† THE ACTION OF TRI-IODOBENZOIC ACID ON GROWTH

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Received December 17, 1947

In a paper devoted largely to flowering, GALSTON (1) has shown that triiodobenzoic acid (abbreviated to TIBA hereafter) acts to oppose the curvature produced by indole-acetic acid in the standard Avena test. The purpose of this note is to point out that under other conditions TIBA acts very markedly to promote, and not oppose, the effects of auxin.

The curvature of slit pea internodes

This test was first described by WENT (4) and was carried out and measured as described by THIMANN and SCHNEIDER (3). In concentrations of 25–100 mg./liter, TIBA causes a slight inward curvature, but if the slit sections are first washed for 2 hours in water, this curvature disappears (table I). Mixtures of TIBA and auxin produce much greater curvature than the auxin alone. Concentrations of TIBA as low as 0.2 mg./liter have a large effect. Typical results are given in table I. The same result was obtained when 2,4-D was used as the auxin. This enhancement effect differs from the "pretreatment" effect described by WENT (6) in two respects:

TABLE I

"PEA-TEST" CURVATURES. THE AUXIN WAS INDOLE-ACETIC ACID 1 MG. PER LITER

CONCENTRATION OF TIBA	CURVATURE DUE TO			
	H_2O	TIBA ALONE	AUXIN ALONE	BOTH
mg./liter				
125	−126	−8	+104	+351
0.2	−126	−153	+104	+319
		TIBA ADDED AT ONCE	TIBA ADDED AFTER 2 HRS. IN WATER	TIBA ADDED AFTER 4 HRS. IN WATER
50	−173	−33	−178	−175
25	−173	−48	−148	−171

(a) the concentrations can be far lower than those of cyclohexane-acetic and phenyl-butyric acids which Went found effective; and (b) pre-soaking for 4 hours in TIBA followed by 20 hours in auxin alone does not give appreciably increased curvature. Since the enhancing effect on low auxin concentrations is considerable, it is suggested that the curvature given by TIBA alone on freshly cut internodes is due to its effect on the residual auxin in the stem.

Straight growth of Avena coleoptiles

This test was carried out essentially as described by SCHNEIDER (2) with the modification that the 3-mm. sections were supported so that they

protruded above the surface of the solution. TIBA at 10^{-4} M (50 mg./liter) and above was very strongly inhibitory, whether alone or in presence of indole-acetic acid. TIBA 10^{-6} M had no effect on growth by itself, but in presence of indole-acetic acid (1 mg./liter) it increased the growth 26% and 29%, respectively, (in two experiments) over that due to the auxin alone. The mol-ratio TIBA/IA here was 0.17 : 1. Figure 1 shows the growth of the

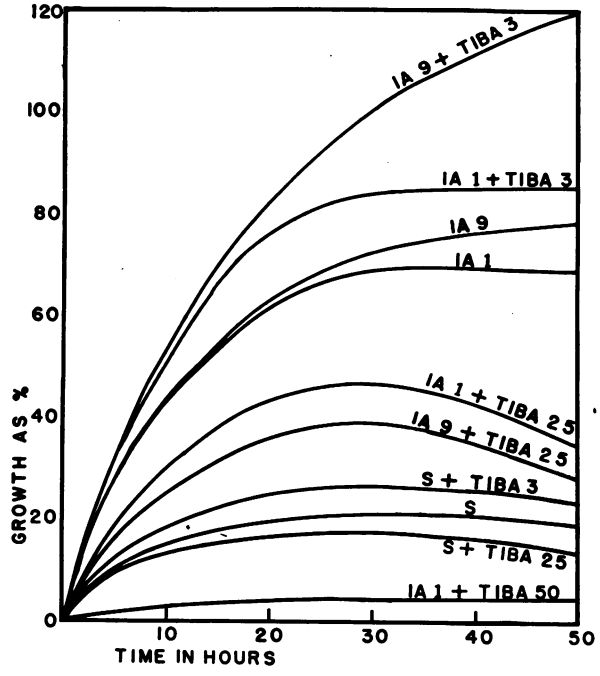

FIG. 1. Time course of growth of 3-mm. Avena coleoptile sections (from plants 72 hours old) in sucrose alone (S), sucrose plus indole-acetic acid (IA), and sucrose plus indole-acetic acid plus TIBA (IA + TIBA). Concentrations in mg. per liter. Dark room, 25° C.

sections in several concentrations of TIBA with and without auxin. Acceleration is shown at mol-ratios of 0.12 and 1.05.

Standard Avena test

This test was carried out in the usual way (WENT and THIMANN (**5**)). The data given by GALSTON show, with a mol-ratio TIBA/IA of 1, no effect; and with a mol-ratio of 5, only inhibition. Closer examination of combinations with the lower mol-ratio values showed, however, that there is a region in which increased curvature results. The effect varies somewhat from test to test. In one case the curvature was raised from 5.6° with indole-acetic acid alone to 12.8° in presence of 0.08 mg./liter TIBA. The mean values are less striking and are given in table II in which the control curvatures are brought to 100% to permit the averaging of four experiments. They show a definite increase at around a mol-ratio of 1 : 1. At

mol-ratios higher than 10 the curvature is decreased below that of controls as shown by GALSTON. In no case did TIBA give any curvature alone.

Conclusions

The primary effect in all these experiments is that TIBA enables a small amount of auxin to bring about a disproportionate amount of growth. TIBA is, of course, by no means the only substance which may promote or inhibit the same reaction according to its concentration. Probably the simplest explanation in this case is based on competition. If auxin brings about its growth-promoting action by combining with a special substrate, then tri-

TABLE II

AVENA CURVATURES. INDOLE-ACETIC ACID CONCENTRATION (EXCEPT WHERE MARKED*) 0.02 MG. PER LITER OF AGAR; AVERAGE CONTROL CURVATURE 5.5° = 100%

TIBA CONCN.	MOL-RATIO TIBA/IA	CURVATURE AS %
0	0	100
0.01	0.175	121
0.02	0.35	170
0.04	0.70	148
0.08	1.4	184
0.10	1.75	115
0.20	3.5	118
0.50	8.75	118
*	14	70
1.5	26	49
*	42	39

* Indole-acetic acid 0.15 mg. per liter; average control curvature 29.6°.

iodobenzoic acid is to be considered as sufficiently alike in structure to indole-acetic acid to be able to combine with the same substrate. This combination does not bring about growth, but (if the concentration of TIBA is not too high) it still leaves open a small number of spaces or active groups on the substrate with which auxin can combine. Alternatively, of course, several different substrates may be involved, of which only one causes growth. The result in either case is that the auxin causes growth with the expenditure of a smaller number of auxin molecules than are normally required. Higher TIBA concentrations, however, take up all the spaces or active groups, so that auxin is excluded and growth is inhibited.

The authors' thanks are due to DR. SALLY M. KELLY for carrying out several additional experiments.

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