Comparative Biological Effectiveness of the Gibberellins

Since the isolation[1] of gibberellin A (later identified[2] as a mixture of gibberellins A_1, A_2 and A_3), and more recently the discovery[3] of gibberellin A_4, numerous physiological responses have been induced in plants[4] with the gibberellins. Takahashi *et al.*[2] reported that A_1, A_2 and A_3 all possessed strong physiological activities in stimulating the elongation of rice seedlings. Apart from this reference, the gibberellins have not been evaluated in terms of specific biological activities. The comparative effectiveness of gibberellins A_1, A_2, A_3 and A_4 and the methyl esters of A_1 and A_3 in promoting vegetative extension, flowering of facultative long-day annuals and in fruit setting is now reported[5].

Beans (*Phaseolus vulgaris*, var. Blue Lake) were germinated in quartz sand, transferred to solution cultures, and after 24 hr. 10 μl. of a 3×10^{-3} M solution of a gibberellin or derivative was applied to the stem apex. Epicotyl elongation was determined after 48 hr. Gibberellins A_1, A_2 and A_3, applied to the stem apex, resulted in significantly greater epicotyl extension than the methyl esters of A_1 and A_3 (Table 1). No significant differences were apparent among the gibberellins. All produced significantly longer epicotyls than the controls. By contrast, in unpublished studies (with B. K. Gaur), gibberellins A_1 and A_3 applied to one of the primary leaves of the bean produced significantly longer epicotyls than A_2. This has suggested a limitation in absorption-transport of gibberellin A_2.

Table 1. Comparative Biological Activity of Gibberellins and Methyl Ester Derivatives

Compound	Epicotyl extension in the bean (percentage of control)	Flowering in lettuce		Stimulation of parthenocarpy in tomatoes (percentage of non-pollinated control)
		Seedstalk heights (cm.)	Time to visible flower primordia (days)	
Control	100	40·5	164·9	296*
3-Indoleacetic acid	—	—	—	216
para-Chlorophenoxyacetic acid	—	—	—	320
Gibberellin A_1	260	49·8	145·3	208
Methyl ester of gibberellin A_1	147	36·4	157·7	160
Gibberellin A_2	253	36·1	157·3	204
Gibberellin A_3	267	54·8	139·3	228
Methyl ester of gibberellin A_3	127	38·8	154·1	140
Least differences necessary for significance at				
5 per cent	32	7·9	6·7	47
1 per cent	42	10·4	8·8	64

* Pollinated control.

The effects of the gibberellins and derivatives on flowering were determined with lettuce (*Lactuca sativa*, var. Great Lakes) and dill (*Anethum graveolens*) grown in pot cultures and treated initially at the 6–7 leaf stage with 10 μl. of the solution described above. Treatments were repeated after two and four weeks. All plants were grown at a night temperature of 18° C. and at the prevailing winter photoperiod (9–11 hr.). The time required for flower primordia to appear in lettuce was significantly reduced and seedstalk heights were increased by treatment with gibberellins A_1 and A_3. Plants treated with A_2 or the methyl esters of A_1 and A_3 flowered slightly earlier than controls, but seedstalk elongation was not affected. Furthermore, no heads formed on plants following treatment with A_1 or A_3, whereas bolting followed heading on plants treated with A_2, the methyl esters of A_1 and A_3, and the controls. Similar effects on acceleration of flowering and seedstalk heights were observed with dill.

Comparative fruit-setting activities, in the absence of pollination, were determined with the tomato (*Lycopersicon esculentum*, var. Michigan–Ohio Hybrid). Three flower buds from the first cluster were emasculated approximately 24 hr. before anthesis. 10 μl. of a 3×10^{-3} M solution of the gibberellins, methyl esters of A_1 and A_3, indoleacetic acid or *para*-chlorophenoxyacetic acid were then applied to the ovary, and its diameter measured after six days. Solutions of gibberellins A_1, A_2 and A_3 and indoleacetic acid were equally effective in stimulating growth of ovaries, but less so than *p*-chlorophenoxyacetic acid at 3×10^{-3} M concentration. At a lower concentration (3×10^{-5} M), however, A_1, A_2 and A_3 were as effective as *p*-chlorophenoxyacetic acid and more so than indoleacetic acid. As in other responses the methyl esters of A_1 and A_3 were less active than their free acids.

Preliminary studies have indicated that gibberellin A_4 was equal in activity to A_1 for promotion of epicotyl extension of the bean and parthenocarpy in tomatoes. It was, however, less effective in stimulating stem elongation and flowering in lettuce and dill.

A consideration of the comparative biological activities of the gibberellins relative to epicotyl extension in beans, stem elongation and flowering in lettuce and dill, and parthenocarpic fruit growth in tomatoes has established the following order of activity: $A_3 > A_1 \simeq A_4 > A_2 >$ methyl ester $A_1 \simeq$ methyl ester A_3.

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Effects of Alkoxyglycerols and especially Selachyl Alcohol on the Bone Marrow in connexion with Irradiation Treatment and in Leukæmia Therapy

In connexion with irradiation treatment it has been shown that alkoxyglycerols to a certain extent prevent and cure leuko- and thrombo-cytopænia[1]. It was found that the effect was related to the amount of alkoxyglycerols administered *per os*. Above a certain dosage there is less effect.