“What is the difference between C3 plants and C4 plants?”

Animals need to eat all year round, however there is no “all season” plant to use for forage. Knowing this allows us to view the plants in their seasonal and photosynthetic. These patterns can be characterized by C3 plants (cool-season, temperate) and C4 plants (warm-season, tropical). It is these growth patterns that are the basic key to having quality forage all year long.

C3 and C4 plants both use the process of photosynthesis to convert light to energy and atmospheric CO₂ into plant food energy (carbohydrates). The plants differ in the leaf anatomy and enzymes used to carry out photosynthesis. These differences are important with respect to their optimal growing conditions, nitrogen and water-use efficiency, forage quality, and seasonal production profile.

**C3 Plants- Cool Season Plants**

C3 plants are called temperate or cool-season plants. They reduce (fix) CO₂ directly by the enzyme ribulose bisphosphate carboxylase (RUBPcase) in the chloroplast. The reaction between CO₂ and ribulose bisphosphate, a phosphorylated 5-carbon sugar, forms two molecules of a 3-carbon acid. This 3-carbon acid is called 3-phosphoglyceric acid and explains why the plants using this reaction are called C3 plants.

C3 plants have an optimum temperate range of 65-75°F. Growth begins when the soil temperature reaches 40-45°F. C3 plants become less efficient as the temperature increases. However, they provide a higher percentage of crude protein than C4 plants. Cool-season grasses are productive in the spring and fall because of the cooler temperatures during the day and night, shorter photoperiods, and higher soil moisture. During the summer, growth is reduced and dormancy is induced by high temperatures and low precipitation.

C3 plants can be annual or perennial. Annual C3 plants include wheat, rye, and oats. Perennial C3 plants include orchardgrass, fescues, and perennial ryegrass. The breakdown of C3 plants in the rumen of the Bovine is often faster than C4 grasses because of the thin cell walls and leaf tissues and are therefore often higher in forage quality.

**C4 Plants- Warm-Season Plants**

C4 plants are often called tropical or warm season plants. They reduce carbon dioxide captured during photosynthesis to useable components by first converting carbon dioxide to oxaloacetate, a 4-carbon acid. This is the reason these plants are referred to as C4 plants. Photosynthesis then continues in much the same way as C3 plants. This type of photosynthesis in highly efficient and little fixed CO₂ is lost through photorespiration.

C4 plants are more efficient at gathering carbon dioxide and utilizing nitrogen from the atmosphere and in the soil. They also use less water to make dry matter. C4 plants grow best at 90-95°F. They begin to grow when the soil temperature is 60-65°F. Forage of C4 species is generally lower in protein than C3 plants but the protein is more efficiently used by animals.

C4 plants can be annual or perennial. Annual C4 plants include corn, sudangrass, and pearl millet. Perennial C4 plants include big bluestem, indiangrass, bermudagrass, switchgrass, and old world bluestem.