

Practice SQ n° 14

BIOASHES FOR ADVANCED AGRI-FOOD PRODUCTION & SOIL FERTILITY

Introduction

Category: Good practice (GP)

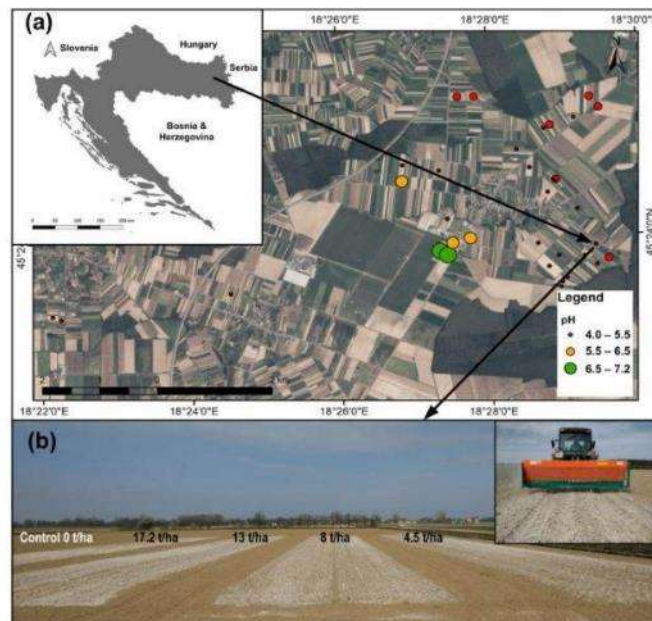
Practice identity card

#Bioash, pedological survey

#SQ, Food, feed, fibre ,oil, industrial, Good practice (GP), Croatia

Short description

- The utilization of bioashes in Croatia presents a valuable opportunity for sustainable disposal and agroforestry applications. These alkaline by-products, derived from forest biomass plants, can effectively address the challenge of acidic soil (pH < 6) by enhancing soil fertility and reducing the need for mineral fertilizers and commercial conditioners.
- At the beginning of the project, we analysed the needs and key goals were identified - to prove the usability of using ash from the biomass thermal power plant for the purpose of improving agricultural production



and the fertility of agricultural areas on acidic and poorly supplied soils with P, K and other macro-/micro-elements. Soil samples were taken from partner-managed plots for initial screening and analysis of pH, P, K, and humus content. Detailed pedological research was conducted on selected plots, including morphological analysis and physio-chemical laboratory analyses. A 2-year field experiment with bioash treatments was carried out, monitoring soil changes, microbiology, and crop yield. Over 400 soil samples were analyzed for physical-chemical and microbiological properties. Plant material was also tested for yield and nutrient content.

- Through years of extensive research in both field and controlled settings, the project has investigated the impact of different bioash doses on physico-chemical and microbiological properties of acid soils, as well as the qualitative and quantitative parameters of agricultural crops. The project resulted in increased soil fertility and innovative products for soil amelioration, recognized with awards for sustainability and waste management.

Implementation process

Which practice is considered as the standard in this region? Conventional agricultural practice, which include using of mineral fertilizers and pesticides.

What was the on-farm issue/challenge/opportunity that led to the implementation of the practice? Acidic and poorly supplied soils with P, K and other macro-/micro-elements.

How long did it take to implement the practice and which are the measures needed to monitor: A 2-year field experiment with bioash treatments was carried out, monitoring soil changes, microbiology, and crop yield.

Logistics

- **Logistic aspects to consider:** The original form of biomass ash is a fine, powdery substance with a highly alkaline nature. As such, its application in the field requires specialized equipment designed for handling dusty materials. To ensure safe and effective use, application should be conducted on windless days to minimize the risk of dispersion and potential environmental impact.
- **Skill/education level required:** rather high

