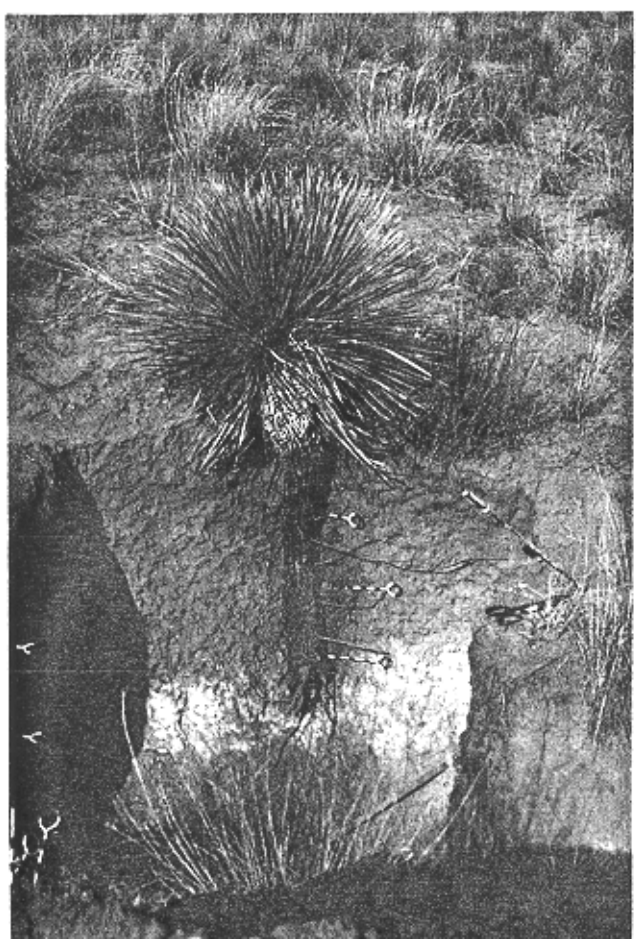
Range Plant Physiology and Morphology

Responses of Photosynthesis and Root Respiration to Temperature, Soil Moisture, and Defoliation

by William B. Sisson

Respiration processes associated with growth and maintenance of perennial plant root systems represent a significant investment of reserve nutrients since root:shoot ratios are often greater than 1. The replenishment of these reserves for aboveground and belowground plant growth through photosynthesis is often limited in semidesert rangelands by low soil moisture, high temperatures, and defoliation of photosynthetic tissue. Although photosynthesis has been quantified for a number of forage species, there is presently no information regarding reserve substrate costs (in the form of CO_2 respired) for root systems of plants in a field situation. Thus, several ongoing studies were designed to define the substrate costs involved in producing and maintaining aboveground and belowground plant components, and the concommitant replenishment of these reserves through photosynthesis. The important interactions of soil and air temperature, soil moisture, and defoliation are also being studied.

Photosynthesis by soap tree yucca leaves provide substrates for growth of new roots and maintenance of old roots.



Initial results using soaptree yucca indicate that root respiration is linearly increased by soil temperature and a doubling of rates occurs for every 10 degree (C) increase in temperature. This type of response occurs during dark periods or when photosynthesis is suppressed by either high temperature or water stress. During periods of minimal water stress and cooler air temperatures when high rates of photosynthesis occur, a photoperiod associated rise in root respiration beyond a simple temperature response occurs. Field studies using Kleingrass show similar types of response to temperature and soil moisture. A reduction in root respiration rates following defoliation is probably associated with root growth cessation.

Future research will be designed to determine physiological tolerances of important range forage species to defoliation. The approach involves, among other physiological parameters, a quantification of reserve substrates relative to environmental variables, defoliation, regrowth, and substrate gains (photosynthesis) and losses (aboveground and belowground respiration).

Growth Patterns of Broom Snakeweed

by Samu Nadabo and Rex D. Pieper

A study was conducted during 1977 and 1978 to determine growth rates of broom snakeweed plants at three locations on the College Ranch. Twenty individual plants were marked with a wooden stake at each location. The height and long and short diameter of the canopy of each plant was measured biweekly during the growing season in both years. Height and diameter measurements were taken on ten additional plants at each

Broom snakeweed undergoes rapid leaf and stem elongation until mid summer.