Plant Physiological, Morphological & Growth Characteristics

Seeds contain the embryonic plant as well as energy storage. Once planted under favorable conditions for the species, the seed germinates. The *germination* process consists of growth of the initial plantlet into a seedling, which is the juvenile structure that develops into a plant.

Photosynthesis is the primary mechanism for energy input in plants (figure 1). Through light capture, plants transform water and carbon dioxide into energy that is used for growth, maintenance, and reserve. This process occurs inside structures called chloroplasts. There are two distinct carbon fixation pathways that classify plants as either C3 or C4. Generally, legumes and cool-season grasses are C3 plants, while warm-season grasses are C4. This nomenclature differentiation is based on the first product generated through the photosynthesis process. Following are some of the main differences between C3 and C4 plants:

- Optimal temperature range for growth is 90 to 95 degrees Fahrenheit for C4 plants and 65 to 75 degrees Fahrenheit for C3 plants.
- C4 plants are more efficient photosynthetically than C3 plants, producing greater dry matter per unit of nitrogen and per unit of water (figure 2).
- C4 plants have lower digestibility and crude protein concentration than C3 plants.

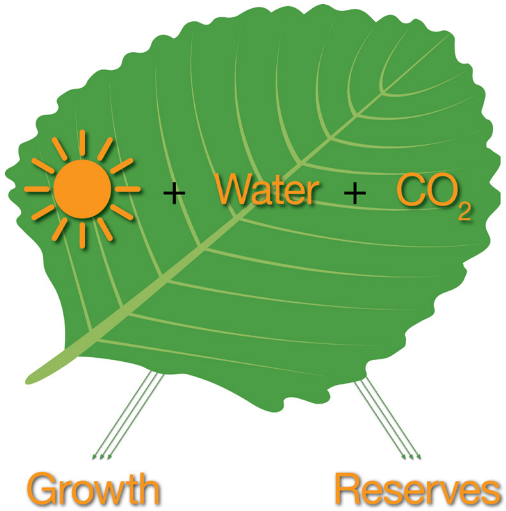

Figure 1. Photosynthesis creates energy for plants.

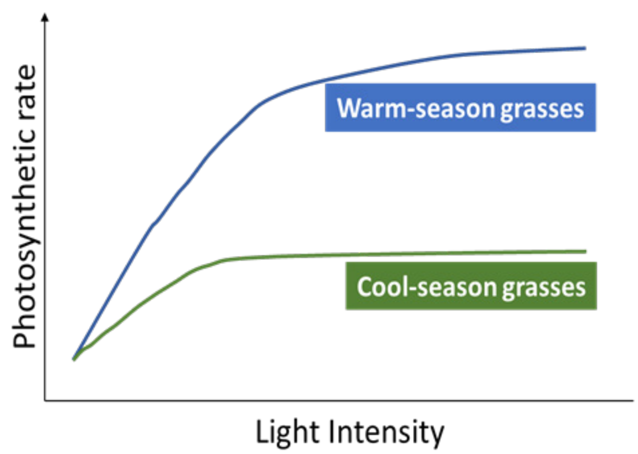

Figure 2. Representation of photosynthetic rate of C3 and C4 plants.

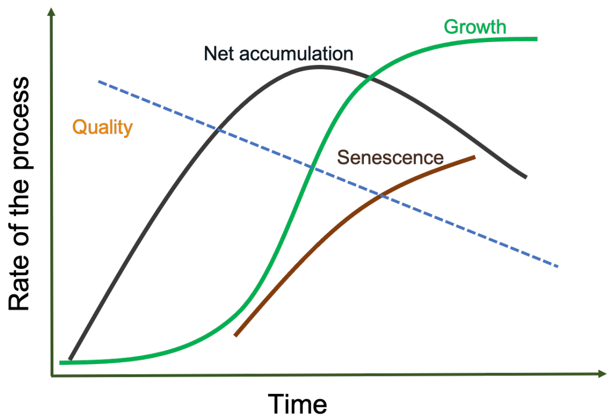

Figure 3. Representation of rate of process of physiological processes. (Photo credit: Marcelo Wallau, University of Florida)

There is a natural process of growth and forage accumulation in pastures. After some time, vegetative material starts to senesce or deteriorate (figure 3). This is a natural cycle since each plant part has a specific life length and will senesce if not harvested.

During senescence, there is a redistribution of nutrients from older leaves into young tissue. The net forage accumulation is the balance between the growth and senescence processes. The optimal point of harvesting refers to when forage quantity and quality are best balanced for a particular species. This optimal point is reflected by harvesting recommendations for each forage species.

Harvesting at the optimal point optimizes the light environment in forage canopies and decreases competition for light due to shading. Generally after harvesting forage, stand growth has priority over storage of carbon as energy reserves. It is crucial to allow plants to properly restore their reserves; this helps avoid stand thinning and death due to overgrazing or high cutting frequency.

Weather conditions affect soil water availability and temperature variations. Forage species generally respond to seasonal temperature changes that are reflected during peak production or start of dormancy. Water is essential for plants to grow. Variations on availability impact forage yield and canopy density, especially during or near establishment.

Sod-forming grasses generally are characterized by their ability to produce either rhizomes or stolons. Rhizomes are underground stems; stolons are found at the soil surface, with new shoots and roots arising from nodes. With these structures, plant growing points are close to the ground. Bermudagrass and bahiagrass are sod-forming forages. Bunchgrasses have minimal spread laterally aboveground; however, they form a tufted growth at the crown, and plant growing points are elevated above the crown base. Upward growth means that growing points of bunchgrass are more susceptible to removal by defoliation. Tall fescue, orchardgrass, pearl millet, and several native warm-season perennial grasses adapted to Alabama are considered bunchgrasses.