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Use of Coal Bottom Ash as a Component of Growing Media

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Abstract

Intensified use of coal in power plants in Israel and the USA has created a problem of disposal of the ash generated. Bottom-ash remains at the bottom of the coal fired boiler after combustion. This is a relatively coarse, gritty material, which has the potential to serve as a component in growing media, in contrast to the fly ash that consists of very fine particles.

The physical and chemical properties of bottom ash from power plants in Israel were characterized and compared to those of volcanic ash (tuff), which is a widely used as container (growing) medium in many countries. Bottom ash particles were found to be stable under irrigation regimes usually employed during the growth period of vegetables and ornamentals in greenhouses in Israel. Particle size distribution of bottom ash originating from power plants contains a large amount of small particles that should be removed prior to use in growing media. Bottom ash that has been sieved exhibited a low level of water content under a tension of up to 100 mBar and a high percentage of air space. Addition of compost, produced from separated cattle manure (CSM), improved the water to air ratio and shifted it to agronomical desired levels.

Bottom ash was found to contain a low level of plant nutrients and like tuff, adsorbed phosphorous (P) from nutrient solutions. The addition of compost increased P content of the solution. However, further addition of fertilizers was needed to maintain optimal levels of nutrients for plant growth.

Analysis of the water extracts and plant canopy and fruit tissue for toxic elements showed no hazardous levels for humans or plants. Tissue analysis of plants grown in a mixture of coal ash and CSM, contained levels of heavy elements similar to those found in plants grown in tuff based media. In fact, leachates obtained from pots containing these mixtures met the WHO standards for heavy metals in drinking water.

Small scale experiments (growth chamber, research greenhouses) as well as commercial greenhouse trials in which coal ash mixtures with CSM has been used, have shown successful growth and high quality and quantity yields of melon, pepper, tomato, basil, cabbage, lettuce, carnation and croton. Addition of coal ash as a side dressing under the dripper line in vineyards greatly enhanced grape yield while maintaining grape quality.

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