property whose magnitude is greatly influenced by the extent of hydrogen bonding. The same explanation suggests itself for the differences in the basicity and boiling point between ethylene and propylene glycols. The decrease in basicity with chain length in the monohydric alcohols follows from the increased forces between longer chains which in turn weakens the hydrogen bonds.

A few other compounds are cited in Table 1 in order to relate the basicity of the alcohols to other functionalities by the same yardstick.

We have found that indicator 1 is analytically useful for detecting water in alcohol samples. For example, "anhydrous," shelf samples of ethanol gave a light green color with this indicator. The water content was 0.3 to 0.5 percent and was found to be suitable for malonic ester condensations.

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Effect of Isonicotinic Acid Hydrazide on Some Plant Systems

Several months ago Wort (*1*) described some effects of the antitubercular compound isonicotinic acid hydrazide (INH) on the growth of certain higher plants when it was applied to the foliage of established seedlings. General retardation of top growth was observed with INH concentrations of 0.4 to 1.6 percent. INH solutions of the same concentrations applied to the soil similarly caused stunting, except at the 1.6-percent level, which was lethal to several species. Wort went further and showed that in oats, beans, and sugar beet seedlings, leaf catalase and phosphatase activities were depressed, although only slightly, by treatment with 1.2-percent INH (87 μM/ml).

Wort's experiments might suggest that plants are not particularly responsive to this compound, a conclusion that would be at variance with observations on other plant systems that are affected by far lower concentrations of INH. In 1952 Schopfer *et al.* (*2*) showed that a concentration of INH as low as 0.0039 percent in the medium would cause 50-percent reduction in elongation of pea roots in sterile culture, and that this effect was partially reversible by indoleacetic acid. Bustinza and Santamaria (*3*) reported that germination of seeds of *Raphanus sativus, Triticum compactum,* and *Lupinus alba* was completely prevented by 0.4-percent INH and that some inhibition of seedling development in these three species was evident at 200, 50, and 10 ppm, respectively (1.5 μM/ml, 0.36 μM/ml, and 0.07 μM/ml). On the other hand, Nickell and Findlay (*4*), using *Lemna minor* as the test system, found substantial stimulation of growth by 1 to 20 ppm INH (0.007 to 0.15 μM/ml, approximately) but did not record the effects of higher concentrations.

In experiments in these laboratories (*5*) this compound INH has been observed to be an active inhibitor of root growth. In aerated water cultures the roots of Moore barley seedlings grown for 5 days in the dark were inhibited to the extent of 50 percent on a dry weight basis by 350 ppm (2.55 μM/ml) INH presented 24 hr after the seeds were moistened. The roots, although not proportionately reduced in length, were distinctly yellow in color.

Similarly in the cucumber germination test of Ready and Grant (*6*), the elongation of the primary root of cucumber var. Early Fortune at 25° was inhibited 50 percent by a concentration of INH of 225 ppm (1.6 μM/ml). The response curve for Moore barley was almost coincident with that for cucumber at low INH concentrations, with the 50-percent inhibition point occurring at 220 ppm. Root elongation of Koto flax, however, was more sensitive to this compound. Fifty-percent inhibition was observed at 37 ppm (0.27 μM/ml). It is perhaps worthy of comment that in these root responses INH is about one-fifth as active as maleic hydrazide, which has found some uses as a growth regulator and growth repressant.

Top application of INH to young Black Valentine bean plants, either as droplets containing 50 or 100 μg to the base of a unifoliate leaf, or by immersing the unifoliate leaf in a solution of either $1 \times 10^{-3} M$ or $1 \times 10^{-4} M$ for 48 hr did not result in any detectable growth repression or morphological change. Only at much higher levels of application was growth repression evident, as is reported by Wort (*1*).

Thus it appears that INH, like numerous other compounds, has physiological potency in the inhibition of root growth and development at levels substantially lower than those that elicit any morphological responses in the tops of established plants. It is perhaps from the ranks of such compounds that materials suitable for preemergence weed control should be sought.

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References and Notes

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