



Article

Effect of Biochar and Irrigation on the Interrelationships among Soybean Growth, Root Nodulation, Plant P Uptake, and Soil Nutrients in a Sandy Field

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Abstract: To investigate the interrelationships among biochar, soil nutrients, and soybean plant growth in more detail, the root nodulation response of soybean (*Glycine max* L.) to biochar application was analyzed in a field study. We further examined the biochar effect on soil phosphatase activity to elucidate the relationships among biochar, phosphatase activity, and plant phosphorus uptake. Soybean was planted in a sandy field wherein the biochar and irrigation conditions were considered the two treatment factors. In our result, irrigation increased the pod number and plant height by 20.7% and 11.1%, respectively. Irrigation reduced the shoot and root dry matter content by 67.9% and 75.1%, respectively. The nodule number increased by 37% due to biochar addition under irrigated conditions. The soil carbon concentration was elevated by 13.4% with biochar application under rainfed conditions. Acid phosphomonoesterase (APM) was increased by 21.8% in the biochar-incorporated plots under the irrigated condition. Principal component analysis and redundancy analysis suggested that biochar application enhanced the relationships between the nodule number and soil potassium and magnesium concentrations. The correlation between soil sulfur content and nodule number was eliminated by biochar application. APM activity was associated with higher shoot and root phosphorus content and shoot dry weight after biochar application.

Keywords: biochar; irrigation; phosphatase activity; soybean root nodulation; redundancy analysis