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ANAEROBIC DIGESTATE AS A SUITABLE PLANT GROWTH PROMOTER IN SUB-ACID SOILS

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ABSTRACT

Biogas production is a suitable renewable alternative to fossil fuels and it is increasingly becoming of deep interest. One of the by-products of this process is the anaerobic digestate (AD), which can be obtained with an anaerobic digestion of animal or plants biomasses or with municipal waste, with different chemical properties and composition. From August 2012, Italian legislation has changed the definition of AD, and the rules for its use. Currently AD is classified as a by-product, instead of a waste. Many studies have assessed that, under controlled supply conditions, it has fertilising properties. Digestate can be used as a replacement for mineral fertilisers, reducing costs to farmers and minimising greenhouse gas emissions from cultivation.

The aim of this work is determining AD (methanogenic digestate, from anaerobic fermentation of swine manure, in which on average 80% of the total nitrogen is NH_4) effect on horticultural model plants with different protocols. Germination index has been assessed in pea (*Pisum sativum*) and phytotoxicity in water cress (*Lepidium sativum*). Shoot elongation and leaf chlorophyll content have been measured in lettuce (*Lactuca sativa*) and endive (*Cichorium endivia*), with a special attention for the fresh/dry weights ratio and for the roots/shoots ratio. In barley (*Hordeum vulgare*) the roots elongation and the radica inhibition indexes were determined by processing the average weights and lengths of roots. Germination and phytotoxicity were assessed by *in vitro* experiment in agarized media, while shoots and roots elongation was assessed in pot experiments on soil.

From left to right the effect on growth of tomato plants (San Marzano cv) with increasing AD concentration is shown

Additional tests were performed using other horticultural plants: tomato (*Solanum lycopersicon*, two cultivars), pepper (*Capsicum annuum*, two cultivars) and geranium (*Pelargonium zonale*, one cultivar). Four different concentrations of AD diluted in a nutrient solution were supplied in order to determine the effects on growth rate, total biomass, leaves chlorophyll content, number of flowers, fruit size, harvest index. Different types of soil have also been tested.

In the experiments with different types of soil, it was shown that the AD from swine manure, with pH 8.0-8.5, had the effect of soil liming. Therefore, it can also be used to adjust the pH of acid and sub-acid soils, besides providing a fertilising effect.

The results of the combined tests on model plants and horticultural plants revealed the optimum concentrations of AD to be applied in order to maximise plants growth and soil liming.

Future perspectives concern the application of AD to several different tomato cultivars in metal polluted soils, to estimate the effect of AD on metal plant uptake.