LITERATURE CITED

Anonymous, 1980-85. Average prices received by farmers in Texas. **Texas Crop and Livestock Reporting Service.**

Bailey, N.T.J., 1959. **Statistical methods in Biology.** The English Universities Press, LTD.

Brewbaker, J.L. and B.M. Hutton, 1979. **Leucaena, Versatile Tropical Tree Legume.** pp. 207-209. In New Agricultural Crops.

Felker, P. and P.R. Clark, 1982. Position of Mesquite (**Prosopis** spp.) Nodulation and Nitrogen Fixation (acetylene reduction) in 3m long Phraetophytically Simulated Soil Columns. **Plant and Soil** 674:297-305.

Giffiths, D., 1920. **Pricklypear as Stockfeed.** USDA Farm Bulletin 1072. pp. 5-7.

Hoffman, G.O. and R.A. Darrow, 1914. **Pricklypear — Good or Bad?** pp. 1-2

Lehmann, V.W., 1969. **Forgotten Legions: Sheep in the Rio Grande Plains of Texas.** Texas Western Press, the University of Texas at El Paso. pp. 140-142.

Monjauze, A. and H.N. Le Houeron, 1965. Le role des Opuntia dans L'Economie Agricole Nord Africane. **Bull. Ecole. Nationale Sup. de Tunisi.** (8-9):85-164.

Shoop, M.C., E.J. Alford, and H.F. Mayland, 1977. Plains pricklypear is a Good Forage for Cattle. **Journal of Range Management.** 30:12-17.

Vallentine, John F., 1971. **Range Development and Improvements.** Brigham Young University Press. pp. 17-19.

Effect of Phenology on Total Available Cabohydrates and Crude Protein in Tobosagrass

James T. Nelson and Michael L. Johnson[1]

ABSTRACT

Total available carbohydrate and crude protein content of tobosagrass (*Hilaria mutica*) was monitored in relation to phenology in the Trans-Pecos region of Texas. The immature leaf, mature leaf, culm elongation, boot, anthesis, seed, and winter dormancy stages were evaluated. Total available carbohydrates only were measured in roots and crowns.

Stems and leaves showed an initial crude protein level of 6.88% which dropped throughout the plant's development to 4.75%. Root and crown carbohydrates showed an initial level of 19%. Shifts in carbohydrates between stems and leaves, roots, and crowns occured throughout the growing season. Root and crown carbohydrates dropped significantly (to 11% and 9% respectively) before and during seed production, but regained early season levels before dormancy.

INTRODUCTION

Non-structural carbohydrates in plants, also known as total available carbohydrates or TAC (Weinman, 1961), are either used as a source of energy, converted to structural form or are stored in the root system for future energy needs. Stored or reserve carbohydrates are essential for the perennial plant to break winter dormancy and initiate the new year's growth. Excessive or repeated removal of new green photosynthetic tissue reduces the plant's ability to produce carbohydrates and forces it to draw on its root reserves. If this continues over a number of years the plant's ability to overwinter and break dormancy is reduced. Eventually the plant may be unable to compete for nutrients and may die (Stoddart, Smith, & Box 1975; Trilica, 1977; White, 1973). Proper grazing management relies on an understanding of the dynamics of carbohydrate storage and protein production in key grazing species. In general protein peaks early and declines as the plant matures. Carbohydrate reserves are usually depleted early and are gradually replenished as the plant matures. Although the general nature of these cycles is recognized the exact nature of this process is unique for each species and is not well documented, especially in the Trans-Pecos.

Tobosagrass is a major component of the vegetation on heavy soils and draw sites in the Trans-Pecos and is an important forage species, especially during its early stages of growth. This study was undertaken in 1985 to monitor total available carbohydrates and protein content in tobosagrass in relation to phenological growth stages. Protein and TAC's were monitored in relation to phenology because we felt that it is important to estimate protein and TAC reserve levels in relation to easily recognizable physical plant characteristics.

