

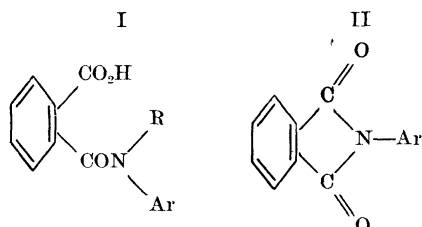
TECHNICAL PAPERS

A New Group of Plant Growth Regulators

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A new group of plant growth regulating chemicals, the N-aryl phthalamic acids, has been discovered. These compounds, which are readily prepared from phthalic anhydride and aromatic amines, can be represented by the general formula I. The esters, amides, and soluble salts of these acids, as well as the N-aryl phthalimides (II) have been found to possess similar activity.



Where R is a hydrocarbon radical or a hydrogen atom, and Ar is an aromatic group.

The nature and degree of the growth response shown by plants treated with these chemicals depend on the type and age of the plant, and on the concentration and identity of the phthalamic acid derivative used. Data from a field test in which Bonny Best tomato plants having from one to three unset blossom clusters were treated with compounds of this group show the effects

TABLE 1

N-aryl phthalamic acid Aryl group	Approximate minimum concentration in ppm to cause :		
	Chemical fruit set	Formative effect	Pro- nounced inhibition of fruit set
2-Chlorophenyl	63	20	632
2,5-Dichlorophenyl	63	200	632
2,4,5-Trichlorophenyl	63	632	632
3-Chlorophenyl	63	632	632
4-Chlorophenyl	63	632	200
4-Bromophenyl	200	632	632
<i>o</i> -Tolyl	200	632	2000
4-Nitrophenyl	200	2000	2000
2-Nitrophenyl	632	2000	*
2-Hydroxyphenyl	632	632	*
<i>m</i> -Tolyl	632	632	*
<i>p</i> -Tolyl	2000	200	*
Phenyl	2000	*	*

* The effect was not produced at 2000 ppm, the highest concentration tested.

obtained (see Table 1). Each plant was sprayed with 100 cc of a solution containing one drop of a commercial wetting agent (Emulphor EL) per 100 mg of chemical used.

It will be seen that the active concentrations of different compounds vary greatly. A general pattern of response, however, is evident. At low concentrations fruit set is stimulated, and seedless tomatoes are often produced. A morphological response involving a broadening of the leaves is usually evident. This formative effect does not appear to injure the plant seriously; in fact, in some cases the test plants actually seemed to be more vigorous than the unsprayed check plants.

As the concentration of chemical is increased, the formative effect becomes more pronounced. Fruit set is inhibited, although the fruits which are formed may be seedless. Fruit set may be greatly diminished at concentrations which do not decrease vegetative growth.

At still higher concentrations (about 2000 ppm) tomato plants are definitely injured, although seldom killed, by the more toxic compounds. Even at 2000 ppm, however, many of the fruit-setting chemicals cause no apparent injury. In all of these experiments the whole plant was sprayed; no effort was made to confine the spray to blossom clusters.

The effects of N-1-naphthyl phthalamic acid differ from those of other members of the series. At 0.1 ppm it causes a leaf roll, at 0.31 ppm epinasty, and at 20 ppm stem swelling (greenhouse data). In the field test it completely inhibited fruit set at 20 to 2000 ppm. The vine weight was almost normal at 20 ppm (the lowest concentration tested) but epinastic and morphological effects were severe.

N-aryl phthalimides behave much like the corresponding phthalamic acids. Compounds derived from secondary amines (formula I, where R is a hydrocarbon radical) are less active than the corresponding compounds in which R is a hydrogen atom.

Maleic Hydrazide, a Unique Growth Regulant

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Maleic hydrazide has been found to have a pronounced, but temporary, inhibiting effect on plant growth. The length of inhibition period appears to be directly proportional to the concentration used. To our knowledge this effect is unique in that growth inhibition is obtained with little visible harm to the plants.

Maleic hydrazide, or more properly, 1,2-dihydropyridazine-3,6-dione, has the following structure (I):