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Corn Growth and Development: Climate Matters

BY LORI ABENDROTH

Corn is one of the world's most studied and geographically adaptable crops, with high yield potential making it a staple grain crop in the world. Incredibly proficient, it can produce more than 20,000 lbs/acre of above-ground dry matter in six months when supplied with ample sunlight, water and nutrients. For decades, U.S. corn yields have been increasing because of major advancements in plant breeding and crop management practices. Today, utilizing the best genetics and positioning them on the landscape appropriately remain important while good management within and across fields has never been more important. Understanding critical times and needs of corn development can help producers and agronomists weigh crop management options as climate patterns change and weather events more extreme.

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Corn development is correlated with air temperature and therefore, vegetative and reproductive development are predicted using growing degree days (GDD). The optimum temperature range for corn is 50° F to 86° F although growth does occur outside these temperatures to varying degrees. An important consideration is the impact changing temperature patterns have on the vegetative period as well as grain fill. A rise in nighttime temperatures can hasten development and is especially important during grain fill when starch is accumulating. High summer-time temperatures also will place additional stress on the vegetative period of development.

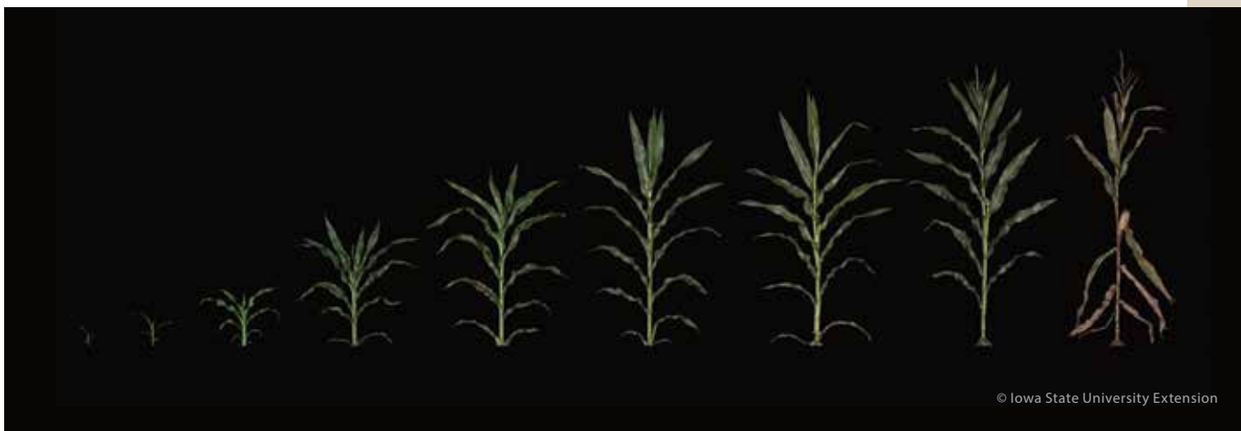
Extreme rainfalls, drought and timing of precipitation within and across seasons, are changing. Extreme rainfall early in the season heightens the risk of flooding and soil erosion as the crop is neither firmly established nor canopied. Prolonged, saturated soils or periods of flooding are detrimental to young seedlings as the whole plant may be submerged or the root system is in an anaerobic state for too long. Corn has two root systems with the initial helping to anchor the young plant, and the second, dominant system in place by knee-high (V6) (see photo on page 7) and at maximum size early in reproductive development. Corn roots can grow an inch per day and to a depth of six feet although most roots are in the upper two to three feet of the soil profile. Deep rooted plants in high organic soils, which have a higher water holding capacity, enable the crop to withstand moisture stress periods. Water stress mid-season is typically associated with shortages, not excess; as the plant is at its highest water use during the silking period (1/3 inch per day). This sensitivity to water stress can result in a reduction of kernels because of poor receptivity of the silks to shed pollen.

Prior to silking, the ear has 700 to 1,000 potential kernels; at harvest, it typically has developed 450 to 550 kernels. Following fertilization, stress will reduce yields early because of kernel abortion. Later in development, stress causes lighter kernels due to less starch accumulation. Overall, the development of grain takes approximately two months from silking to physiological maturity with the last month crucial for dry matter accumulation; temperature or moisture stress during this period will directly reduce yield.

A corn crop needs up to six months to progress through vegetative and reproductive development. During this time, the land and crops are exposed to variable weather, leaving the farmer to determine management strategies that can be employed pre- and mid-season to meet these challenges. The Sustainable Corn Project team is discovering and evaluating strategies that build greater resilience into our Midwest agricultural systems.

Lori Abendroth is the project manager of the Sustainable Corn Project with expertise in crop physiology and production and years of in-field agronomic research experience. She is lead author of the guide, "Corn Growth and Development," which is available at the Iowa State University Extension and Outreach store.

> Plant development from second leaf (V2) to physiological maturity (R6)



^ "Knee high" V6 corn.