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Does Sugarcane Bagasse Ash Modify Soybean Growth and Development?

VITALIJ DOMBINOV¹, SILVIA SCHREY¹, JOACHIM WERNER ZANG², MICHELLE WATT¹, NICOLAI DAVID JABLONOWSKI¹

¹*Forschungszentrum Juelich GmbH, Inst. of Bio- and Geosciences: Plant Sciences, Germany*

²*Federal Institute of Goiás IFG, Sustainable Process Technologies, Brazil*

Abstract

After extraction of sugarcane juice, the remaining fibrous material, so-called bagasse, is burned for energy production resulting in bagasse ash. Bagasse ash is poor in nitrogen (N) but still contains varying amounts of other plant-nutrients, including phosphorus (P) and potassium (K). In between sugarcane rotations, N-fixing cover crops like soybeans are planted to increase soil N-content and to reduce the need for subsequent N fertilisation. Since soybean does not rely on mineral N, bagasse ash has the potential of serving as a fertiliser. Here we study the bagasse ash effects on soybean growth and development.

In our analyses, soybeans inoculated with Rhizobia were cultivated under greenhouse conditions for 56 days. Nutrient poor substrates were homogeneously mixed with eight doses of bagasse ash (between 0 and 30 g ash/L substrate) and the control treatments contained identical amounts of P and K, in form of triple superphosphate and potassium sulphate, as supplied by bagasse ash. After harvesting, plant biomass was determined and stems, petioles, leaflets, pods, roots and nodules were analysed with regards to morphology and N, P and K contents.

The results show that bagasse ash P and K are less plant-available than from the traditional fertilisers. Soybeans growing on bagasse ash treated substrate responded by morphological plasticity. Furthermore, the N content of bagasse ash treated soybeans significantly decreased compared to traditional fertilisers and this was probably a result of significantly decreased nodules activity. Thus, the application of bagasse ash increased the plant biomass, modified the plant plasticity and reduced the activity of N-fixing Rhizobia.

Keywords: Dose-response experiment, ICP-OES analyses, nodule activity, non-invasive plant phenotyping, phosphorus and potassium plant-availabilities, plant plasticity, soybeans, sugarcane bagasse ash