield; therefore, plants are not cut or defoliated until harvest at plant maturity. In contrast, the emphasis in forage crops is on vegetative growth (leaves and stems). Because plant growth rate is related to leaf area, knowledge of how and where new growth initiates and interacts with the environment is necessary to maintain pastures in a productive state.

Forage Adaptability

The better adapted a plant species is to its environment (soil and climate), the less management and fewer inputs are required to maintain that plant. The first step toward a profitable pasture system is to use forage species adapted to the soils on your farm or ranch. Soils vary in texture (sand, loam, and clay), slope, internal drainage, nutrient content, pH, water holding capacity, and pests such as nematodes. Producers have some influence over the nutrient level and pH but very

[1]Professor of Pasture Management, Texas A&M University Agricultural Research and Extension Center, Overton

little control over the other soil characteristics. We cannot change the soil, at least not economically. The best soils are generally used for food and grain production. Marginal soils not suited for row crop production because of slope, rocks, low nutrient and water holding capacity, or poor drainage are usually planted to forages. Identification and description of soils on your farm or ranch should be available at the county office of the USDA Natural Resource and Conservation Service.

Temperature and rainfall amount and distribution are the main climate factors influencing plant adaptability. Temperature extremes such as the minimum winter temperature are more likely to determine forage species adaptability than temperature averages. Rainfall distribution during the year is more critical than total annual rainfall. Mediterranean climates where there is little or no summer rainfall restrict forage species to cool-season annuals. Plants adapted to low rainfall areas have developed drought tolerance mechanisms such as high temperature dormancy, low transpiration rates, deep root systems, or some other morphologic or physiological trait. Information of adapted species for your area can be obtained from the local County Agricultural Extension Service, Natural Resource Conservation Service, or nearby Agricultural Research and Extension Centers. Caution should be exercised in planting forage species developed in other countries or areas of the US. Varieties developed locally are usually better adapted and more productive than those from other regions. It is best to plant only a small acreage of a new forage the first year to observe how well it performs before making a large investment in seed, land preparation, and labor.

Forage Classes

Grasslands are primarily composed of grasses and legumes. Forbs and shrubs are also part of the grassland ecosystem on native rangeland. Species of the grass and legume families are divided into annuals and perennials, and each of these categories is further divided into cool- and warm-season forages (Ball et al., 1996). Annuals germinate, grow, and mature in one year or growing season and, therefore, must be established from seed each year. Perennials have the ability to live more than one year under appropriate conditions. They usually die back (go dormant) sometime during the year and then initiate new growth from roots, rhizomes, or stolons. Most perennial forages produce seed and can be established from seed. Warm-season forages generally begin growth in the spring and then die or go dormant in the autumn with the first killing frost. Cool-season forages generally begin growth in autumn and mature or go dormant in late spring or early summer.

The most prominent class of forages in Texas are the warm-season perennial grasses such as bermudagrass, bahiagrass, dallisgrass, switchgrass, and Johnsongrass. They take advantage of the long growing season with maximum growth occurring between 80 and 90°F. Unfortunately, they have the lowest digestibility. Sod-type perennial grasses are best for deer pasture systems because they tolerate close, selective grazing. Examples of warm-season annual grasses are sorghum-sudan hybrids, sudangrass, millet, and crabgrass. There are few cool-season perennial grasses adapted to the eastern half of Texas. Tall fescue is grown in East Texas, but is limited to creek and river bottom soils which maintain some soil moisture during the hot summers. Prominent cool-season annual grasses are annual ryegrass, rye, wheat, oats, and barley. Their principal use is for young growing animals during the winter when warm-season perennial grasses are dormant. Forage legumes used in Texas are primarily annuals with the exception of alfalfa which is classified as a cool-season perennial. Examples of cool-season annual legumes are arrowleaf clover, crimson clover, rose clover, and vetch. White and red clovers are perennials but act as annuals because they do not persist through the hot Texas summers. Few warm-season annual legumes are used in Texas, but cowpea and hay-type soybean are some examples.

Plant Growth

Moisture, plant nutrients, and light are essential for plant growth. After the drought of 1996 and 1998, forage producers and home owners alike, understand the importance of moisture. Less than 1% of the water taken up by plants is used for plant growth. The remaining 99% acts as a cooling system for the plant and is lost through stomata (small pores) in the leaves. Depending on plant species and temperatures, about 300 to 1000 pounds of water are required to produce 1 pound of plant dry matter.

