GIBBERELLIC ACID-INDUCED CHANGES IN THE RESPONSE OF

AVENA SATIVA STEM SEGMENTS TO TEMPERATURE

by

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SUMMARY

Stem segments isolated from *Avena sativa* plants, were used to explore various aspects of the mechanism and mode of action of Gibberellic acid (GA$_3$). Although prolonged treatment of oat plants with GA$_3$ produced marked changes in phospholipid and sterol composition of stem segments, these changes did not always accompany the GA$_3$-induced growth response of the segments. Treatment of stem segments with GA$_3$ for only 20 hr produced a significant growth response with little or no effect on lipid composition, suggesting that neither the mechanism nor the mode (at least in the short term) of hormone action in this system involves an alteration of lipid (membrane) composition.

A micro-growth measuring technique was used to measure the growth response of stem segments to a variety of GA$_3$ concentrations over a range of incubation temperatures. It was found that the growth rate varied with GA$_3$ concentration, temperature at which the rate was measured, and the growth temperature of the plants prior to excision of the segments. The sigmoid curves relating segment extension rates to temperature were affected by GA$_3$ such that the linear portion of the curve was shifted to higher rates as GA$_3$ concentration was increased. The results were compared with, and may be analogous to, GA$_3$-induced shifts of thermally-induced phase transitions in glucose leakage from liposomes, observed by Wood and Paleg (1974).

Stem segments taken from plants grown at different temperatures, were found to vary in their lipid composition depending on the growth temperature; as growth temperature was lowered, there was a shift towards
a greater proportion of unsaturated fatty acids. Significant increases were observed in the concentration of linolenic acid (18:3) and in the sitosterol/stigmasterol ratio as growth temperature was lowered. Growth temperature prior to excision of segments was also found to affect subsequent growth response of segments to GA$_3$. Generally, as growth temperature was lowered, segments responded less in terms of hormone-induced elongation rate or final length attained in response to GA$_3$.

The lipid composition of segments was manipulated in various ways in order to establish whether there were correlations between responsiveness of the tissue to GA$_3$ and specific lipid parameters. High correlations were obtained between growth and total phospholipid, individual phospholipids and fatty acids (except for 18:3), total saturated fatty acids, stigmasterol content, and the unsaturated/saturated fatty acid ratio. However, it was concluded that although the lipid composition, and particularly the total saturated fatty acid content, may be important contributory determinants of the GA$_3$-induced growth response in this system, they are not obligatory prerequisites, nor the only endogenous factors capable of influencing the response. The hypothesis that the membrane is the primary target for hormonal action in plants is discussed.