Topsoil thickness is a major contributing factor to variability in corn and soybean yield, profit, and nutrient dynamics on claypan soils. Understanding how and when topsoil thickness affects these factors is crucial for improving management on these challenging soils. Targeted placement of perennial crops grown for bioenergy, such as switchgrass, and accounting for local variation in nutrient requirements could improve overall productivity, and ultimately profitability in the region. Therefore, studies were conducted on a claypan soil to compare the productivity and economics of corn, soybean, and switchgrass production and to determine if phosphorus and potassium management could be improved by accounting for topsoil thickness. Research was conducted in Columbia, MO from 2009 to 2016 on areas with differing topsoil thickness representative of those found on typical Midwest claypan landscapes. Results indicated, in general, that switchgrass yield and economic return was more stable than corn or soybean at very shallow topsoils. However, due to the low market value of bioenergy switchgrass, it was unable to surpass soybean, but was able to produce greater profits than corn on very shallow topsoils. Results also found that the amount of fertilizer needed to raise and maintain soil test levels decreased for phosphorus, but increased for potassium as topsoil thickness increased. This information will aid producers in deciding where to place corn, soybean, and switchgrass on the landscape, as well as how to increase fertilizer efficiency on claypan soils.