Specific Leaf Weight: Daily Trends in an Alfalfa Field

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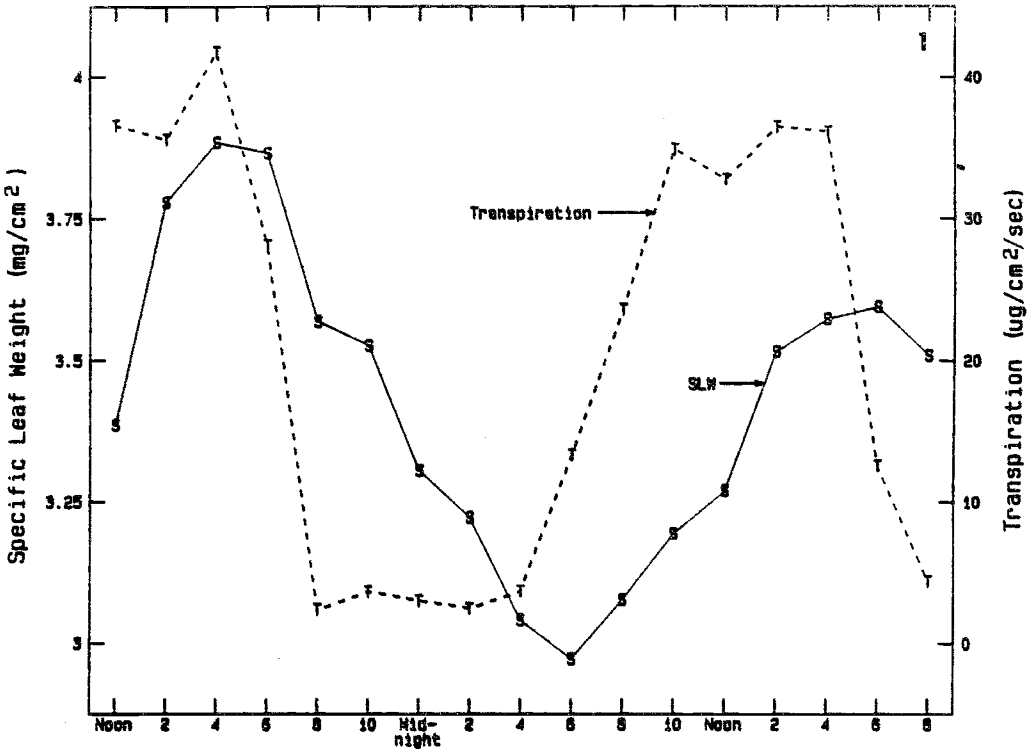
Specific Leaf Weight (SLW) is one of the few morphological characteristics of plants that shows large changes over the course of a single day. This value, calculated by dividing the dry weight of leaves by their surface area, makes SLW one of the easiest components of growth to measure. Since alfalfa is a vegetative crop, several researchers have looked for correlation between SLW and yield. Results have been variable. One reason is that SLW is affected by changes in the environment. It is the interplay of SLW with environment that motivated this study of hourly changes in leaf weight.

During a typical 24-hour period, two basic physiological activities of plants act together in altering their leaf weight: 1) photosynthesis fixes carbon from the atmosphere thus adding to SLW and 2) translocation removes photosynthates from leaves and exports them to the roots, growing points and flowers.

This study was conducted at the SCS Plant Material Center in Tucson on July 10, 1985. Leaves were randomly removed from ten 2-year-old plants (variety 'Mesa-Sirsa') growing in the field at 1 meter distances. Starting at noon, 100 leaflets were picked at 2 hour intervals for 32 hours. Leaves were measured with a leaf-area meter, then dryed and weighed. Leaf transpiration rates were determined at each interval using a steady-state porometer. Environmental factors (air temperature, relative humidity and radiant energy) were also monitored.

