point flow lines,'' an unexpected harmony becomes evident; extrapolation of these lines results in the establishment of a *focal point.* When other pairs of pressures are taken in the same way, other focal points are

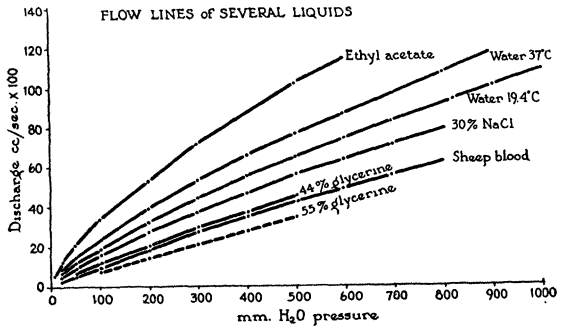

FIG. 1

established. All of these focal points appear to lie on a line passing through the origin.

Several valuable features arise from this observation. First, a given apparatus may be characterized by the slope of the line described by the focal points. Next, it is easy to determine whether a given liquid is flowing in a normal fashion. An example of an abnormally flowing liquid is blood: its two-point flow line does not reach the focal point established by normal liquids (Fig. 2).

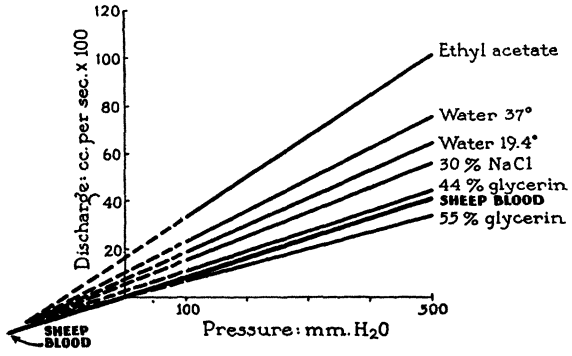

FIG. 2

Another advantage is that a single flow measurement will serve to define the whole logarithmic flow line of a normal liquid, since one point is already available in the focus and the curved line can be derived from the straight line thus determined.

The relationship described depends on the properties of the simple logarithmic curves traced by the flow lines. They belong to the type, A log X + B = log Y. These curves occur in families, each family with its own line of focal points passing through the origin if the treatment described above is applied. What seems remarkable is that normal liquids of a wide range of viscosity appear to flow through a given capillary in precisely the manner required to produce a group of flow lines that belong to a single family of logarithmic curves. A consideration of the known flow properties of normal liquids suggests that this is an effect to be anticipated.

Effect of Chemical Treatment Prior to Storage on Viability and Growth of Cottonseed

M. G. LAMBOU, GLADYS S. KING,[1] and M. Z. CONDON[2]

Southern Regional Research Laboratory, [3]
New Orleans, Louisiana

Cottonseed having a moisture content of 8–11% can be stored without loss of viability (*8*) for periods as long as two years in most sections of the United States. Seed with a moisture content of 12% or above, however, present storage difficulties which depend on the climatic conditions existing in the locality in which they are stored. Investigations at the Southern Regional Research Laboratory on the applicability of chemical treatment in preventing or minimizing heating and deterioration of moist seeds stored in bulk prior to processing for oil and meal have demonstrated that a number of chemicals of various types are effective (*1–5*) for these purposes. Among these chemicals are propylene glycol dipropionate (PGDP) and 4,6-*bis*-chloromethyl xylene (DCB) (*6*).

It was of interest to determine whether these compounds could also be used to prevent loss of viability during storage of moist seed, and accordingly they were investigated separately and in mixtures. The preliminary results of storage experiments using a mixture of these two compounds are reported in this publication. A more detailed report will be presented at a later date.

