Chapter 9

The Physiology of Plant Tolerance to Temperature Extremes

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Temperature is the major uncontrollable climatic factor that delimits crop production areas and limits crop yield. The suitability of geographic areas for winter grain production, for example, depends largely on temperature. Cotton (*Gossypium hirsutum* L.), a species of tropical origin, is restricted to a climate with temperature above 15°C for 110 to 120 days. Thus, winter grain production depends on tolerance to freezing and cotton production is limited by intolerance to chilling. Other crops, such as blugrass (*Poa pratensis* L.) are limited by heat extremes.

The limiting effect of temperature extremes on crop yields range from such well-publicized events as a “freeze-out” of the Florida citrus crop, to intangible losses due to a reduction of plant vigor in soybean [*Glycine max* (L.) Merr.], corn (*Zea mays* L.), or cotton after incidence of chilling during germination, or short-term, high-temperature periods during critical plant processes such as pollination and fruit set. Research on temperature relations in crop plants needs little justification when focused on (i) reducing the impact of temperature extremes on yields or (ii) expanding crop production to areas that are now unsuitable due to unfavorable temperatures.

Considerable basic information is available on plant response to temperature. Much of this information is used or has potential for use by crop breeders in selection for plant temperature tolerance, and by crop physiologists to ameliorate temperature stress by cultural methods.

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