The need to add plant nutrients as commercial fertilizer, animal waste, compost, or other source varies with annual rainfall and soil type. The eastern edge of Texas has an annual rainfall of about 50 in., but most of the soils are acid and sandy with low natural fertility. Leaching of nitrogen and potassium is a problem. As one moves to the western edge of the state, annual rainfall decreases to about 10 in. and soils have higher natural fertility. Native rangeland in central and west Texas is seldom fertilized because of more fertile soils, unpredictable rainfall, and poor response of native forages to added plant nutrients.

Light is essential for plant growth because it is the energy source which drives photosynthesis (Nelson, 1995). Photosynthesis occurs primarily in green leaf blades where energy is absorbed from sunlight, CO_2 from the air, and water from the soil to form sugars. Photosynthesis is greatest in new fully expanded leaves in full sunlight and decreases as leaves age. Leaves live for 30 to 60 days depending on forage species, temperature, and moisture. Sugars from photosynthesis are used to support growth of leaves, stems, and roots, or are stored for later use. Light also influences tiller and stolon growth.

When an annual forage emerges or a perennial forage "greens up" at the beginning of the growing season or after a hay harvest, only a small percentage of sunlight is intercepted because there are few leaves. As the pasture sward grows, new leaves and tillers are produced and the amount of sunlight intercepted increases. With time, the lower part of the forage plant becomes shaded, photosynthesis in the older shaded leaves stops, tiller development is reduced, and the pasture growth rate reaches its upper limit. The rate of new leaf production at the top of the sward is equal to the death rate of old leaves at the bottom of the sward. Proper grazing management keeps the pasture at a height that allows light into the pasture sward to generate new tillers and leaves. If pastures are grazed too short, only part of the incoming sunlight is utilized because of few leaves which in turn reduces growth rate of the pasture sward.

Nutritive Value

The nutritive value of forages is based on the nutritional level (energy, protein, etc.) and its availability to the digestive system of the animal. Based on digestibility, which is a measure of nutritive value, forages can be divided into the following five categories: 1) warm-season perennial grasses; 2) warm-season annual grasses; 3) cool-season perennial grasses; 4) cool-season annual grasses; and 5) cool- and warm-season legumes. The normal range in digestibility for these five forage classes and how they relate to the nutritional requirements of various deer growth stages are shown in Fig. 1. As percent digestible dry matter increases, animal performance in terms of weight gain, milk production, weaning weight, and conception rate increases. In general, cool-season grasses are higher than warm-season grasses, and annuals are higher than perennials. Legumes are more digestible and higher in protein, calcium, and phosphorus than grasses. Deer and elk prefer legumes over grasses because they are higher quality and resemble forbs due to their broad leaves.

Within each forage class, plant age is the major influence on forage nutritive value. Nutritive value is highest in new growth and decreases with plant maturity. One reason is that leaves are more digestible than stems and the percent leaves in the available forage decreases as plants mature and become more stemy. The second reason is that cell contents are 98% digestible and include carbohydrates, protein, triglycerides, and glycolipids. Cell walls are mainly composed of cellulose, hemicellulose, and lignin but are only from 45 to 75% digestible. About 70% of young plant cells are the highly digestible cell contents and 30% cell wall. As the cell wall thickens with age and adds more lignin, the cell accounts for 80% of the cell but is less digestible.

Literature Cited

Ball, D. M., C. S. Hoveland, and G. D. Lacefield. 1996. Southern Forages. 2nd ed. Potash and Phosphate Inst., Norcross, GA.

Haigh, J. C., and R. J. Hudson. 1993. Farming wapiti and red deer. Mosby-Year Book, Inc., St. Louis, MO.

Hoveland, C. S. 1995. Pastures for deer farming. p. 21-23. *In* The North American Deer Farmer, Winter 1994-1995, Lanham, Maryland.

