SPATIAL VARIATION PATTERNS OF SOIL PROPERTIES AND WINTER WHEAT GROWTH PARAMETERS IN CHINA NATIONAL EXPERIMENT STATION FOR PRECISON AGRICULTURE

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SUMMARY

Spatial distributions of soil properties, winter wheat growth and yield were measured in a approximately 50-ha. field in China National Experiment Station for Precison Agriculture located in Xiaotangshan Town, Beijing City since the year of 2002. The following results are obtained.

1. Soil survey was conducted in 2002 and it was discovered that the soil profiles in the field are usually composed of A_p, A_b, B_k, and B_g horizons. Buried A horizon is widespread in the field. Calcic horizon is also popular in the field. In the southwestern part of the field, the calcic horizon is shallow, while in southeastern part of the field there exists no calcic horizon within 1.5m from soil surface. It is supposed that the productivity of soil is negatively related to depth of the calcic horizon.
2. When using EM-38 to collect soil EC distribution in March 23, 2010, distribution measured by the two modes, i.e., horizontal and vertical dipole modes, were distinctively different. In vertical mode, northern parts of the field has lower EC than southern field, indicating a lighter texture in northern parts than in the southern parts of the field. With horizontal mode, western field has a larger value than eastern field, indicating lighter soil texture in upper layer of eastern part, especially northeastern part of the field. Values measured with vertical mode were mostly larger than those by the horizontal mode, indicating heavier soil texture in deep layer than in upper layer of the soil profile.

3. Averaged clay content within 1.5m depth from soil surface was calculated and correlated with EC measured with vertical dipole mode. The coefficient of determination is 0.6074 in 29 measured points with positive correlation. The averaged clay content of 1.m depth from soil surface is negatively correlated with EC measured with horizontal dipole mode, with a coefficient of determination equal to 0.6862. Correlations of silt content with Ec values are relatively poor.

4. When relating the EC value with the depth of upper boundary of the calcic horizon of soil profile, the EC measured with the vertical mode is positively correlated with the depth of upper boundary of the calcic

horizon, with a coefficient of determination of 0.7197, while the EC measured with the horizontal mode was negatively correlated with the depth of upper boundary of the calcic horizon, with a coefficient of determination of 0.5193. The upper boundary of calcic horizons are usually within 70cm from soil surface in the western parts of the field, while in eastern parts of the field, upper boundary of calcic horizon is usually bellow 80cm from soil surface, with large area in eastern parts of the field without obvious calcic horizon within 1.5m from soil surface. The depth of buried A horizon is independent of soil EC.

5. The spatial distribution pattern of total soil nitrogen, plant available soil nitrogen, plant available soil phosphate and plant available soil iron is similar to the spatial distribution pattern of EC measured with vertical dipole mode, in that the low values of these soil nutrients and soil EC distributed in the northern parts of the field. The spatial distribution pattern of plant available soil potassium is opposite to the pattern of the other soil nutrients andsoil EC.

6. Yield maps since 2002 were compared with EC map measured in march 2010. The spatial pattern of yield maps in 2008 and 2009 were parallel to the spatial pattern of EC measured with horizontal dipole mode in March 2010, with high EC values and low yield in the western part of the field, and low EC values and high yield in th eastern part of the field. The spatial pattern of yield map in 2002 was similar to the EC distribution measured with the vertical mode, with high yield and high EC in the southern part of the field, and low yield and low EC in the northern part of the field. Yield maps of other years are more or less independent of EC distribution because of field experiment treatments in those years.