MISSISSIPPI SOYBEAN PROMOTION BOARD
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FINAL REPORT

Title of Project: The effect of silicon on the growth and yield of soybean grown on nonirrigated sites

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EXECUTIVE SUMMARY

About 50% of Mississippi soybeans are grown on dryland or nonirrigated sites; thus, these soybean are more susceptible to yield loss from drought stress. Therefore, there is a great need to develop production systems to maintain consistent yields of soybeans grown on these sites across years.

Silicon (Si) has recently been recognized as an important element in plant nutrition, and has been associated with biomass production, cell wall integrity, and increased drought tolerance in crop plants. Possible physiological mechanisms behind increased drought tolerance from silicon application include reduced water loss through stomatal and cuticular transpiration, and increased water use efficiency.

In the soil, the total silicon content may be large, but the amount of soluble silicon (silicic acid) available for plant uptake is limited. Plants take up soluble silicon into their tissues, but it is not returned to the soil through biodegradation. Thus, continuous cropping of land can cause deficiency of soluble silicon in the soil.

Because of the beneficial effects of silicon on crops described above, silicon application to soil may prove to be a strategy that will improve the growth and yield of soybeans grown on dryland or nonirrigated sites. The objectives of this research were to determine 1) if silicon application to soil benefitted soybean plant traits associated with increased drought tolerance, and 2) its effect on seed yield of soybean grown on nonirrigated sites.

Studies conducted for this project showed that soil application of potassium silicate 1) can improve vegetative growth of soybean via increasing the water use efficiency of plants growing under water-limiting conditions, 2) silicate application can improve soil moisture retention under water-limiting conditions, and 3) silicate application to nonirrigated field sites can increase seed yield of soybeans grown on those sites.

The cost of the potassium silicate product used in this study is prohibitively expensive to use in dryland soybean production systems. However, alternate sources such as rice husk ash and blast furnace slag are being explored for use in these environments to obtain the same benefits as those found in these studies.