Alfalfa leaves showed significant changes in water loss rates during a 24-hour period (Figure 1). Leaf transpiration was highest in mid-afternoon and lowest at night, following a pattern very similar to changes in sunlight (Figure 2). Transpiration activity often mimics photosynthesis since they are both primarily controlled by the openings in leaves called stomates.

Compared to transpiration, SLW showed a slower response to changes in the environment. SLW was lowest at 6 a.m. and then steadily increased soon after sunrise. About .623 mg/cm^2 of photosynthate was added to the leaves during the daylight hours causing SLW to reach its maximum at about 5 p.m. Translocation became most evident after 6 p.m. when photosynthesis declined. Leaf weights declined at night by .912 mg/cm^2. In this study, alfalfa leaves showed a cycle of increase and decrease in dry weight of more than 20% per day. Measurement of SLW over time is an effective way of monitoring this activity. Specific Leaf Weights are easy to measure and provide information not only about dry matter production, but also how efficiently photosynthates get moved out of leaves and around the plant. Knowledge of these translocation patterns may reveal more about alfalfa stand maintenance, regrowth and overall forage production.



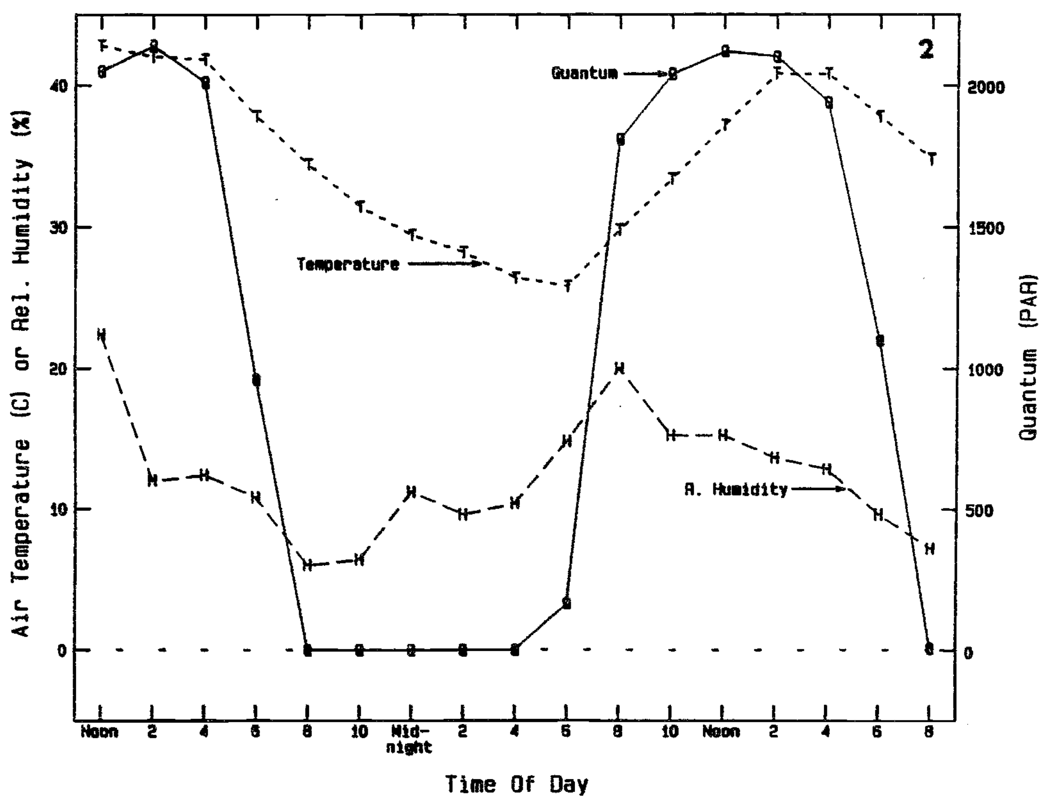


Figure 1. Daily trends in an alfalfa field for Specific Leaf Weight and Transpiration.

Figure 2. Daily trends for Air Temperature, Relative Humidity and Quantum (Photosynthetically Active Radiation).