

EFFECTS OF AUXINS AND CYTOKININS ON THE GROWTH OF DISCS OF PARENCHYMOUS TISSUES

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SUMMARY

Discs of parenchymous tissue of storage organs, which are used as a test material for qualitative and quantitative auxin determinations, do not respond to gibberellic acid, but are sensitive to cytokinins. This sensitivity limits their suitability for auxin assays.

1. INTRODUCTION

Since the discovery by REINDERS (1942) that auxins are able to stimulate the water uptake of discs of potato tuber tissue, discs from storage organs of various plants, mostly Compositae, have been used as test materials in auxin assays. These discs, used both for qualitative (RUTHERFORD, GRIFFITHS & WAIN, 1966) and for quantitative (NITSCH & NITSCH, 1956) auxin determinations, grow both by cell division and by cell elongation. NITSCH & NITSCH (1960) demonstrated the presence of a cytokinin-like factor in tubers of *Helianthus tuberosus* L.. They regard this factor as present in an optimum amount for cell division, so that growth should be determined only by the concentration of auxin acting on cell elongation. It will be shown, however, that the growth of discs of parenchymous tissue depends on the concentrations of both auxins and cytokinins.

2. METHOD

From roots of chicory (*Cichorium intybus* L. var. "Lange Flakkeese") and from tubers of Jerusalem artichoke (*Helianthus tuberosus* L. var. "Patate Vilmorin", and the dwarf variety "Washington"), cylinders of parenchymous tissue of 8 mm diameter were bored with a cork borer and cut into discs of 2 mm. thick. In a Petri dish, 10 discs were placed on a 9 cm Whatman 1/64" seed test filter paper in 25 ml. aqueous solution, adjusted at a pH value of 6.0. The samples were incubated at 25°C in darkness. At intervals the fresh weights of the discs were determined after superficial blotting with filter paper.

3. RESULTS

LATIES & KENT (1966) state that discs from chicory roots show the strongest response to auxins; according to RUTHERFORD, GRIFFITHS & WAIN (1966), the optimum response occurs at about 10^{-5} M. In our experiments, optimum growth stimulation of discs from chicory roots was found between 10^{-6} M and 10^{-4} M of auxin, e.g. of 1-naphthylacetic acid (NAA). Different auxins showed only minor differences in effect.

Cytokinins, such as 6-benzyladenine (BA) and 6-furfuryladenine, also stimu-

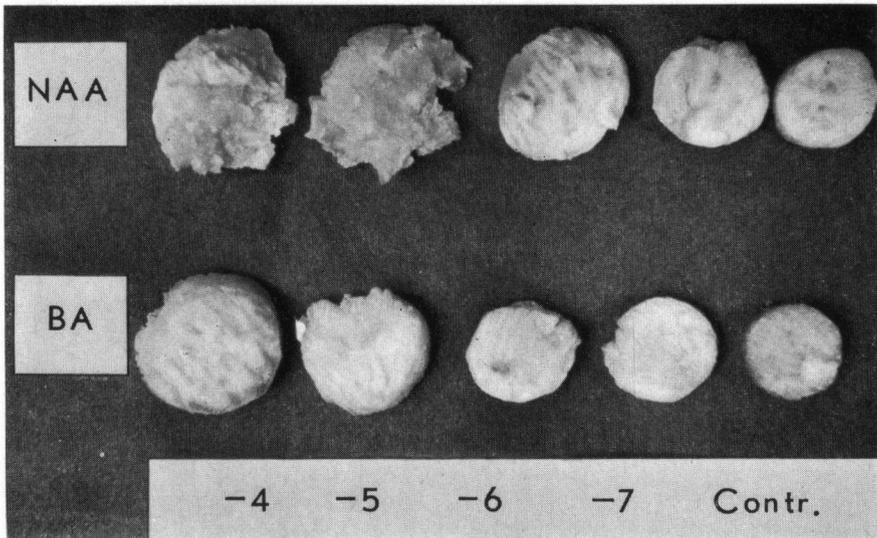


Figure 1. Discs of chicory roots grown for 138 hrs. on 10^{-7} M to 10^{-4} M 1-naphthylacetic acid (NAA) and 6-benzyladenine (BA), and on water (control).

lated growth at these concentrations, their activity being about one tenth of that of auxins. The appearance of the discs was different, however: *fig. 1*. With auxins large cells proliferated and the discs became flocky, ultimately tending to disintegrate. With cytokinins the discs remained intact and consisted of large numbers of smaller cells.

Different combinations of the two regulators invariably led to decreased growth responses, as shown in *table 1*.

Table 1. Weight of discs of chicory roots after 136 hrs. of incubation, in % of initial weight.

control	$5 \cdot 10^{-6}$ M NAA	$5 \cdot 10^{-5}$ M BA	$5 \cdot 10^{-6}$ M NAA + $5 \cdot 10^{-5}$ M BA
175 ± 7	373	312	233

Gibberellic acid, either alone or in combinations, had no effect at all. This agrees with results obtained by NITSCH & NITSCH (1962) with tuber discs of Jerusalem artichoke.

Table 2 shows that although the growth response of these tuber discs of *Helianthus tuberosus* L. is far smaller than that of the discs from chicory roots, again both auxins and cytokinins stimulated growth. In contrast with discs from chicory roots, however, combinations of the two regulators often showed a synergistic effect.

Table 2. Weight of discs of Jerusalem artichoke after 140 hrs. of incubation, in % of initial weight.

variety	control	5.10^{-7} M NAA	5.10^{-6} M BA	5.10^{-7} M NAA + 5.10^{-6} M BA
Patate Vilmorin	119 ± 2	128	126	156
Washington	119 ± 2	136	126	159

4. DISCUSSION AND CONCLUSION

The experiments showed that not only auxins but also cytokinins are able to increase the growth of discs of parenchymous tissues, although to a lesser extent. With cytokinins a stimulation of cell division is more pronounced, with auxins an enhanced elongation.

NITSCH (1966) demonstrated the occurrence of both types of regulators in chicory roots. The effects of externally applied regulators may well depend on internal hormonal levels, that will vary with the species, perhaps with the variety and also with the storage conditions of the roots (LATIES & KENT, 1966) and tubers (NITSCH, 1966).

This may explain the different effects that the combinations of regulators exerted on the growth of discs of different origins: a decrease of growth with discs from chicory roots and an increase with discs from tubers of Jerusalem artichoke.

The results imply that the growth response of discs of parenchymous tissues of storage organs is less specific for the auxin-type of regulators than is usually assumed. The requirement for cytokinins can not be saturated simply by their addition to the test solutions. Removal of cytokinins from test solutions prior to their examination for auxin activity leaves the interference of the endogenous cytokinins. This situation limits the suitability of parenchymous tissue discs for the qualitative and quantitative determinations of auxin activity.

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