

Title: PLANT GROWTH PROMOTING ACTIVITY OF HUMIC SUBSTANCES

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Interpretive Summary: Humic substances, the major components of soil organic matter, are important to agricultural areas such as soil chemistry, biology, and fertility, as well as environmental quality. The multiple parts played by these materials can greatly benefit plant growth. Examples are their contributions in plant growth enhancement, increasing fertilizer efficiency, or reducing soil compaction. Results of experiments at St. Paul, Minnesota have indicated that the humic substances extracted from Minnesota peats exhibit positive effects on turfgrass growth. A review of earlier and present work by several world-wide scientists has been prepared. The subject of plant growth hormone activity versus increased nutrient availability is high-lighted. Our work indicates that plant stimulation provided by increased micro-elements iron and zinc availability, in the presence of humic substances, is the most important factor. Information derived from the humic substances influence on shoot and root growth has been provided to turf, horticultural and ornamental specialists. The impact will be on providing less expensive methods for applying micro-nutrients to turfgrasses, with a secondary benefit to environmental quality of decreased ground and surface water pollution.

Technical Abstract: Studies on the effects of humic substances (HS) on plants, under conditions of adequate mineral nutrition, consistently show stimulation of plant growth. Enhancement of root growth was usually more apparent than stimulation of shoot growth. Both increase in root length and development of secondary roots have been observed for HS in nutrient solutions. Typical response curves showed enhanced growth with increasing HS concentration, followed by a decrease in growth at high concentrations. Shoots generally showed similar trends in growth response to HS. Some researchers attributed the stimulative effects of HS to higher uptake of nutrients. Others, however, suggested that hormone activity of HS promotes plant growth. A small fraction of lower molecular weight components of HS can be taken up by plants. These components are considered to increase cell membrane permeability and to exhibit

hormone-like activity. In soils, addition of composts was found to stimulate growth beyond that provided by mineral nutrients, presumably because of the effects of HS. The hypothesis that HS originating from various sources contain plant growth hormones was tested recently. The results will be discussed, in light of supporting literature data, showing that plant growth enhancement results from increased nutrient availability, iron and zinc in particular, due to their chelation by HS, rather than due to plant hormones which could not be found in these materials.