Public Abstract

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Title:EFFECTS OF DEEP VERTICAL PLACEMENT OF LIME ON CORN AND SOYBEAN RESPONSE AND SOIL CHEMICAL PROPERTIES IN CONSERVATION TILLAGE SYSTEMS

Central claypan soils utilized for corn (Zea mays L.) and soybean (Glycine max (L.) Merr.) production often have been managed to have adequate surface pH for crop growth, but the presence of acidic subsoils may limit crop production. Subsoil acidity may inhibit root growth leading to decreased drought tolerance and grain yields. A lime application can increase soil pH, improve soil structure and provide calcium and magnesium to the soil, but surface amendments that often occur in no-till systems rarely affect the subsoil, resulting in potential chemical and physical barriers to root growth. Surface applications of gypsum also may alleviate aluminum toxicities in acidic soils, increase calcium levels, and alter soil properties in the subsoil. The objective of this study was to determine the effects of surface and deep vertical placement of lime and gypsum at several application rates on corn and soybean plant growth and yields in a conservative tillage system. Field trials were conducted from 2012 to 2014 in Northeast Missouri with treatments of lime (0, 3.4, and 6.7 Mg ha-1) and gypsum (0, 2.9, and 5.2 Mg ha-1) broadcast on the soil surface or applied as a deep vertical band to a depth of 51 cm. When precipitation was below average, compared to control plots, deep vertical placed lime at 6.7 Mg ha-1 significantly raised corn yields by 1.3 Mg ha-1 four years after treatment for Trial #2, of which had the lowest initial pHs of the trials. In years with adequate moisture, no significant increases in corn yield were observed with deep lime placement treatments compared to control plots. Treatments of lime had a greater effect on corn yield than soybean. Deep vertical placement of lime resulted in no significant increase in soybean yield compared to the controls for all trials. Inconsistent results for corn and soybean yields from gypsum treatments made it unclear on the benefits of adding gypsum. Longer observation time may be needed to fully evaluate the effects of these treatments. Soil pH results indicated that the top 13 cm of soil was not affected by deep lime placement, but at depths of 13 to 25 cm soil pH increased up to 0.6 and 0.7 units for deep vertical placed lime at 3.4 and 6.7 Mg ha-1 respectively. When compared with control treatments, vertical placement of lime at 3.4, and 6.7 Mg ha-1 increased subsoil pH at depths of 13 to 25 and 25 to 38 cm, respectively one year after application. A similar comparison with the control treatment indicated that deep vertical placement at 6.7 Mg ha-1 increased subsoil pH at 13 to 25 cm depths by 6.5 and 5.7% two and three years after application, respectively. No differences in soil pH were observed 38 to 51 cm deep in the soil profile one, two, or three years after application. Analysis of the spatial distribution of soil pHs and neutralizable acidity in the soil profile indicate penetration of liming effects up to 38 cm into the subsoil but showed slight evidence of movement away from the initial vertical placement band over a seven-month period.