

## CHANGE IN TOTAL CHLOROPHYLL AND TOTAL SOLUBLE SUGAR IN THE SEEDLINGS OF MAIZE RAISED FROM VARIOUSLY STORED SEEDS

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The seedlings raised from the fungus stored and control seeds seemed of similar effect at 60 and 70% RH. Total chlorophyll and total soluble sugar both were significantly less in the seedlings raised from the treated seeds stored at 80% RH. Seeds stored with Thiram, Captan and Bavistin produced seedlings with more total chlorophyll and total soluble sugar when stored at 60% RH. There appears -ve correlation between the rise of storage temperature of seeds and total chlorophyll and total soluble sugar in the seedlings. Both the biochemicals were significantly less in the seedlings raised from the seeds stored with fungicides and insecticides at 80% RH.

**Keywords :** Fungicides; Insecticides; Maize seed; Seedlings; Soluble sugar; Storage fungi; Total Chlorophyll; Varying temperature.

### Introduction

The deterioration of seeds by storage fungi with respect to loss in germinability has been extensively studied<sup>1,2</sup>. The change in the stored food of the seed has also been investigated<sup>3,4</sup>. Involvement of toxins in deterioration of pea seeds secreted by *Aspergillus ruber* has been confirmed<sup>5</sup>. Biochemical changes in the seedlings due to stored fungi were also worked out<sup>6</sup>. In the present paper the maize seed was variously stored and total chlorophyll and total soluble sugar were estimated in the seedlings.

### Materials and Methods

Stored seeds of maize (*Zea mays* L) var MBP4 was collected and fungi were isolated adopting Tempe<sup>7</sup> blotter method. Based on their high frequency *Aspergillus flavus* Link ex Fries and *A. niger* Van Tieghem were selected for observing their effect. These were grown on Czapek Dox Agar medium.

Fifty g of seed of the said variety of maize having moisture content of 8.27% and 100% germinability was surface sterilized with 0.1% aq.  $HgCl_2$  solution for 1 min and infested with 0.5 ml spore suspension of *A. flavus* and *A. niger* separately each containing nearly  $1 \times 10^3$  spores/ml and stored in sealed desiccators over glycerol solution to maintain 60, 70 and 80% RH<sup>8</sup> at  $30 \pm 1^\circ C$  for 60 days.

In another set 0.3% (w/w) fungicides i.e. Thiram, Captan, Dithane M-45 and Bavistin and insecticides i.e., Carbofuran, Malathion and Foliodol were dressed separately to 50 g of said maize seeds and stored in the condition stated earlier. For the storage of seeds at varying temperature 10, 20, 30 and  $40^\circ C$  were selected and maintained in incubators for sixty days.

The seeds stored with fungi were grown in autoclaved soil at 20 psi for 20 min for two consecutive days. The soil was filled in earthen pots of the dimension 20 cm top diameter, 15 cm base diameter and 15 cm depth and ten seeds per pot at equidistance were sown 1 cm deep in the soil. The soil was covered with nearly 0.5 cm thick sterilized cotton wool till the emergence of the plumule. The cotton wool was removed and light watering was maintained every alternate day for next 15 days. The seeds stored in other ways were sown in the garden soil and grown for the period noted above.

Total chlorophyll (TC) was estimated<sup>9</sup> in the second leaf of the seedlings cutting at 12 noon. Total soluble sugar (TSS) was estimated in the same leaf<sup>10</sup>.

### Results and Discussion

There appears insignificant difference between treated and control seeds stored at 60% RH. The difference between the effect of storage at 60 and 70% RH seemed distinct. TC and TSS both were significantly less in the seedlings raised from the seeds stored at 80% RH. Seeds stored with Thiram, Dithane M-45, Captan and Bavistin produced seedlings with more TC and TSS as compared to the control when stored at 60% RH. Both the biochemicals were significantly less in the seedlings raised from the seeds stored with fungicide and insecticides at 80% RH (Table 1, 3). There appears -ve correlation between the rise of storage temp. of seeds and TC and TSS in the seedlings. Thus maximum amount of the two biochemicals were found in the seedlings raised from the seeds stored at  $10^\circ C$  and minimum at  $40^\circ C$  (Table 2, 4).

Distinctly less TC in the seedlings raised from the seeds stored with fungi at 80% RH might be due to

**Table 1.** Total Chlorophyll (mg/g fresh leaf) content of the seedlings of maize raised from the seeds stored with fungi, fungicides and insecticides at varying RH (%).

