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A proposal for environmental requirements for the application of coal ash in agriculture¹

Existing environmental requirements

- Fly ash
 - The use of fly ash to stabilize and improve soils will be approved only after conducting a fly ash - soil interaction analysis in order to estimate the release of trace elements from the ash into the soil and their mobility and availability. In addition, the concentration of the trace elements in the agricultural products should meet the requirements of the Food and Nutrition Services of the Ministry of Health.
- Bottom ash
 - The use of bottom ash in growth media for plants will be permitted if the ash meets the requirements of the compliance tests for usable ash and if the concentrations of trace elements in the agricultural products meet the requirements of the Food and Nutrition Services.²

Proposed environmental requirements as derived from research findings:

- Fly ash as an additive to soil³
 - In view of groundwater susceptibility, addition of fly ash will be permitted subject to criteria similar to those defined for the use of ash for soil improvement in infrastructure works.
 - Based on the assumption that the concentrations of trace elements in the ash do not exceed those defined as an upper limit for nonhazardous materials by the European Union criteria, the maximum quantity of fly ash that can be added to soil on which crops sensitive to boron are grown in the same year as the ash application is calculated by the Keren model⁴. For 10 cm incorporation depth the limits of application are:
 - * 0.25 T/dunam⁵ in soils with up to 20% clay content
 - * 0.5 T/dunam in soils with 20%-40% clay content
 - * 1.0 T/dunam in soils with a clay content of 40% and higher

¹ As a soil additive and a growth medium for plants. The application of coal ash in animal litter will not be discussed here.

² Authorization was granted by the Ministry of Health for annual plants.

³ The conditions are related to one time application. Additional applications in the future will require a separate consideration. Application in areas susceptible to floods and soil erosion requires site specific assessment.

⁴ [Keren model for simulating boron adsorption by soils, clays and Al- and Fe oxides.](#)

⁵ Dunam = one tenth of a hectare.



The above values were calculated for the crops most sensitive to boron (such as citrus), where the fly ash is applied only to the upper 10 cm of the soil and the pH of the soil solution is 7.5. The amount of fly ash per unit area of soil can be increased linearly with the depth of the soil layer to which the fly ash is applied. The amount of the applied fly ash can also be increased for more boron tolerant crops as well as at higher pH values. At higher pH values, the adsorption capacity of the soil for boron increases and the boron dissolution rate from fly ash decreases. The crop's root architecture should be taken in account as well. Higher fly ash application rates can be allowed in the upper 10 cm of the soil if the roots reach deeper.

Under these specific conditions it is possible to calculate the allowed amount of fly ash using the Keren model⁴.

- In all cases the concentration of the trace elements in the agricultural products grown on soil-fly ash mixtures should meet the requirements of the Food and Nutrition Services.
- **Bottom ash as a plant growth medium**
 - The existing requirements will remain in effect.

Documents of the professional-scientific team in 2009 workshop:

- [Discussion Platform](#)
- [Discussion Protocol](#)
- [Link to the background material of the discussion \(Session E3 in the workshop page\)](#)