**Summary**

On an attempt to explore the multivariate spatial structure of soil acidity data, the variables Calcium (Ca), Magnesium (Mg), active acidity (pH) and potential acidity (H+Al) were measured by 204 soil samples collected 0-20 depth from a 60 m regular grid on a corn/soybean crop at Aragauari-MG, Brazil. They were chemically analyzed as well. Under scope of Linear Model of Correlation (LMC), direct and cross variograms were modeled with a nugget effect and a spherical model at 451.28 m range, analyzing coregionalization structure among soil acidity variables, in parallel with Principal Component Analysis (PCA) of this analysis captured acidity in two different scales. The model proposed estimated by co-kriging was filtered, once interested on long range variability. The filtering process removed the frequencies present in the nugget effect, resulting in a more continuous map of the acidity phenomenon on this soil.

**Introduction**

Soil acidity is a frequent problem in tropical soils, which affects major agricultural crops. The main effect of high acidity is the availability of Aluminum (Al) on soil, which is toxic to plants. Aluminum represents a serious problem in natural acid soils and in soils acidified by human activity. Much attention has been paid to the determination of the content of soluble aluminum on soil, and pH is generally the most important indicator of the aluminum availability, acidity and mobility. However, simple practices like line application can solve that problem, making Al unavailable to most, besides providing Calcium (Ca) and Magnesium (Mg) to plants.

A high number of variables in this process, a lot of factors are involved in this process, by soil handling human factor) by type (pedofactorial). Some factors which govern soil variations have a short range action, whereas others operate at a larger scale. As a result, soil acidity can be expected to be correlated in a way that is scale dependent (Castignanò et al. 2000). The methodology of soil factorial analysis (PCA) was developed by Nathan (1982) and used to model the correlations among the soil physical and chemical properties at each of the different spatial scales. This work had as objective study the spatial variability of soil acidity at a precision farming field in central Brazil and show plausible explanations for their distributions among different scales.

**Results and discussions**

Under scope of Linear Model of Correlation (LMC), direct and cross variograms were modeled with a nugget effect and a spherical model at 451.28 m range, analyzing coregionalization structure among soil acidity variables, in parallel with Principal Component Analysis (PCA)

A first attempt at these variograms and the cross variograms suggested the presence of three basic components at different spatial scales. The first observed structure was pure nugget variance, not accounted for in the within the smallest sampling interval 60 m. The second structure reflected a transitive process of plate-size range, approximately 300 m. The third structure seemed bounded at the scale of study. It could be represented either by an unbounded variogram or by a transitive model with a longer range, approximately of 1500 m. In this case PCA analysis revealed that this structure didn’t have a nugget effect due to measurement errors and micro-variation within the smallest sampling interval 60 m. The third structure seemed unbounded at the scale of study; it could be represented either by an unbounded variogram or by a transitive model with a longer range, approximately of 1500 m.

**Table 1. Structural correlation matrices for each spatial scale.**

<table>
<thead>
<tr>
<th>Spatial scale</th>
<th>Ca-H+Al</th>
<th>Mg-H+Al</th>
<th>pH-H+Al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nugget effect</td>
<td>0.817</td>
<td>0.583</td>
<td>0.583</td>
</tr>
<tr>
<td>Spherical model</td>
<td>0.7357</td>
<td>0.8146</td>
<td>0.7925</td>
</tr>
<tr>
<td>Experimental field at Araguari(MG)-Brazil</td>
<td>Fig. 1. Sample scheme (60m regular grid)</td>
<td>Fig. 2. Principal components results for nugget effect and spherical model at 451.28 m</td>
<td></td>
</tr>
</tbody>
</table>

**Proceeding**

The model proposed estimated by cokriging was filtered, once interested on long range variability. The procedure allow visualize the interest features, removing discontinuities (pedological factor). Some factors which govern soil variations have a short range action, whereas others operate at a larger scale. As a result, soil acidity can be expected to be correlated in a way that is scale dependent (Castignanò et al. 2000). The methodology of soil factorial analysis (PCA) was developed by Nathan (1982) and used to model the correlations among the soil physical and chemical properties at each of the different spatial scales. This work had as objective study the spatial variability of soil acidity at a precision farming field in central Brazil and show plausible explanations for their distributions among different scales.

**Conclusion**

Multivariate geostatistical analysis has allowed separating the different sources of spatial variation at different scales. This method has offered ways for formulating hypotheses about the probable sources of soil variation, resulting in a better understanding of the dynamics of additional factors and separating their effects on final map results and removing noise at high frequencies. That is a possible way to treat problems like discontinuities resulted by sample schemes or nugget effects. These techniques have great potential to explore phenomena over chrono and toposequences, landscapes, watersheds and drainage basins.