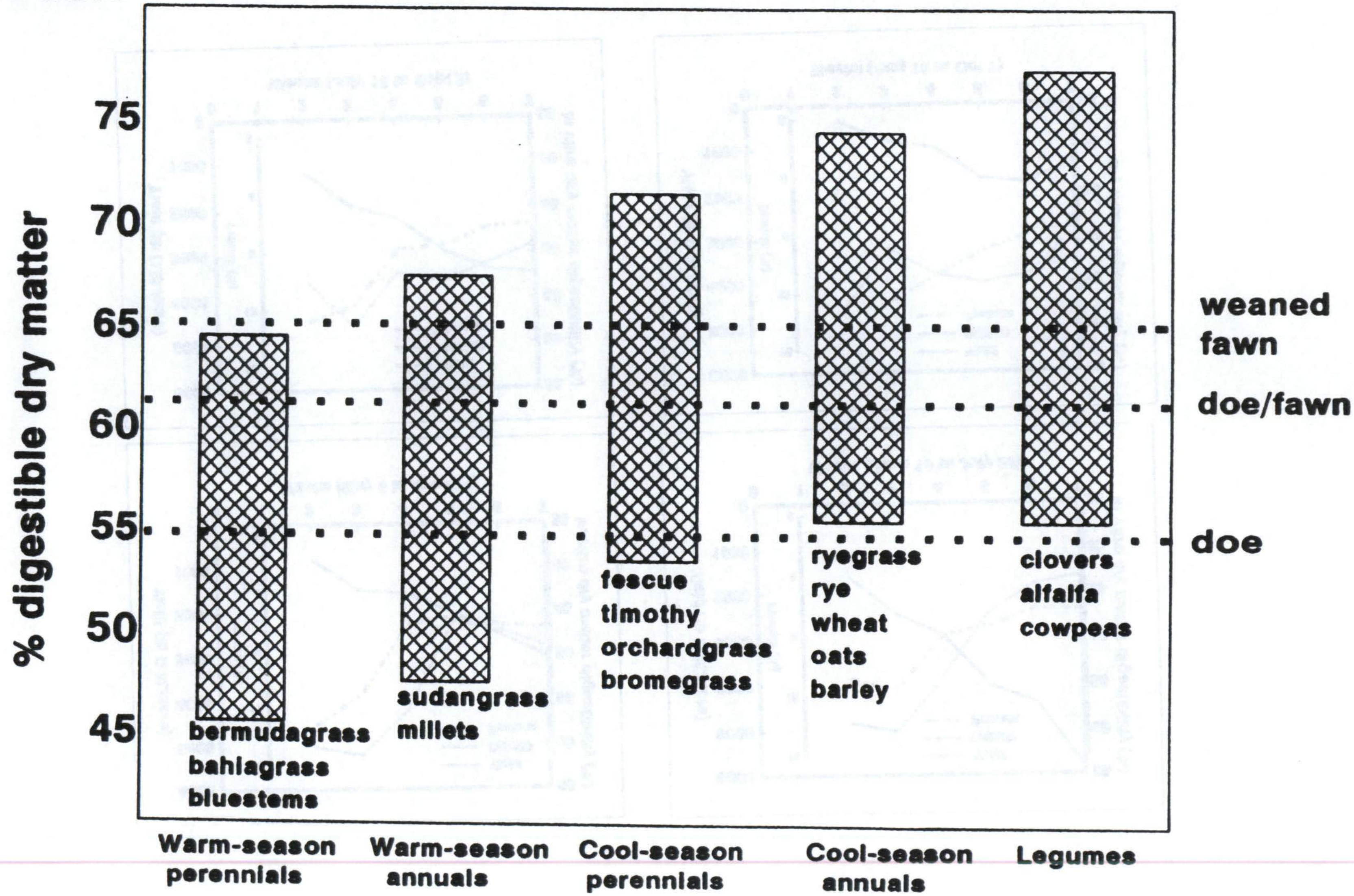
Hunt, W. R., and R.J.M. Hay. 1992. Seasonal differences in pasture species preferences by red and fallow deer in New Zealand. p. 463. *In* R. D. Brown (ed.) The biology of deer. Springer-Verlag, New York.

Kelly, R. W., P. F. Fennessy, G. H. Moore, and K. R. Drew. 1982. Management, nutrition and reproductive performance of farmed deer in New Zealand. p. 450-460. *In* C. W. Wemmer (ed.) Biology and management of the cervidae. Smithsonian Institution Press, National Zoological Park.

