Metabolic Changes during Germination of Cotton and Sorghum and the Role of Gibberellic Acid

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Early germination was noticed in seeds of cotton (*Gossypium herbaceum* L. var. Digvijay) (G. Prathapasanen, unpublished work) and sorghum (*Sorghum vulgare* Pers. var. 8) (Kamalavalli *et al.*, 1969) as a result of treatment with gibberellic acid (compound GA₃). To examine further how compound GA₃ brings about early germination, metabolic changes in the storage organs of seeds during different stages of germination under the influence of compound GA₃ were studied; the results are summarized below.

There was a decrease in the dry weight of cotyledons or endosperms during germination, with an initial lag phase. Analysis of cotyledons of cotton during different stages of germination showed depletion of fat and soluble sugars with an increase in reducing sugars. In the presence of compound GA₃ an early and rapid depletion of fat and soluble sugars, and a higher concentration of reducing sugars, were observed. However, in both control and treated seeds there was increase in the concentration of soluble sugars during the later stages of germination, and this increase was higher in seeds treated with compound GA₃. The starch content remained almost constant. In sorghum starch disappeared as the germination progressed with a concomitant increase in soluble and reducing sugars, and this process was quickened by compound GA₃.

Both cotton and sorghum showed mobilization of total nitrogen and protein with an increase in the amino acid pool. In the presence of compound GA₃ cotton showed a more rapid mobilization of nitrogen and protein than did sorghum. It is concluded that compound GA₃ brings about early germination by quickening the mobilization of stored food materials in the seed.

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3-Amino-1,2,4-triazole, a Herbicide Affecting Chloroplast Development

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The application of the herbicide 3-amino-1,2,4-triazole (AT) at 0.5mM concentration, either as a spray or by injection, produces albinistic leaves in both *Canna indica* L. and *Phaseolus radiatus* L. Further, the presence of this herbicide in the medium retards seed germination and growth considerably.

When the dark-grown *Phaseolus* seedlings were exposed to light in the presence or absence of 3-amino-1,2,4-triazole, the rate of development of chlorophyll and carotenoid pigments was considerably decreased. Studies with suspensions of cells from *Canna* leaves showed only a slight increase in respiration, as measured by O₂ uptake polarographically, and a 40–60% decrease in the photosynthetic rate in the presence of 0.5mM-3-amino-1,2,4-triazole as compared with control suspensions. Studies with the mitochondrial fraction *in vitro* showed no inhibitory effect of the herbicide and recorded a higher rate in its presence than in controls.

The inhibition of the photosynthetic rate was reversed by the simultaneous addition of equimolar quantities of histidine, cysteine, proline, glutamate, Mg²⁺ and Fe²⁺ to the reaction mixture. Other amino acids such as lysine and alanine and metal ions such as Na⁺ and Ca²⁺ had no reversal effect on the action of 3-amino-1,2,4-triazole.

Studies with [¹⁴C]glycine incorporation indicated that 3-amino-1,2,4-triazole interferes in the chlorophyll-biosynthetic pathway. An interference with purine metabolism was also indicated from the evidence that the herbicide inhibits the biosynthesis of histidine, riboflavin and possibly nucleic acids.

Studies on the Ureide Metabolism of Germinating Oilseeds and Legumes

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The activities of enzymes allantoinase (allantoin amidohydrolase EC 3.5.2.5) and urease (urea amidohydrolase, EC 3.5.1.5) and the effects of systemic fungicides on these activities are being studied in the germinating seeds of the groundnut (*Arachis hypogaea*), soya bean (*Glycine max*), mung bean (*Phaseolus aureus*), mash (*Phaseolus mungo*) and lentil (*Lens esculentum*).

Allantoinase activity has been found in all these seeds. The allantoinase activity of the groundnut stays constant during germination, but in mung-bean and