

Soybean Pod Fill During Drought Stress

The greatest risk for loss in soybean yield potential due to drought stress occurs during R4 through R6 (full pod through full seed) growth stages because soybean flowering stops and plants are unable to compensate for lost pods.

Drought Effects

Compared to corn, soybean plants can produce flowers over a wider window of time; therefore, plants can typically withstand drought stress reasonably well. However, plants are most sensitive to intense and prolonged stress during the flowering and early pod fill growth stages. Drought stress can cause floral abortion, reduced pod number, fewer seeds per pod, and reduced seed size. A moderate drought stress can significantly reduce or stop nitrogen fixation, disrupting seed development.² Drought stress during R4 through R6 (full pod through full seed) can have a devastating effect on yield potential because flowering stops and plants cannot compensate for lost pods.³ Specifically, early drought stress during seed fill can reduce the number of seeds per pod. Later drought stress can reduce seed weight.⁴

Heat Effects

It can be difficult to separate effects of high temperature from the effects of water stress on soybean plants. Often these stresses occur together and magnify the effects of each other. Extension Soybean Specialist Jim Dunphy, North Carolina State University, indicated that “when temperatures get above about 95°F, soybean plants simply cannot pump enough water to keep up with transpiration and evaporation. The plants close the stomata in their leaves and water cannot get out. That also means carbon dioxide (CO₂) can’t get in, and plants can no longer get the carbon they use to make the sugars that fuel everything that goes on inside the plant.”

Managing Stressed Soybean Plants

If soybean plants are drought stressed to the point of losing leaves, it is time to decide whether to leave the plants in the field and hope for the best or cut them for hay. This decision depends on the stage of growth and condition of the plant.⁵ Plants with 30 percent of the leaves still attached, may be considered for hay. These plants can produce 0.75 to 1.25 tons dry matter per acre with 13 percent protein and 48 percent in-vitro dry matter digestibility.⁵ If adequate rainfall occurs and photosynthate is available after R5, the plant may compensate for earlier losses by producing larger seeds (within its genetic capacity).³ Once the plant reaches R6, pods are not normally aborted. Managing stress from insect, disease, or nutrient sources can also help reduce the overall stress load on the plant and potentially limit yield losses.

Summary

Floral abortion, reduced pod number, and fewer seeds are the result of drought stress on soybean plants during flowering and early pod fill. A management decision should be made when leaves start to curl and defoliate but based on the condition and growth stage of the stressed plants.

Sources: ¹Wright, J., Hicks, D., and Naeve, S. 2006. Predicting the last irrigation for corn and soybeans in Central Minnesota. University of Minnesota, Minnesota Crop eNews. ²Lenssen, A. 2012. Soybean response to drought. Iowa State University. <https://crops.extension.iastate.edu/>. ³Hall, R.C. and Twidwell, E.K. 2002. Effects of drought stress on soybean production. South Dakota State University. ExEx8034. ⁴Desclaux, D., Huynh, T.T., and Roumet, P. 2000. Identification of soybean plant characteristics that indicate the timing of drought stress. Crop Science. Vol. 40:716-722. ⁵Roozeboom, K. 2011. Drought-stressed soybeans means decisions for producers. Kansas State University. Web sources verified 9/4/2018. 140716020902

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