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4-1-1987

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Cabrera, E. R. and Boyd, A. H., "Delinting Cottonseed with the Dilute Sulfuric Acid Method" (1987). *Proceedings of the Short Course for Seedsmen*. 463. https://scholarsjunction.msstate.edu/seedsmen-short-course/463

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#### DELINTING COTTONSEED WITH THE DILUTE SULFURIC ACID METHOD

#### E. R. Cabrera and A. H. Boyd<sup>1</sup>

The dilute acid process for delinting cottonseeds, developed by Cotton Incorporated, has been employed by numerous plants throughout the cotton belt. Seed quality problems thought to be associated with heat and/or acid damage have periodically occurred.

In the dilute acid delinting process, gin-run cottonseeds are wetted with a 10-15% solution of sulfuric acid by weight. The excess solution is removed by a centrifuge and the seeds transferred to a rotating drum where they are dried and delinted.

The objectives of this study were (1) to evaluate the effects of delinting temperatures on germination of cottonseeds, and (2) to determine optimum delinting temperatures.

A seed delinting unit was constructed similar to the one described by Jones (1). A top loading clothes washer was utilized as a centrifuge to remove excess sulfuric acid solution. An electric clothes drier was used as the drying unit. The drier was slightly modified by adding a more accurate thermocouple to control temperature. Angle iron baffles were attached to the inner surface of the rotating drum to provide more friction.

In one study, gin-run seeds of "Stoneville 825" (ST-825) were delinted using 12% and 15% sulfuric acid concentrations and five different chamber-air temperatures. Drying times for each temperature are shown in Table 1. The seeds were then cleaned with a fractionating aspirator and placed in open storage (no temperature or humidity control) for six months. Sub-samples were removed and tested for germination each month beginning two months after delinting.

In a second study, two high quality seedlots and one low quality seedlot were wetted with 12% acid solution and delinted at  $55^{\circ}$ C,  $60^{\circ}$ C and  $65^{\circ}$ C. These temperatures were determined at the exhaust of the drying drum. The drying time for each temperature is shown in Table 2.

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Table	1.	Drying	time	for	concentration	and	chamber-air	temperature
		treatme	nts.					

T	emperature (C)	Drying Ti 12% Solution	me (min.) 15% Solution
	50 Ibyo8 .	4 45 mmdet	.9 .345
	60	40	40
	70	35	35
	80	25	22
	85	20	18
. The axcess nsferred to a	sold by weigh	contribute at a not	ted with a 10-15% solution is removed by a
Table 2. Dry	ing time for Temperatur	each temperature e	treatment.
urtace of the	55	Were attached to	35 35 35 35 35 36 36 36 36 36 36 36 36 36 36 36 36 36
	60 65		25
re or humidity nd basbed for ing.	(ao temperatu na neuvod an after delint	fin open storage Sub-samples we finding two months	ng aspirator and placed strol) for six months. minetion each month beg
			In a second study lity soldlot were weth C. 60°C and 65°C. T Bust of the drying drum wn in Table 2.

13.

All delinted samples were neutralized with sodium bicarbonate, and cleaned with a fractionating aspirator. Laboratory evaluations using standard germination and tetrazolium tests were performed immediately after delinting.

#### Temperature Effect

Chamber-air temperatures of  $60^{\circ}$ C and  $70^{\circ}$ C did not adversely affect seed germination (Table 3). Temperatures higher than  $70^{\circ}$ C had a detrimental effect on germination, even though shorter periods of time were required to achieve adequate delinting. Germination percentage of seeds delinted at  $50^{\circ}$ C was lower than seed delinted at  $60^{\circ}$ C and  $70^{\circ}$ C. The seeds delinted at  $50^{\circ}$ C were never delinted to the desired level and flowability was restricted. For this reason, the aspirator did not adequately remove immature seeds.

#### Sulfuric Acid Concentration Effect

No significant difference was observed between standard germination of cottonseeds delinted by 12% and 15% sulfuric acid solution immediately after delinting (Figure 1). However, seeds delinted with the 15% acid solution showed a greater decrease of germination during the six-month storage period. At delinting temperatures which resulted in acceptable germination levels, there was no difference in time necessary for adequate delinting.

Seed temperature increased from about  $30^{\circ}$ C to near exhaust-air temperature in about 15 minutes and stabilized at exhaust temperatures for the remaining period, which was 10 to 20 minutes, depending on delinting temperature (Figures 2-4).