Nelson, C. J. 1995. Photosynthesis and carbon metabolism. p. 31-43. *In* R. F. Barnes et al. (ed.) Forages: The science of grassland agriculture. 5th ed. Iowa State Univ. Press, Ames.

Thorleifson, I., T. Pearse, and B. Friedel. 1998. Elk Farming Handbook. The North American Elk Breeders Association. Platte City, MO.

Figure 1. Digestibility percent ranges for several forage groups and requirements of different classes of exotic deer.



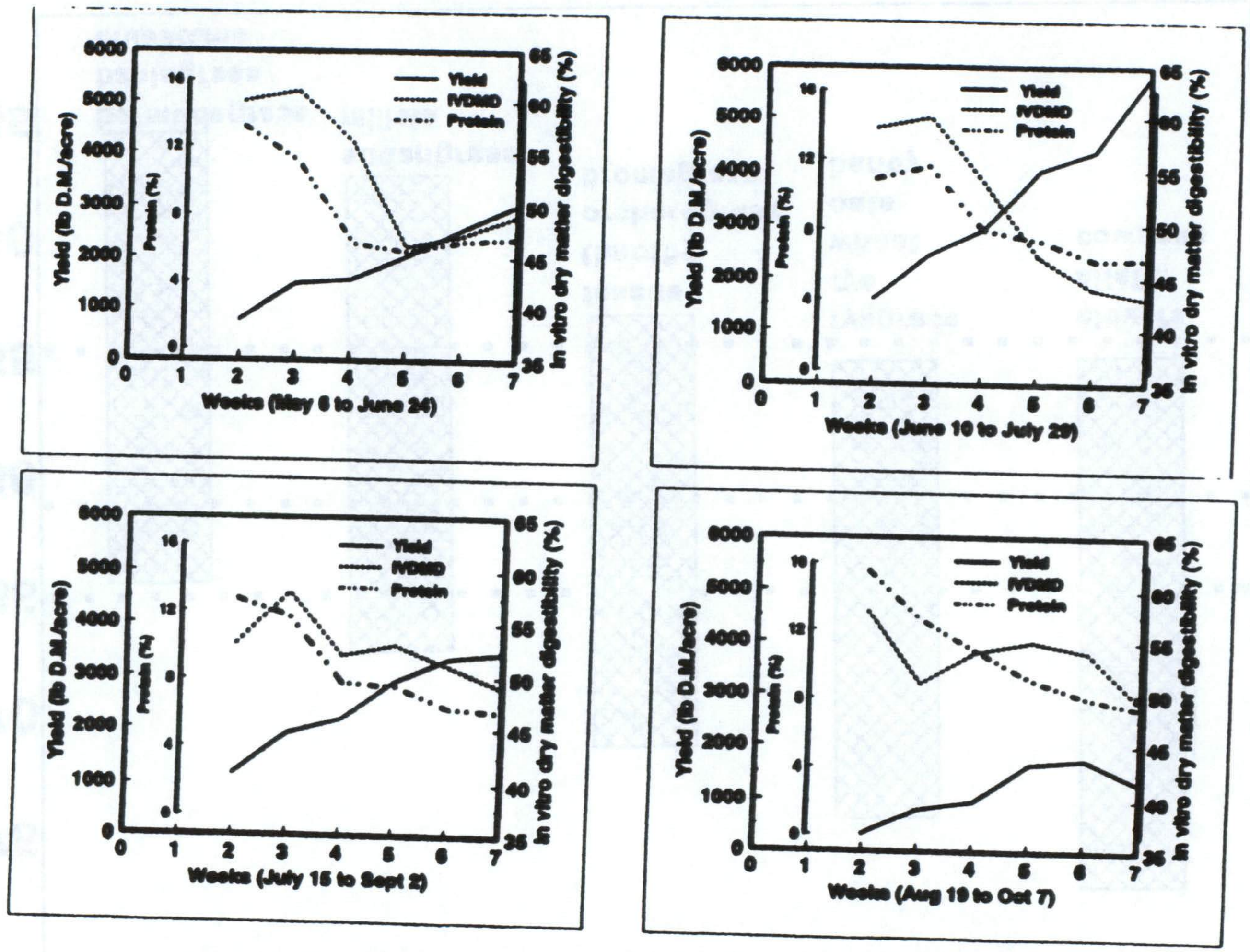


Figure 2. Interaction of yield, in vitro digestibility and protein concentration with age of Coastal bermudagrass throughout the growing season at Tifton, Georgia (W. G. Monson, 1971).