A Stoneville 2B variety of cottonseed, harvested in 1946 and having an initial moisture content of 8.9% and a germination count of 92%, was artificially conditioned to a moisture content of 12%, as described in a recent publication (*7*). The conditioned seed was divided into three equal lots. The first lot was untreated and served as the control; the second was treated with 0.28% (based on the dry weight of the seed) of a solution of DCB in PGDP, in the ratio of 1: 8 by weight; the third was treated with 0.14% of the same solution. All three lots of seed were stored individually in screw-top glass jars of 1-gal capacity which were maintained at room temperature in the dark. Samples of 50 seeds were withdrawn from each jar for the determination of germination counts and seedling growth at 30-day intervals over a period of 6½ months. Germinations were carried out by the standard blotter technique at room temperature, and the counts were recorded for 4-day-old seedlings. Growth measurements of various parts of all seedlings that germinated were made at intervals up to 12 days. During this period the seedlings were sup-

[1] Histologist, Agricultural Chemical Research Division, Bureau of Agricultural and Industrial Chemistry, USDA, New Orleans.

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[3] One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, USDA.

ported individually in 20-ml glass bottles containing sufficient water to cover the roots and were exposed to artificial light in the laboratory.

The effects of the chemical treatment on the viability and seedling growth of cottonseed after 4, 5, and 6½ months of storage are listed in Table 1. It may be observed from these data that the treatment with the mixed chemicals successfully maintained viability and growth at a level considerably higher than that of an untreated control under identical conditions of storage. The observed effects on growth appear to indicate the possibility that this compound has growth-promoting properties.

TABLE 1

Treatment*	Period of storage (months)	Germination in 4 days		Combined length of root and hypocotyl at 5 days		Length of hypocotyl at 7 days		Length of hypocotyl at 12 days	
		(%)	(% of control)	(mm)	(% of control)	(mm)	(% of control)	(mm)	(% of control)
Control	4	59	...	41	...	78	...	85	...
0.28% PGDP and DCB (8:1)	4	76	129	49	120	83	106	113	133
0.14% PGDP and DCB (8:1)	4	88	149	44	107	78	100	88	104
Control	5	48	...	70	...	75	...	90	...
0.28% PGDP and DCB (8:1)	5	66	138	100	143	92	123	130	144
0.14% PGDP and DCB (8:1)	5	84	175	87	124	85	113	115	128
Control	6½	52	...	50	...	36	...	65	...
0.28% PGDP and DCB (8:1)	6½	62	119	84	168	62	172	82	126
0.14% PGDP and DCB (8:1)	6½	70	135	73	146	60	167	85	131

* Based on the dry weight of the seed.

In addition to the above determinations of germination and growth, a sample of 1,000 seeds was taken from each of the jars of stored seed at the end of 6½ months of storage and germinated as previously described. The results of this test and the measurements made on the seedlings are shown in Table 2. The results obtained on this larger quantity of seeds confirm the trends observed with the smaller sample stored for the same length of time. It will be noted that the percentages of seeds germinating are given for the fourth day only. Experiments on this sample of seed have shown that it is not advantageous to continue tests using the blotter technique for a longer period of time. After four days the increases in the percentages of seeds germinating are very small, and, if the tests are permitted to continue, evidence of microbiological infection is observed. The results indicate that the treatments did not merely accelerate germination but actually resulted in a higher percentage of germination over that of the untreated control.

An analysis of the samples after storage for 6½ months for moisture and free fatty acids is given in Table 3. It is clear that there was a significant decrease in the rate of formation of free fatty acids in the treated samples. Despite the fact that the moisture content of the treated seed was reduced during storage, this loss of 2% of moisture over a period of 6½ months could hardly account for the substantial difference between treated and control seeds in amount of free fatty acids formed. These results confirm those previously reported (*4*) on the effect of the above-mentioned compounds in preventing free fatty acid formation during storage.

TABLE 2

Treatment*	Germination in 4 days		Combined length of root and hypocotyl at 3 days		Length of hypocotyl at 7 days	
	(%)	(% of control)	(mm)	(% of control)	(mm)	(% of control)
Control	33	...	24	...	36	...
0.28% PGDP and DCB (8:1) ..	47	143	41	171	62	172
0.14% PGDP and DCB (8:1) ..	67	203	36	150	59	164

* Based on the dry weight of the seed.

TABLE 3

Treatment	Moisture content* (%)	Free fatty acids* (%)
None (control)	11.6	6.25
0.28% PGDP and DCB (8:1)† ..	9.8	1.48
0.14% PGDP and DCB (8:1)† ..	9.6	1.03

* According to the Methods of the American Oil Chemists' Society (1947).

† Based on the dry weight of the seed.

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