Effect of Irrigation on Physiological Traits of Corn for Silage Grown under On-Surface Drip-Irrigation System

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Introduction
Corn for silage requires adequate amounts of water, nutrients, and good management practices for profitable production. In arid and semiarid regions, including growing areas in northwest Wyoming, proper irrigation is required to achieve high corn yield and quality. Corn is more susceptible to water stress during early reproductive stages of development. Water deficit, which usually occurs during a period of high air temperature and drought, can cause severe yield reduction. Physiological parameters are often described to be affected by water reduction in corn plants. Among the parameters are photosynthesis (production of food from water and carbon dioxide by using sunlight), stomatal conductance (rate of carbon dioxide entering or water vapor exiting the leaf), transpiration (evaporation of water from plants), and other physiological processes.

Objectives
The objective of this study was to investigate the effect of water stress on physiological attributes of corn grown in a semiarid environment under an on-surface drip-irrigation system.

Materials and Methods
The study was conducted in 2014 at the Powell Research and Extension Center (PREC) on a clay loam soil. Almost half of the average rainfall per year (6.9 inches) is received during the growing season of May to August in a typical year. Managed with an on-surface drip irrigation system, the hybrid ‘P8107HR’ corn was grown under four levels of irrigation: 100 ETc (crop evapotranspiration), 80 ETc, 60 ETc, and no water from V9 to R3 stages. The Vn stage is when the collar of the nth leaf is visible, and the Rn is the reproductive stages (the nth leaf is the number of leaves that are completely developed).

The study used a complete randomized design with three replications. An infrared gas analyzer (LI-COR Inc.) was used to obtain photosynthesis, stomatal conductance, transpiration, and intrinsic water-use efficiency (the ratio of photosynthesis and stomatal conductance) from August 10 to August 28 when corn was at its maximum water requirements (V14–R2) stage. Data were analyzed using the statistical software SAS.

Results and Discussion
Photosynthesis and transpiration rates were greatly affected by water deficit; both were maximum for 100 ETc and minimum for no water treatment (Figure 1). This could be the result of low stomatal conductance due to water stress (Figure 1). The highest level of stomatal conductance was observed under 100 ETc; thereby, photosynthesis and transpiration were high. Although no differences were observed among irrigation levels, there was an increasing trend of intrinsic water-use efficiency with increasing water deficit. This indicates that the late vegetative-growth stages might be the most critical period under water stress. Results showed that water stress during a period of high water requirements at V9–R3 stage affected corn photosynthesis and transpiration rates. Irrigation timing seems to be a key factor affecting corn physiology and growth.

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**Figure 1.** Physiological response of corn to different irrigation levels. Treatments with the same letter do not differ at $p<0.05$. 

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