Particulars	RH (%)			C D Value
	60	70	80	
<b>Fungi</b>				
<i>A. flavus</i>	18.16	12.03	4.23	CD for RH=2.64
<i>A. niger</i>	16.83	10.94	3.14	CD for fungi=3.52
Control	19.85	17.02	8.21	
<b>Fungicides</b>				
Thiram	23.65	15.12	03.68	CD for RH=2.74
Captan	22.86	14.06	03.12	
Dithane M-45	19.23	12.12	02.69	CD for fungicide=
Bavistin	20.15	11.02	02.02	3.54
Control	17.35	16.02	08.21	
<b>Insecticides</b>				
Carbofuran	19.65	10.42	03.12	CD for RH=2.03
Malathion	20.15	12.16	04.02	
Foliodol	19.95	11.85	03.85	CD for insecticide=
Control	19.85	17.02	08.21	2.34

**Table 2.** Total Chlorophyll (mg/g fresh leaf) of the seedlings of maize raised from the seeds stored at varying temperature ( $^{\circ}\text{C}$ ).

Temperature $^{\circ}\text{C}$	Total Chlorophyll	Statistical Analysis
10	22.65	$r=-0.895$
20	21.43	( $P=0.5$ )
30	17.52	
40	07.12	

**Table 3.** Total Soluble sugar in the seedlings of maize raised from the seeds stored with fungi, fungicides and insecticides at varying RH (%) (expressed as % concentration).

Particulars	RH (%)			C D Value
	60	70	80	
<b>Fungi</b>				
<i>A. flavus</i>	0.048	0.040	0.020	CD for RH = 0.0035
<i>A. niger</i>	0.049	0.043	0.025	(P=0.001)
Control	0.052	0.047	0.032	CD for Fungi=0.0035 (P=0.5)
<b>Fungicides</b>				
Thiram	0.063	0.045	0.022	CD for RH = 0.0004
Captan	0.061	0.043	0.021	(P=0.001)
Dithane M-45	0.059	0.041	0.020	CD for Fungicide
Bavistin	0.065	0.040	0.018	=0.005 (P=0.5)
Control	0.056	0.047	0.026	
<b>Insecticides</b>				
Carbofuran	0.044	0.034	0.014	CD for RH=0.001
Malathion	0.047	0.040	0.021	(P=0.001)
Foliodol	0.045	0.036	0.017	CD for insecticides
Control	0.052	0.046	0.028	=0.002 (P=0.001)

**Table 4.** Total soluble sugar of the seedlings of maize raised from the seeds stored at varying temperature ( $^{\circ}$ C) (expressed as % concentration).

Temperature	Total soluble sugar	Statistical Analysis
10	0.09	r=-0.98
20	0.07	(P=0.01)
30	0.05	
40	0.02	

increase in more equivalent moisture of the seed and consequent luxuriant growth of the fungi secreting appreciably more toxic compounds in the seed affecting adversely the biochemistry of the seedlings. TC in the seedlings due to storage of seeds with fungi might be less on account of loss of cation including Magnesium as seed leachate and root exudate<sup>11</sup> due to damage of plasmamembrane, less availability of nitrogen in the form of organic compound due to sluggish activity of nitrate reductase and urease<sup>12</sup> and disturbed nitrogen metabolism in the seed as reported earlier in lablab bean<sup>13</sup>. Toxic effect of storage fungi on disturbance in chlorophyll synthesis has earlier been reported in radish and mustard seedlings<sup>14</sup>. Similar effect was observed recently due to metabolite of the storage fungi in wheat, gram and mustard<sup>15</sup>. It is axiomatic that less chlorophyll in seedlings will automatically result in less TSS. Fungicidal storage of wheat at 70 and 80% RH has recently been found detrimental for the growth of plant<sup>16</sup>. The insecticides behaved similarly as fungicides. More TC and TSS in the seedlings raised from the seeds stored at 10 and 20°C seems to preserve the activity of the enzymes and the amount of precursors necessary for the synthesis of chlorophyll. High storage temperature serves as factor of precocious ageing<sup>17</sup>. Crippled metabolism has earlier been reported in the plants raised from the seed stored at high temperature<sup>18</sup>. - ve correlation between the rise in temperature and TC, TSS, total free amino acid and the activities of nitrate reductase and ureae in the wheat var Sonalika 308 seedlings has been reported recently<sup>19</sup>.

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