

Analysis of Plant Hormones in IBR Liquid Concentrate

Bioassays were conducted by the Center for Environmental Microbiology Inc. on a IBR liquid concentrate to determine if the solution contains plant hormones that may influence the physiology of plants during growth and development. Bioassays have been used to establish the existence of endogenous plant growth regulators. The bioassays selected for this study have established detection limits and a linear range, which are quite adequate as a physicochemical assay. However, the selectivity of the assay is a distinct limitation in identifying classes of plant hormones rather than a specific plant hormone. These bioassays provide extremely valuable tools in screening various matrices for the presence of plant hormones. Although the IBR liquid concentrate is known to carry a luxurious source of nutrients it has not been characterized for its plant hormone composition.

The IBR liquid concentrate was diluted to 0.1% and tested on the Mung bean adventitious root induction assay. This assay responds to auxins (indole-3-acetic acid) capable of stimulating root initiation. The IBR solution had a very strong response at 0.1%, and a moderate response at 0.001-0.01%, indicating auxin activity in the IBR solution. With this positive test, the bioassay indicates that the IBR liquid contains auxins. Plant responses to auxins include cell enlargement, vascular differentiation, geotropism, phototropism, fruit setting in groves, flower promotion, and increased growth rate.

The IBR liquid (0.5-1.0 %) was tested on the growth of excised radish cotyledons, a bioassay used for the detection of cytokinins. Cytokinins are known for their enhancement in cell division, enhancement in root development, enhancement in root hair formation, shoot initiation, leaf expansion and delay in leaf senescence. The IBR solution (0.5%) stimulated the growth of the excised radish cotyledon equivalent to a range of 0.025-2.5 ug/mL of kinetin with a 6.23-fold increase in growth over the control. As the IBR solution increased, the percent of growth increased indicating cytokinin bioactivity in the IBR liquid product.

The IBR liquid (0.5%) was tested on the growth of intact pea seedlings, a bioassay used for the detection of gibberellins. Gibberellins are mainly known for cell division stimulation, hyper-elongation of the stem, induction of seed germination, fruit setting and fruit ripening. The IBR solution promoted a slight increase in plant height (1.53-fold over the control). Further tests are needed to determine the optimum concentrations to display a gibberellin response.

The IBR solution was tested on the classic triple response (reduction in elongation, swelling of the hypocotyl and horizontal growth pattern) bioassay of pea seedlings. This assay responds well to exogenous ethylene. Plant responses influenced by ethylene include growth inhibition, epinasty, leaf abscission, fruit abscission, flower senescence and respiration changes. In this assay the application of ethylene displayed the classic triple response, but seedlings tested with the IBR solution (0.5%) did not respond to the triple response indicating the absence of precursors that might produce ethylene.

Overall, the bioassays tested indicated the presence of auxin, gibberellins and cytokinins in the IBR liquid. The agronomic response to IBR is most likely due to a nutritional as well as physiological impact affecting plant growth and development.