Materials and Methods

The study area was located in a draw site on the Del Norte Ranch 12 miles south of Marathon, Texas in a desert grassland association. Average annual rainfall is reported to be 11 inches most of which occurs in the form of summer thunderstorms (SCS, 1972). Precipitation was measured from April to December, 1985.

Tobosagrass collections were made in an ungrazed area from April through December, 1985 during each of 7 identifiable growth stages: immature leaf (less than 3 leaves), mature leaf (3 or more leaves), culm elongation, boot, anthesis, seed, and winter dormancy. Each collection consisted of 5 subsamples of 1 or more entire plants (roots, crowns, stems and leaves).

---

[1]Authors are Assistant Professor of Range Management and Graduate Student, Range Management, Respectively; Range Animal Science Dept. of Sul Ross State University. Alpine, TX 79832. This study was funded in part by a grant from the State of Texas (Chihuahuan Desert Research).

Plant material was collected at or as close to 1800 hrs. as possible since TAC's are reported to be at their highest daily levels at that time (Weinman, 1947). Samples were placed in an insulated container with dry ice and transported to the laboratory where they were dried at 120 degrees F for 72 hours. After drying, plant material was separated into three categories: current year's stems and leaves, crowns, and roots. Each of this material was then separately ground in a wiley mill using a 1 mm screen and stored in glass jars. Before chemical analyses all ground samples were oven dried again at 120 degrees F for 16 hours to remove all moisture. Nitrogen determinations were made by the kjeldahl method and multiplied by 6.25 to obtain crude protein content (A.O.A.C., 1970). Non-structural carbohydrate content was determined using the anthrone method of Viles and Silverman (1949) with modifications described by personnel of Texas Tech University (G. Scott, personal communication, January, 1986). Following analysis of variance, Duncan's multiple range test was used to determine if differences between carbohydrate levels at each growth stage and between protein levels at each growth stage were significant ($P<.01$), (Little and Hills, 1978).

RESULTS

Root and crown carbohydrates followed a parallel pattern throughout the growing season, although the magnitude of change between growth stages was different between these 2 plant components (Fig. 1). Total available carbohydrates in both roots and crowns decreased from the immature leaf stage through mature leaf to culm elongation. TAC's then increased significantly ($P<0.01$) between culm elongation and boot. This was followed by a sharp and significant ($P<0.01$) decrease through anthesis and seed production. TAC's in roots and crowns regained early season high levels by winter dormancy.

Stem and leaf TAC's increased slightly (from 16% to 18%) between the immature and mature leaf stage. This was followed by a significant ($P<0.01$) decrease to 13% at culm elongation. Minor fluctuations occured until after seed production, when at dormancy stem and leaf TAC's regained early season levels.

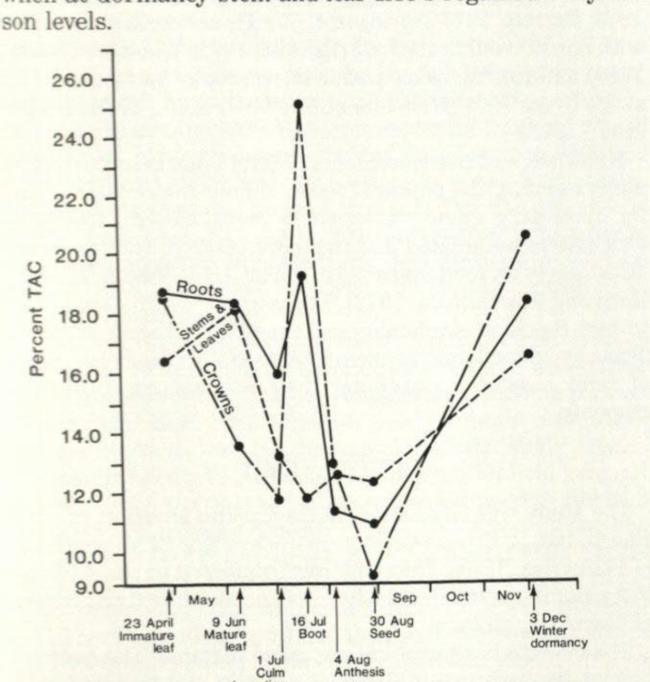

Figure 1. Total available carbohydrate content of roots, crowns, and stems and leaves of tobosagrass at 7 stages of growth from 23 April to 3 December 1985.

