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Having evolved on numerous occasions over many years, it's not surprising there are variations in C-4 photosynthesis and even intermediate plants that exhibit greater photosynthetic efficiency but do not possess all the characteristics of a C-4 plant.

Heat tolerance in turfgrasses is not solely a function of being wended with C-4 photosynthesis. Elevated temperatures can cause other malfunctions in cool-season grasses where root sensitivity to heat can be especially troublesome. The lipid saturation level of cell membranes, the ability to detoxify O₂ free radicals, and the synthesis of heat-stable growth-promoting proteins all appear to play a role in making cool-season turfgrasses more heat tolerant.

However, there is ample evidence that C-4 photosynthesis does contribute to a plant's aggressiveness, especially in warm climates. C-4 plants comprise less than 4 percent of plant species but account for about 18 percent of the Earth's annual plant production.

Of the 18 plants designated as the world's worst weeds, 14 exhibit C-4 photosynthesis. Genetic research has not been successful in transferring C-4 photosynthesis into a C-3 plant. There is a lot involved in the C-4 syndrome and such a genetic feat may not be realistic. However, understanding what really distinguishes a warm-season from a cool-season turfgrass may be helpful in managing each to its fullest potential.

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