A Method to Estimate the Percentage of Calcined Clay in a Baseball Infield Mix

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Introduction

Baseball infield mixes are often amended with inorganic materials such as calcined clay due to their ability to increase the moisture retention and porosity of a soil profile. Some field managers also use calcined clay for aesthetic reasons. During athletic field construction, rootzone mixes are often amended with similar inorganic amendments to increase both the total and capillary porosity of the rootzone (Bigelow et. al, 2004). Amendments can be incorporated into a soil with a high level of precision prior to construction. However, there is no method to measure the amount of inorganic amendment in a soil mix after it has been installed in the field.

Objective

Develop a method to estimate the percentage of calcined clay in a baseball infield mix.

Materials and Methods

Twenty one different baseball infield mixes were constructed for this project. Diamond Tex Professional infield mix (Diamond-Tex, Inc., Honeybrook, PA 19334) served as the principal component for all the mixes. Soil textural analysis according to the methods of ASTM 1632 (ASTM, 2005) indicated that Diamond Tex Professional infield mix measured approximately 50-60% sand, 25-35% silt, and 10-25% clay. Calcined clay (heat treated, 865°C, illite clay, 74% SiO_2, Profile Products Corp., Buffalo Grove, IL) was blended into the Diamond Tex Professional infield mix at twenty one different rates, ranging from 0% (v/v) to 100% (v/v) in increments of 5%. Thus, creating twenty one different baseball infield mixes.

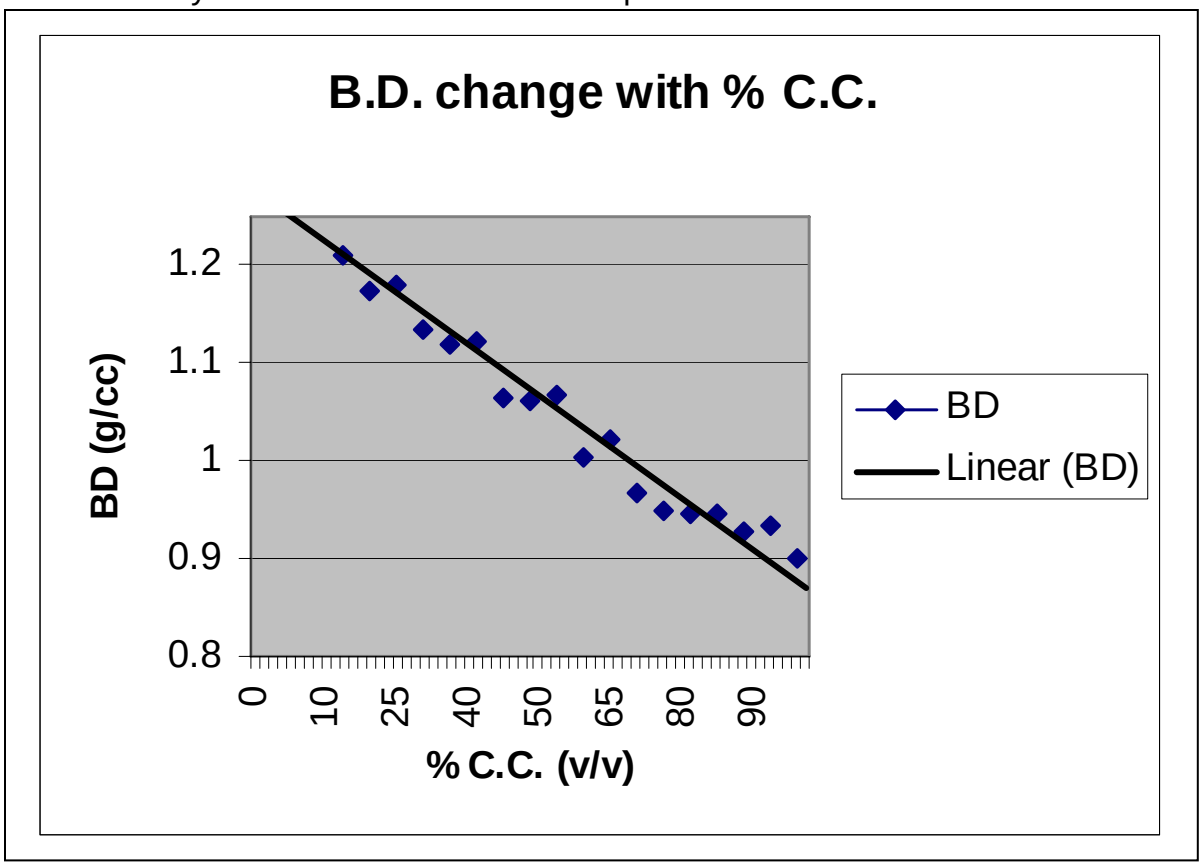
Three sub-samples of each Diamond Tex – calcined clay infield mix were measured for loose bulk density in a graduated cylinder. The mean bulk density for the three sub-samples was then plotted (Figure 1). This created a scale which measured the change in bulk density that corresponded with increasing calcined clay content.

Results

The relationship between loose bulk density and calcined clay content was significant ($p < 0.001$). A regression equation was developed to estimate the percentage of calcined clay in a baseball infield mix using measurements of loose bulk density. That equation can be seen below. The R^2 value for this equation was 0.9754

$$\% \text{ Calcined Clay} = 315.43 - 247.52 \times \text{Loose Bulk Density}$$

Figure 1: Linear relationship between loose bulk density and the percentage of calcined clay in baseball infield mixes comprised of Diamond-Tex Professional



Conclusion

A method was developed to estimate the percentage of calcined clay in a baseball infield mix. Measuring the loose bulk density of a sample in a graduated cylinder and using the regression equation, one can estimate of the percentage of calcined clay present in the sample. The relationship between loose bulk density and calcined clay content was linear, with bulk density decreasing with increased calcined clay content. Previous research supports this relationship (Bigelow et. al, 2005)

The regression equation is not applicable to soils containing very low percentages of calcined clay, as it will generate negative values. This may be due to the fact that only one soil was used as the principal component for each mix. Additional research is needed using more soils and different amendments in order to develop a more accurate model for estimating the percentage of calcined clay in a baseball infield mix.

References

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Bigelow, C.A., Bowman, D.C., and D. K. Cassel. 2004. Physical Properties of Three Sand Size Classes Amended with Inorganic Materials or Sphagnum Peat Moss for Putting Green Rootzones. Crop Science. 44 (3): 900-907