Above ground crude protein was highest (7%) early in the growing season at the immature leaf stage. Crude protein content decreased significantly ($P<0.01$) to 5% by culm elongation, made a noticeable but statistically insignificant ($P>0.01$) increase at seed development and then decreased to below 5% at dormancy (Fig. 2).

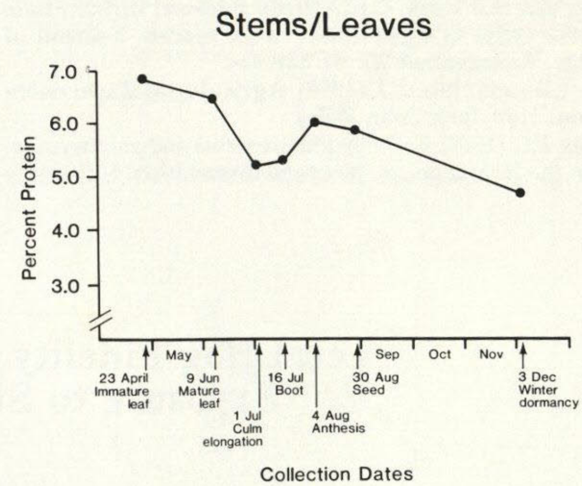

Figure 2. Crude protein content in tobosagrass stems and leaves at 7 stages of growth from 23 April to 3 December 1985.

DISCUSSION

Total available carbohydrates in tobosagrass exhibited fluctuations throughout the growing season that indicated translocation between roots and crowns, and stems and leaves; and periods of net TAC depletion alternating with net TAC production. The 16 day period between culm elongation and boot appeared to be extremely important for TAC accumulation in roots and crowns. At the same time stem and leaf TAC decreased indicating TAC translocation from the photosynthesising areas of the plant to storage zones. Anthesis and seed formation appeared to place high energy demands on the plant once again, as shown by the rapid decrease in root and crown TAC's to their lowest levels. All plant components regained their original TAC levels by the onset of winter dormancy. These data confirm the results of other reseachers such as Trilica (1977) who found low TAC root reserves in desert grasses after spring regrowth and maximum levels at winter dormancy, and Coyne and Cook (1970) who found higher concentrations and greater fluctuations of TAC in the crowns than in the roots of indianricegrass **(Oryzopsis hymenoides)** and needleandthreadgrass **(Stipa comata).** Our data suggest that the TACA fluctuation in tobosagrass follows a pattern more similar to that found in curly mesquite **(Hilaria belangeri)** than to that found in galletagrass **(H. jamesii)** by Pinkney (1972). Apparently tobosagrass, like curly mesquite is able to build up TAC reserves during high July temperatures and again during the cool fall period. Galletagrass made its major TAC gains in the fall (Pinkney, 1972).

Two general patterns of grazing are recognized to allow replenishment of TAC reserves in range grasses. One is to graze early and remove livestock early enough to allow TAC reserves to build back up prior to dormancy. The other is to defer grazing until after reserve TAC has been replenished (usually at seed stage). The carbohydrate and protein cycles in tobosagrass on this study area appear to support the first pattern rather than the latter.

REFERENCES CITED

Association of Official Analytical Chemists. (1980). **Official methods of analysis.** Wash. D.C.: Associated Office of Agricultural Chemists.

Cook, C.W., and Harris, L.E. (1950). The nutritive content of the grazing sheep's diet on the summer and winter ranges of Utah. **Utah Agricultural Experiment Station Bulletin 342.**

Coyne, P.I., and Cook, C.W. (1970). Seasonal carbohydrate reserve cycles in eight desert range species. **Journal of Range Management 23** (6), 438-444.

Little, T.M., and Hills, F.J. (1978). **Agricultural Experimentation.** New York: John Wiley.

