operative in the greater resistance of starved female rats to burns.

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The Effect of Applied Sugars, Light Intensity, and Temperature upon the Chemical Defoliation of Cotton[1]

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In experiments (*1–3*) conducted during the past two years it was noted that the addition of sucrose to defoliant sprays generally resulted in increased defoliation of the cotton plant. This response was more consistent in greenhouse-grown plants than in field plants (*1*). These results appear to be contrary to the effects of sucrose upon abscission obtained by other investigators (*4–6*) working with various species. Went and Carter (*6*) reported less abscission of flowers and increased fruit set in tomato following the application of sucrose under conditions of high temperatures and low light intensity. Livingston (*5*), working with citrus explants, and Brown and Addicott (*4*), using bean explants, obtained a retardation of the abscission process when sucrose was applied daily.

Most workers (*7–10*) seem to agree that hormone phytocides, particularly 2, 4-D, are absorbed into the leaf in the dark better than, or as well as, in the light, but there is probably no translocation of 2, 4-D from the leaf in complete darkness or from one that has been made starch-free. Moreover, other workers (*8–12*) have reported that the addition of sugars to leaves devoid of translocatable carbohydrates resulted in transport of 2, 4-D, as well as other synthetic auxins from leaves kept in the dark.

Because of the apparent importance of sugar in the translocation of materials from the foliage and the opposite effect noted upon abscission (seemingly depending upon whether sucrose was applied alone or in combination with defoliants), it appeared worth while to study the phenomenon in greater detail. To accomplish this an experiment was undertaken whereby chemically induced defoliation could be followed in cotton plants maintained under varying conditions of light intensity, temperature, and sugar supply.

On June 19, 1951, young, preflowering Stoneville 2B cotton plants, grown outside in fertile soil in 3-gal jars, were selected for uniformity and divided into eight lots of 16 plants each, 4 plants per jar. Duplicate lots were placed under the following conditions of light and temperature: *A*, Lots 1 and 2, outside in high light intensity (8000–10,000 ft-c at noon), high temperature (96° F av max, 72° F av min); *B*, Lots 3 and 4, moderate light intensity (3000–5000 ft-c at noon), moderate temperature (88° F av max, 74° F av min); *C*, Lots 5 and 6, darkness and high temperature (mean 98° F); and *D*, Lots 7 and 8, darkness and moderate temperature (mean 83° F).

On June 23, when starch could no longer be detected in the leaves of plants placed in the dark (Lots 5–8, inclusive) by the I_2KI test, aqueous solutions of 3% Shed-A-Leaf (sodium chlorate–pentaborate) and 2% Endothal (disodium 3, 6-endoxohexahydrophthalate + ammonium sulfate) were prepared, as well as other solutions of the defoliants, plus 2.5% of the various sugars as indicated in Table 1. The plants were then treated as indicated (Table 1) by rolling the leaf slightly to facilitate immersing it into a beaker of test solution, the excess allowed to drain, and the procedure repeated for all leaves in a given treatment. On the average each treatment included 32–36

TABLE 1

THE EFFECTS OF SUGARS, LIGHT INTENSITY, AND TEMPERATURE UPON THE CHEMICAL DEFOLIATION OF YOUNG COTTON PLANTS

Defoliated with Endothal		Defoliated with Shed-A-Leaf	
Sugar Additive	% Abscission	Sugar Additive	% Abscission
Lots 1 and 2			
Endothal Control	50	Shed-A-Leaf Control	60
Dextrose	80	Dextrose	84
Levulose	70	Levulose	88
Sucrose	92	Sucrose	84
Lots 3 and 4			
Endothal Control	40	Shed-A-Leaf Control	60
Dextrose	60	Dextrose	85
Levulose	100	Levulose	93
Sucrose	100	Sucrose	90
Lots 5 and 6			
Endothal Control	10	Shed-A-Leaf Control	6
Dextrose	45	Dextrose	95
Levulose	70	Levulose	92
Sucrose	70	Sucrose	80
Lots 7 and 8			
Endothal Control	Lethal	Shed-A-Leaf Control	5
Dextrose	"	Dextrose	90
Levulose	25	Levulose	100
Sucrose	Lethal	Sucrose	100

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leaves. After treatment Lots 5 and 6 were placed under shade in diffuse light in the greenhouse (maximum light intensity 200 ft-c) to check the effects of light after starch depletion, and Lots 7 and 8 were retained in the dark following treatment.

