

## 12. Optimizing the thickness of mineral soil deposits on fly ash and coal gangue for agricultural reclamation - conceptual approach and preliminary results from Huainan (China)

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### Abstract:

Hard coal mining results in subsidence of land surface. Thus, former agriculturally used terrestrial soils are converted into water submerged soils. The land losses are partly compensated by depositing residues of hard coal mining (e.g. coal gangue) or coal fired power plants (e.g. fly ash) onto these areas. It is suspected that unfavorable soil water balances, a lack of available nutrients or phytotoxic element contents persist. Low yields due to limited plant growth may be the result. Consequently, it is recommended to cover the residues by natural mineral soil (topsoil). Following the approach of sustainable land use, the consumption of topsoil should be restricted to the necessary degree.

Therefore, this study aims at the development of a concept to decide upon the optimal thickness of topsoil oriented towards adequate yields.

The field and lab analyses are conducted to assess the potential plant growth. The investigated sites are located at subsidence and wetland areas in the vicinity of the industrialized hard coal mining region of Huainan city (Anhui Province, China). They are reclaimed by topsoil deposits of different thicknesses overlaying coal gangue or fly ash. Each investigated site covers an area of 2.5 ha and is cultivated with wheat.

To localize the spatial distribution of the actual thickness of the topsoil a soil survey is conducted using a push probe (1 m). Three classes of thicknesses are distinguished: low (< 50 cm), medium (50-70 cm), high (> 70 cm). For each class three replicates of test plots are marked on site. Bulk samples are taken at the A- and C-horizon of the topsoil and the C-horizon of the residue (coal gangue or fly ash), respectively. The soil samples are measured for pH and EC. The plant available and total nutrient contents (N, P, K, Mg), the organic carbon content as well as the heavy metal contents (As, Cd, Cr, Cu, Ni, Pb, Zn) are analyzed according to Chinese and German standard methods.

The water balance parameters are assessed based on the soil description of one site representative soil profile. Especially the penetration and density of roots are observed. Moreover, bulk density samples (100 cm<sup>3</sup> soil columns) are taken in five replicates per horizon.

Finally, the wheat biomass is harvested at three subareas at each test plot at the same time. The weights of stem and corn are recorded separately.

Because the research is in progress, detailed conclusions about nutrient and element status can be drawn after finishing the analyses of the above mentioned soil and plant parameters. Initial results on the thickness of the topsoil layers are obtained according to the soil survey. It ranges between 40-90 cm at the coal gangue site and 30-70 cm at the fly ash site. Pre-tests of element analyses prove a low level of heavy metal content.

**Keywords:** topsoil thickness, subsidence areas, agricultural reclamation, fly ash, coal gangue

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