Pinkney, F.C. (1972). Carbohydrate reserves and photosynthesis in the Hilaria genus. (Doctoral dissertation, University of Arizona, Tucson, 1972). **Dissertation Abstracts International 33** (2), 521B.

Stoddart, L.A., Smith, A.D. and Box, T.W. (1975). **Range Management.** New York: McGraw-Hill.

Trilica, M.J. (1977). Distribution and utilization of carbohydrate reserves in range plants. In R.E. Sosebee (Ed.), **Rangeland plant physiology** (pp. 73-96). Denver: Peerless Printing.

U.S.D.A., Soil Conservation Service. (1972). Climatic Description - Desert Grassland, Trans-Pecos region, Texas. **Technical Guide Section II-E, Area 18.**

Viles, F.J. and Silverman. (1949). Determination of starch and Anthrone. **Analytical chemistry. 21** 950-953.

Weinmann, H. (1961). Total available carbohydrates in grasses and legumes. **Herbage Abstracts 31,** 255-261.

White, L.M. (1973). Carbohydrate reserves of grasses: A review **Journal of Range Management 26** (1), 13-18.

Feral Hog Fidelity to Home Range After Exposure to Supplemental Feed

Ahmed Mansouri and Charles A. DeYoung[1]

ABSTRACT

Thirteen feral hogs were captured on the King Ranch in South Texas and fitted with radio transmitters in order to test if their movements were based on food availability. Supplemental feed was introduced into the range of some animals after they were tracked for a period of time with no feed. Six sows and a boar yielded enough radio locations to calculate home range size. The average home range size calculated by the minimum convex polygon method for unsupplemented sows was 143% of that for supplemented sows. Two sows exhibited a decrease of 67% in their average core areas after exposure to feed. Supplemented animals spent a great deal of time in the vicinity of feeding sites but did not totally abandon their previous home range.

INTRODUCTION

Feral hogs (**Sus scrofa**) are descendents of domestic swine gone wild and in some cases are crossed with the taxonomically identical European wild boar. European wild hogs were introduced in Texas as a game animal in the 1930's and since then many landowners have released them in new areas as well as areas which already had feral hog populations (Ramsey, 1968). Jackson (1964) estimated the Texas population of feral hogs at between 0.5 and 1 million animals.

In some areas, feral hogs are important game animals. In other locals, they are economically significant pests because of their depredation on agricultural crops (Pine and Gerdes, 1973; Barrett, 1977; Springer, 1977). Feral hogs also compete with native wildlife for food (Barrett, 1971; Wood and Roark, 1980) and can serve as a disease reservoir, particularly for swine brucellosis (**Brucella suis**) (Wood et al., 1976; Becker et al., 1978).

Knowledge of the movements of feral hogs is important to understanding the potential scope of their depredations, and for developing game management plans. Several investigators have hypothesized that the movements of feral hogs are based solely on food availability (Pullar, 1950; Wodzicki, 1950; Kurz and Marchinton, 1972). The purpose of this study was to test the food availability-movement hypothesis in South Texas by introducing supplemental feed into the home range of feral hogs and observing their subsequent movement response.

STUDY AREA

The study was conducted on the Encino Division of King Ranch, Inc., in Brooks County, approximately 12 mi southeast of Falfurrias, Texas. Research was conducted in the 6,000 ac Mota Bonita pasture and 640 ac of the southwestern corner of Hormigas pasture.

The climate is subtropical but quite variable. The average annual temperature is 22° C. As a rule, winters are mild although cold fronts may cause short periods of freezing temperatures. Rainfall for Falfurrias has averaged 23.8 in. annually since 1907. However, there are great fluctuations from year to year.

[1]Former graduate student and Professor of Wildlife Management, respectively, Caesar Kleberg Wildlife Research Institute, Texas A & I University. The U.S. Agency for International Development and the Caesar Kleberg Foundation for Wildlife Conservation funded this study. We thank Andres Garza and Kenneth Hyde for field assistance. The cooperation of Peter McBride, foreman, Encino Division, King Ranch, Inc., and Bill Richardson, manager, Dresser Hunting camp, was appreciated.