#### Effects of Exhaust-air Temperature

The germination results of the three lots delinted at three different exhaust-air temperatures as determined by the standard germination and tetrazolium tests are given in Tables 4 and 5. The germination of those samples delinted at  $55^{\circ}$ C and  $60^{\circ}$ C was essentially the same. However, when the exhaust-air temperature was raised to  $65^{\circ}$ C, the germination was lowered significantly (Figure 5).

The detrimental effect of the highest exhaust-air temperature on the quality of the delinted seeds can be best described by the tetrazolium test results. The low vigor section of these samples was always increased. The initial quality of the seeds to be delinted is an important factor. Even though the germination of all lots was lowered at about the same rate, the low quality seedlot suffered a greater decrease in vigor potential (Figure 6).

Table 3.	Effect of	chamber-air drying temperature on the germinatic	on
	of dilute	acid delinted cottonseeds.	

Months in		inter late				
Open Storage	50	60	70	80	85	
		tooh3 (	%	<u>.</u>		
2	77.6 ab	84.5 a	82.0 a	64.6 b	47.6 c	
3	75.9 a	82.8 a	79.8 a	54.1 b	47.7 c	
4	79.3 a	78.1 a	80.4 a	54.2 b	41.5 b	
sill 5 nonserv 2	64.6 b	78.5 a	79.3 a	55.6 b	37.6 c	
6	77.4 a	68.3 a	74.8 a	42.8 b	32.2 c	

Means in the same row not sharing a common letter differ significantly at the 5% level as determined by DMRT.

solution immediately after destrucing (Figure 17. However, seets destructed with the 15% and solution showed a grader decrease of garmination during the sizemonth storage period. At defining tenperatures which resulted in acceptable germination levels, there was no difference in time necessary for adequate definiting.

Seed temperature increated from about 30°C to near eshaust-air temperatures to be a canavat temperatures for the remaining pariod, which was 10 to 20 minutes, depending on deining temperature (Frances 2-4).

#### Effacts of Eduaust-eff Temperature

The permittation results of the shree lots delinited at three ormination and tetrazolium tests are given in Tables 4 and 5. The germination of those semples delinited at 50°C and 50°C was essentially the same However, when the exhaust-sir temperature was raised to dPC, the germination was lowered significantly (Figure 5).

The detrimental effect of the highest estimate-air temperature on the quality of the delinited seeds can be best described by the terresolvum test results. The low right section of these samples was always increased. The initial quality of the sample to be celinited is an important factor. Even though the germination at all lots was lowered at acout the same rate, the low maility tendint suffered a granter decrease in vigor potential (Figure 5).



CONCENTRATION

Figure 1. Monthly germination of cottonseed following delinting with 12% and 15% sulfuric acid solutions.

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Figure 1. Honthis germination of cotonsend following equinting



Figure 3. Exhaust-air and seed temperature curves for the 60C exhaust-air temperature treatment.







Table 4. Germination of cottonseeds delinted at three different exhaust-air temperatures as determined by the standard germination test.

Temperature (C)	Germination %				
55	83.7 a				
60	83.3 a				
65	78.8 b				

Means not sharing a common letter differ significantly at the 5% level as determined by DMRT.

Table 5.	Ge	rmination haust-air st.	of temp	cottonse peratures	eds as	delinted at determined by	three the	different tetrazolium
Temperatu	re	(C)		1.1.5.0 F.S.		Germi	nation	%
55						84	.8 a	
60						83	.9 a	
65		in the second	4			77	.3 b	_

Means not sharing a common letter differ significantly at the 1% level as determined by DMRT.







Results of the standard germination test in the first study indicated the following:

- Germination of seed samples delinted at chamber-air temperatures as high as 70°C was not significantly different from those delinted at lower temperatures.
- Chamber-air delinting temperatures above 70°C decreased germination.
- Inadequate delinting occurred with the 50°C chamber-air temperature. Flowability of these seed samples was poor and removal of immature seeds with the fractionating aspirator was unsatisfactory.
- There was no significant difference in germination between samples delinted with 12% or 15% sulfuric acid concentration.

In the second study, standard germination and tetrazolium tests results suggested the following:

- Samples delinted by using exhaust-air temperatures of 55°C and 60°C germinated highest.
- Germination and vigor were lowered when the exhaust-air temperature was raised to 65°C.
- 3. The standard germination reduction for the low quality lot was of about the same magnitude as for high vigor lots. However, the vigor of the low quality lot was lowered more than that of high quality lots, when estimated by the tetrazolium tests.
- During delinting, seed temperature increased rapidly during the first 15 minutes, becoming more stable for the rest of the drying cycle.

#### Reference

Jones, J. K., et at. 1976. Dilute sulfuric acid process for delinting cotton planting seed. ASAE paper no. 74-3009.