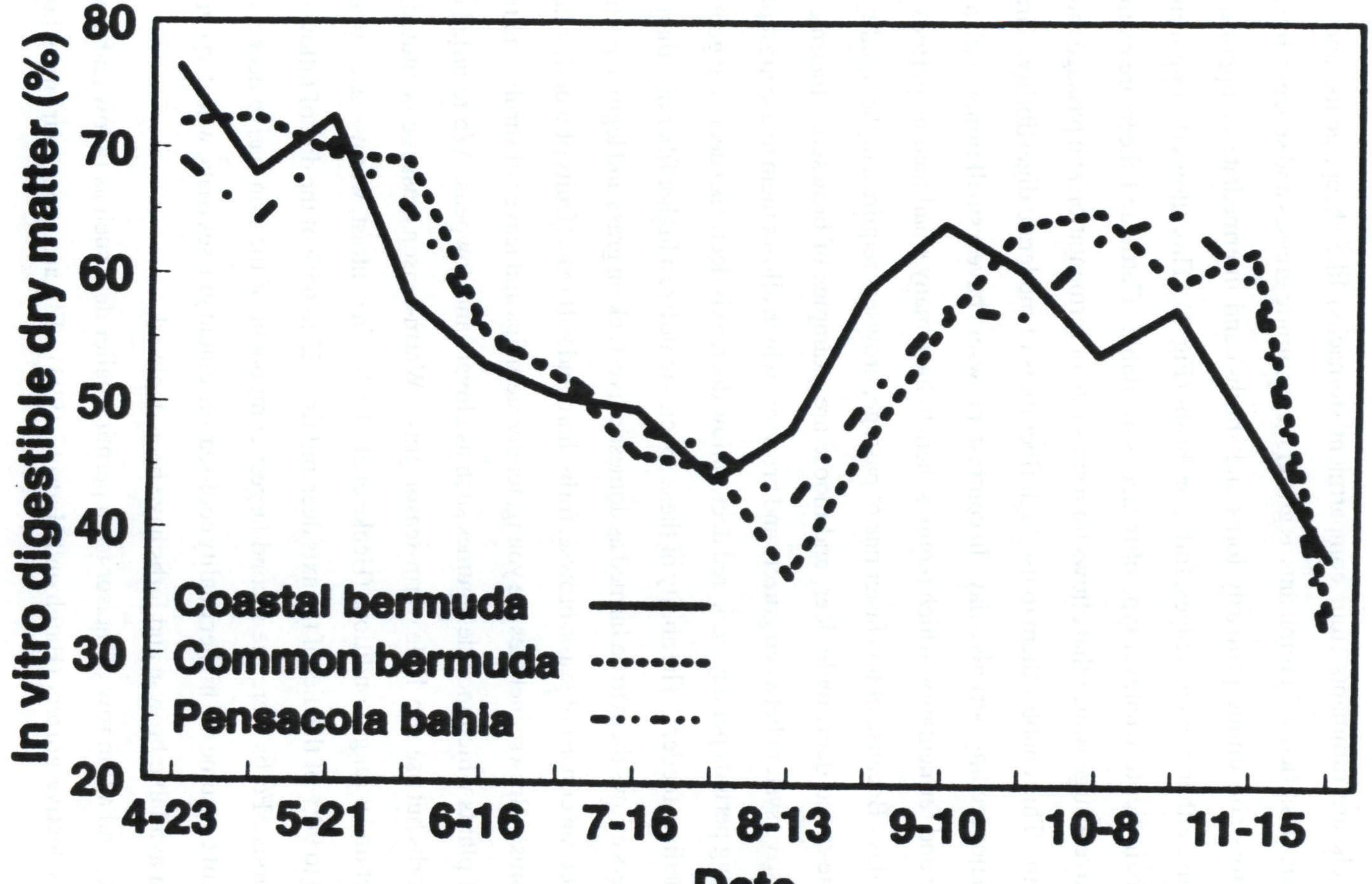


Figure 3. Influence of season on digestibility of continuous grazed sod grasses at Overton, Texas sampled at 2 week intervals (Duble, 1970).