



EFFECTS OF ATRAZINE ON THE ASSIMILATION
OF INORGANIC NITROGEN COMPOUNDS
IN PLANTS AND MICROORGANISMS

by

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A thesis submitted in fulfilment of the
requirements for the degree of
Doctor of Philosophy

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September 1978

Awarded November 1978

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SUMMARY

1 The application of sub-lethal amounts of atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-S-triazine] increased the growth of maize and barley. The elongation of roots of 7-day-old maize seedlings was increased within 4 h of adding 0.1 μ M atrazine either with or without nitrate. However, the fresh weights of roots and shoots of 7-day-old maize seedlings were enhanced by the herbicide over a 7 - 40 day period only in plants supplied with nitrate. When 100 μ M atrazine was supplied daily to maize, then the fresh weights of both roots and shoots were markedly depressed. Barley plants were more sensitive to atrazine than maize.

2 The uptake of nitrate was increased within 2 h of applying 0.1 μ M atrazine to maize seedlings. Of the other ions investigated (K^+ , Ca^{2+} , Mg^{2+} , Cl^- and PO_4^{3-}), only K^+ content was enhanced by the herbicide. The uptake of Cl^- and PO_4^{3-} by the seedlings however was not affected by atrazine.

3 The rate of exudation as well as the nitrate and amino nitrogen contents of the xylem sap of maize plants grown with nitrate were increased by sub-lethal amounts of atrazine. Glutamine was a major compound of the xylem sap in maize plants grown with either nitrate or ammonium irrespective of atrazine treatment.

4 The activities of nitrate and nitrite reductases, glutamine synthetase and glutamate synthase were enhanced in both roots and shoots of nitrate grown maize and barley treated with sub-lethal amounts of atrazine. The herbicide did not directly affect the synthesis or the stability of nitrate reductase. The activities of glutamine synthetase and glutamate synthase were not affected by atrazine when the plants

were grown with ammonium.

5 The uptake of $^{15}\text{NO}_3^-$ and its incorporation into TCA-precipitable protein as well as into total nitrogen of roots and shoots of maize and barley respectively were increased when micromolar quantities of atrazine were included in the nutrient solutions. However, the incorporation of [^{14}C]-leucine into TCA-precipitable protein of detached leaves from 7-day-old barley seedlings was stimulated, only when combined nitrogen was omitted from either the culture solution or the *in vitro* incubation mixture containing the labelled amino acid.

6 Growth of *Escherichia coli*, *Anabaena cylindrica*, *Chlorella pyrenoidosa* and *Neurospora crassa* was depressed by the inclusion of atrazine (over the range 0.001 to 600 μM) in the culture media. *E. coli* was more resistant to the herbicide than the other microorganisms since its growth was only reduced by 30% by 600 μM atrazine. The growth of *N. crassa* and the two algae was completely inhibited by 330 and 10 μM of the herbicide respectively.

7 Atrazine depressed the nitrate uptake in *A. cylindrica* as well as the respiration (to both nitrate and oxygen as terminal acceptors) in *E. coli*. The activities of nitrate reductase in *N. crassa* and *C. pyrenoidosa* as well as that of nitrogenase in *A. cylindrica* were also inhibited by the herbicide.