How Well Does Sweet Corn Tolerate Its Neighbors?

In order to maximize crop yield, there needs to be a sufficient number of plants to utilize available resources (e.g., water, light, and nutrients). However, if the field has too many crop plants, they compete with each other and decrease yield—the result of “crowding stress.” A balance must be struck between having too few and too many crop plants in a field.

The steady increase in average U.S. grain corn yield the last few decades is driven in large part by greater tolerance to crowding stress in modern grain corn hybrids. Today’s hybrids are grown at higher plant populations than their predecessors, with the rate of increase approximately 280 plants/ac/year. Can the same be said of a highly related crop—and one of America’s favorite vegetables—sweet corn? A recent article in the March–April 2013 issue of Agronomy Journal identifies considerable room for improvement.

Marty Williams, with USDA-ARS in Urbana, IL, found large differences in tolerance to crowding stress among widely used sweet corn hybrids grown for processing. Relative to hybrids with poor tolerance to crowding stress, hybrids with the best tolerance to crowding stress were >$200/ac more profitable for the grower and approximately $1,500/ac more profitable to the vegetable processor. Nonetheless, plant populations used in sweet corn lag far behind those used in field corn.

Crop plants compete not only with each other, but also with weeds. A previous survey found that a majority of fields in the Midwest suffered yield loss due to weed competition. Fortunately, some sweet corn hybrids inherently tolerate weed competition better than other hybrids, and work is under way to exploit this weed-fighting trait.

To better understand how crowding stress affects the crop’s tolerance to weed competition, and vice-versa, Williams grew two hybrids that differed in tolerance to weed competition across a range of crop plant populations, with and without wild-proso millet—a common weed in sweet corn. Field trials were also conducted in Prosser, WA with USDA-ARS’s Rick Boydston. By conducting field trials in Illinois and Washington State, the two researchers had sites that represented production in the Midwest and Pacific Northwest—regions that account for nearly all of the U.S. sweet corn grown for processing.

Since crops and weeds would be competing for the same resources, the team hypothesized that a hybrid with superior tolerance to weeds would also have a higher tolerance to crowding stress. To their surprise, this was not observed. While the two hybrids responded to weed competition as they had expected, the hybrids had a similar response to crop populations. How the crop competes with itself versus weeds is apparently complex and will require further study, according to Williams. Nonetheless, weeds continue to threaten sweet corn productivity, and hybrids with greater tolerance to weeds may play an important role as one of many tools for weed management.

The team found a large regional effect on sweet corn performance. Sweet corn grown in Washington could tolerate about one-third more of its own neighbors than in Illinois. This finding underscores the importance of improving tolerance to crowding stress in sweet corn, which is proving highly advantageous in field corn. Specifically, when the crop can tolerate more of its own neighbors, it can be grown at higher populations, and when it can be grown at higher populations, yield increases. Given the poor tolerance to crowding stress in sweet corn, relative to field corn, and the need to increase plant populations to improve yield, Williams states, “Sweet corn breeding programs are likely to aim for higher tolerance to crowding stress, which would benefit the entire sweet corn industry.”


doi:10.2134/csa2013-56-4-2