Comparison of soil mapping and EC results in salty chernozem soil

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Introduction

One of the main advantages of precision agriculture that it utilizes the differences within a field, and allows differentiated input usage in seeding, fertilizing and plant protection. In order to measure those in-field differences, adequate input data are needed, which can come from yield mapping, soil sampling, soil scanning, and drones or satellite images. Soil scanning is a way to determine the relative in-field differences and helps to define the management zones for variable input doses and soil sampling areas. Soil scanning has an advantage compare to soil sampling by producing several hundred data /hectare compare to regular 5ha / soil sample, but it can measure only relative differences. The most frequent sensors are Electric Conductivity (EC) organic matter (OM), soil pH and towing resistance. The soil EC is correlated with several soil attributes like humidity, cation exchange capacity, salt content, sodium content, soil compaction. In this study the soils sampling and EC data were compared determining the main influencing factors and correlation on the examined field. (Smuk, 2017; Sinfield et al. 2010).

Materials and methods

The examined field is 27.5 ha in area, the soil type is chernozem, the physical characteristics is loam, with 3 major salt spots (one the western side). The field is situated in the west side of Hajdúsági loess plateau. The field is irrigated and usually sweetcorn and green peas are sown there. The soil sample were collected in autumn 2017 from the top 30 cm layer. The distribution of the 3 hectares plot sizes were defined on the basis of satellite images – total 9 average samples.

The soil scanning was done in by VERIS U3 deceive with EC, OM and pH sensors in April 2018 before fertilisation and sowing. Prior to soil scanning the tillage was sub-soiling (with ~ 45 cm depth) and field cultivator / chisel plough on November 2017, therefore the effect of different soil compaction due to tillage mistakes influencing the EC readings was minimized. The equipment was towed by tractor, the swath distance for measurement was 10 metres. The scanning was conducted in one direction, diagonally to the cultivation; the field boundaries were scanned in 2 parallel lines 5 and 15 metres from the edges. The driving of the tractor was assisted by a GPS guidance monitor with 30 cm on-path accuracy with EGNOS DGPS correction. The spatial data analysis, map generating were done with the help of Surfer and QGIS software.

Results and discussion

The field sample values verified the assumption that in this particular field the sodium content was the major factor for the elevated EC values. The map in Figure 1 shows the sodium ion and EC distribution in the examined field.

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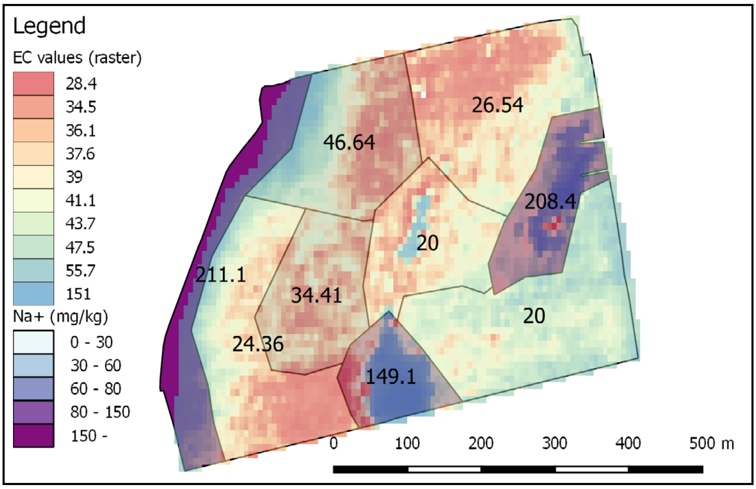

*Figure 1: The distribution of Sodium (Na) and EC (*Source: own editing*)*

The total salt content was in between 0.04-0.09% with low salt contend and mildly saline; the higher values corresponded with higher EC readings. The Arany coefficient was in the range of 40 to 46 values, with a loam and clay-loam, and that showed slight correlation to EC values. Though the elevation difference was only 2.5 metres in the field, this also shows connection to EC values – mostly due to different water content and sodium accumulation. The diagonal northeast-southwest red swath in EC map was also the highest elevation points in the field.

Conclusions

The salt spots and the elevation difference were the main in influencing factors in EC measurement. However, in different fields, different factors may be the major to influence to the EC results. The results showed that the plot boundaries could have been slightly different if it would be sampled according the EC readings.

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