Twenty-four hr after application abscission had begun on plants in the dark treated with the defoliant-sugar combinations, but none had occurred on plants in the dark treated with the defoliants alone. Also, at this early date abscission had become initiated in the plants kept in the light, with and without sugar additions to the defoliants.

Ninety-six hr after treatment abscission was mostly complete, and defoliation counts were made. These are recorded in Table 1 as the average percentage abscission per treatment. The results show a general increase in percentage abscission when sugar, regardless of type, was added to the defoliant, over the defoliant alone. This effect was noted under high light intensity and temperature conditions as well as under moderate light intensity and temperature conditions. The importance of translocatable carbohydrates in the abscission process was demonstrated by the difference in response of the starch-depleted plants kept in the dark when they were treated with the sugar-defoliant combination compared to the defoliant alone. This effect appears to be due primarily to the addition of sugar. When plants were placed in diffuse light after starch depletion in the dark (Lots 5, 6), they did not respond much differently to the defoliant than those kept continuously in the dark (Lots 7, 8), unless sugar was supplied. It is apparent that the form of sugar (at least among the three types tested) is not critical.

It should also be pointed out that in other work (*3*) we have obtained, in agreement with others (*4–6*), a retardation of abscission by spraying cotton plants with sucrose prior to chemical defoliation or by using a high sucrose concentration with the defoliant. The disparity between the inhibiting effect of sucrose and the accelerating effect obtained by applying the defoliant with a lower concentration of sucrose is not clear at this time. This point is now being investigated.

Repeated research has clearly assigned to sugar a definite role in metabolic absorption by the root. The function of an ion-binding substance formed from sugar accounting for the transport of inorganic ions across the root cell has been postulated (*13*). Weintraub and Brown (*10*) considered their results with sugar and growth-regulators inconsistent with the idea of a definite combination occurring between the two. However, the possible role of sugar in an ion-binding or complex formation capacity in the leaf should be more carefully investigated before definite conclusions can be formed.

Juhrén and Went (*14*) have also suggested a tonic or protective effect of sugar on plant cells. This effect, in light of the known toxicity of chemical defoliants as well as the role of soluble carbohydrates in polar translocation of metabolites, respiration, and abscission (*2, 15*), needless to say, needs further study.

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Lipid Detection in Paper Electrophoresis

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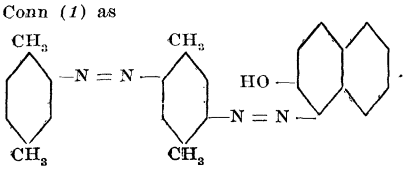
In the course of an investigation of protein-lipid relationships in serum by paper electrophoresis (to be reported elsewhere), several lipophilic dyes have been examined. In our experience the dye oil red 0[1] has proved to be superior to any other examined, including Sudan III, which was used by Bennhold (*2*) in following the migration of lipid serum components with the electrophoresis apparatus of Michaelis and which has recently been used in paper electrophoresis by Fasoli (*3*).

Fig. 1 illustrates results obtained with oil red 0 compared to bromphenol blue staining (*4*) for a normal and a pathological serum. Photoelectric scanning patterns, which were automatically recorded, are included for each strip. The bromphenol blue strips were scanned at 590 mμ and the oil red 0 strips were scanned at 525 mμ in an apparatus to be described elsewhere.[2]

Strip *A* is a bromphenol blue pattern of a normal

[1] Oil red 0 is sometimes confused with Sudan II. The latter has Color Index No. 73, whereas oil red 0 has not been assigned a Color Index number. The formula for oil red 0 is given by Conn (*1*) as



[2] The particular bromphenol blue scanning patterns presented here show albumin areas which are known to be relatively low. This is due to the high optical density of the albumin zone which for these strips exceeded the linear range of the instrument. Grassman and co-workers (*5*) have described another direct scanning apparatus for paper strips.