Agronomical traits

- **Can the practice be applied to a multitude of cultivation techniques?** Yes, the project is based on the implementation of several years of research activities in the field and under controlled conditions, where the influence of the application of different doses of bioash on physico-chemical and microbiological changes in acid soils as well as qualitative-quantitative parameters of agricultural crops will be studied. The project will also lead to the development of new bioash-based products with the potential for wider application in the chemical remediation of acidic soils. It can be applied to a multitude of cultivation practice.
- **Targeted crop categories:** Food, feed, fibre, oil, industrial
- **Soil types suitable for the practice:** clay, loamy
- **Expected effect on crop yield:** increase
- **Expected effect on crop yield variation:** similar
- **Expected effect on crop quality:** similar
- **Expected effect on crop quality variation:** similar
- **Which costs may increase due to the practice?** transportation
- **Which costs may decrease due to the practice?** fertilizers, pesticides
- **Expected long-term/indirect economic benefits of the practice:** Reduction in the use of conventionally expensive soil conditioners and mineral fertilizers: the use of biomass ash can reduce the need for the use of expensive soil conditioners and mineral fertilizers, resulting in a reduction of production costs and the negative environmental impact associated with the production and application of mineral fertilizers and the promotion of sustainable practices in the agricultural sector. The development of effective and sustainable soil amelioration strategies, including the recycling of potentially valuable waste materials (accumulation in world ~ 700 Mt/year, EU ~15.5 Mt/year in Croatia ~100 000 t/year), could offer a more sustainable approach compared to certain commercial products used for soil fertility and crop performance in acid soils.
- **Expected effect on the leaching of nutrients:** The application of biomass ash effectively ameliorated the acid and nutrient-deficient soil, leading to a substantial increase in soil pH and

concentration of key nutrients (P, K, Ca), without soil contamination.

- **Specific materials applied through the practice:** Industrial waste, agriculture residues

Administrative context

- **Does the practice qualify for subsidies?** Yes
- **Status of the legal framework that regulates the practice:** existing, however with gaps
- **Are there any policy barriers complicating the practice's application?** Yes. There is no regulation in terms of application (which dose of bioash, how many times during some time, etc.)
- **Does the practice involve the use of hazardous substances?** It is important to emphasize the inherent diversity of biomass ash matrices, which are influenced by numerous factors. Specifically, the physicochemical composition of bioash matrices depends on: i) the type of ash,
- ii) the biomass source, iii) combustion parameters, iv) post-combustion. It's important to analyze physicochemical properties of biomass ash to confirm that the levels of organic pollutants (e.g., PAHs, PCBs) and potentially toxic trace elements (e.g., Cd, Mo, Pb, Hg, As, Cr, Co) in the tested bioash are below the maximum permitted concentrations for agricultural soil application.
- **Is the practice compliant with EU organic farming practices?** Yes, it is. Our study addresses significant knowledge gaps by exploring the unique potential of the bioash matrix in ameliorating acidic soils under field and organic farming conditions.
- **Are there any gaseous emissions to be considered upon application of the practice?** No
- **Greenhouse gas (GHG) reduction potential of the practice:** little or none
- **All features of the practice than may hinder its social acceptance:** dust
- **Expected effects from the practice on the time occupation of the farmer?** none
- **May the practice contribute to a better public image of agriculture?** Yes. Increasing soil fertility with less use of mineral P and K fertilizers and other commercial soil conditioners (various calcareous materials, fractions of limestone and dolomite) to neutralize acidic soils. Increasing the productivity and profitability of agricultural holdings. Encouraging innovation and application of new technologies in agriculture. Increasing awareness of the importance of sustainable agriculture and environmental protection. Creating preconditions for smart and competitive agriculture. Improving processes for environmental protection, adaptation and mitigation of climate change (application of biomass ash fits into the sustainable and efficient management of by-products from biomass power plants).
- **May the practice improve the farmer's self-image?** Yes. Project provides opportunities for farmers to enhance their skills, knowledge and experience in modern agricultural practices, with special attention to the sustainability. Their active involvement in the development and promotion of sustainable practices in agriculture has supported their career development in the field. Also, participation in the project enabled them to establish connections and partnerships with other experts and organizations and expanded the network of contacts.
- **Other relevant information:** The methods and technologies developed in the project can be applied in other areas of Croatia and abroad. The experiences and results of the project, as well as the developed innovative products, can be useful to farmers, researchers and interested stakeholders who face similar problems and challenges of managing biomass ash as a by-product for the purpose of improving soil fertility, with adaptations to the specific conditions and needs of a certain area. Also, the project can serve as a model and source of inspiration for the implementation of similar innovative solutions in other areas. Active participation and successful cooperation between universities, research institutions, farmers and rural stakeholders in research activities and application of results, that provided an opportunity for direct application of new knowledge and techniques in real environment, encouraging sustainability and local development.

Contact

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Eu member state: Croatia

Find out more

Source of information EIP-AGRI Project database

Additional info/links:

Bioashes for advanced agri-food production & soil fertility,

https://eu-cap-network.ec.europa.eu/projects/bioashes-advanced-agri-food-production-soil-fertility-ash4soil_en#tab_id=overview