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THE EFFECT OF POLYMER SEED COATINGS ON SEED QUALITY RATINGS

Daniel B. Olivier and David Becker
Texas Tech University
Lubbock, TX
Norman Hopper
Texas Tech University and
Texas Agricultural Experiment Station
Lubbock, TX
Tom Wedegaertner
Cotton Inc.
Lubbock, TX

Abstract

Modern planting equipment requires cottonseed to flow in a single seed manner to function properly. Linters and small amounts of long fibers that are not removed by the ginning process resist this single seed flowing action by causing the seed to clump together. Therefore, cottonseed is delinted by using an acid delinting procedure prior to planting. This acid delinting process is very effective and inexpensive, yet concerns associated with the process include potential seed damage, worker safety, waste disposal, and deterioration of equipment exposed to acid. The use of an alternative method of preparing cottonseed for planting could address some of these concerns associated with acid delinting. The objective of this study was to evaluate several mechanical delinting times and polymer starch coatings with subsequent density separation fractions on several measures of seed quality (Cool Germination Test – CGT, Warm Germination Test – WGT, and Cool Warm Vigor Index – CWVI). The data from the seed quality tests suggested that a 10 minute delinting time was generally equal to or superior to 20 and 60 minute delinting times. Therefore, based upon the data collected, the 10 minute delinting time was selected to evaluate the effects of starch levels and density fractions on the seed quality parameters. Test results collected from the different starch levels indicated that the starch treated seed exhibited significantly increased germination and vigor percentages in the CGT, WGT, and CWVI tests. Data also showed that starch-coated seed can be separated into fractions of different seed qualities - presumably of differing densities. Generally the light fraction performed significantly lower than the medium and heavy fractions for the three seed quality tests.

Introduction

For modern planting equipment to function properly, cottonseed must flow in a single seed manner. Linters and small amounts of long fibers not removed in the ginning process cause the seed to clump together preventing this single seed flowing action. Therefore, seed intended for commercial sale is delinted prior to planting by using one of two acid delinting procedures, Hydrochloric acid (Gas) and Sulfuric acid (Liquid). Even though acid delinting is a very effective and inexpensive method of preparing cottonseed for planting, it is also associated with a few concerns or disadvantages. These concerns include: potential seed damage, worker safety, waste disposal, and deterioration of equipment exposed to acid. As commercial gins strive to increase their capacity by more aggressive ginning, they potentially cause more damage to the seed coat. This increased damage to the seed coat allows the acid delinting process to cause more damage to the seed. The use of an alternative method of preparing cottonseed for planting could address some of these concerns associated with the acid delinting process. Methods tried in the past include: Flame burners - this method is associated with high heat which causes damage to the seed; Mechanical delinting - previously an abrasive process that generated a lot of heat which could cause mechanical and heat damage to the seed. More recently polymer/starch coatings have come to the attention of the seed industry with the *Easiflo* method of coating cottonseed for cattle feed. Therefore, one objective of this study was to evaluate various mechanical delinting times, using a new proprietary mechanical delinting process (no heat) developed by Tom Wedegaertner from Cotton Incorporated, on several measures of seed quality (Cool Germination Test-CGT, Warm Germination Test-WGT, and Cool Warm Vigor Index-CWVI). In addition, the effect of starch-coating of the mechanical delinted seed was evaluated using the same seed quality tests after performing a density separation on the coated seed. Since polymer coating of cottonseed is not a process developed for planting purposes, a few questions need to be answered: 1) does the polymer coated cottonseed provide adequate flowability to be used in modern planting equipment; 2) do polymer seed coatings affect the rate and the total germination/emergence under a range of temperature and moisture conditions; 3) does mechanical delinting time have any effect on seed quality rating; 4) is it possible to gravity separate partially delinted (mechanical) starch coated cottonseed; and 5) does polymer coatings have any effect on disease incidence?

Materials and Methods

A sample of fuzzy cottonseed was exposed to a proprietary mechanical delinting process developed by Tom Wedegaertner from Cotton Incorporated for various time periods (10, 20, and 60 minutes). The seed samples were then treated with starch (10min. – 1and 3%; 20min – 0 and 2%; and 60min – 0 and 1%), resulting in six treatments to be evaluated (Table 1). Bulk samples of each of the twelve treatments were run through a Fractionating Aspirator developed by Carter Day, resulting in a

light, medium and heavy fraction. In addition, a non-separated fraction was evaluated as a control. Adjustments to the aspirator were such that the light fraction consisted of 15% (± 5%) of the total sample. The remaining portion of the sample was divided between the medium and heavy fractions.

The samples from each treatment were evaluated in the laboratory by subjecting seed from each treatment to the Cool Germination Test (CGT), Warm Germination Test (WGT), and Cool Warm Vigor Index (CWVI). In the CGT and the WGT, four replications of 50 seeds each for the treatments were planted on standard germination towels, rolled, and placed in a germination chamber. For the CGT the temperature was set at a constant 18˚C and germination counts was taken 7 days after planting. Only seedlings with a healthy hypocotyl/radical length of 1.5 inches or greater were counted. The WGT temperature was set at an alternating 20˚C for 16 hours and 30˚C for 8 hours in a 24 hour period. The WGT germination counts were taken after 4 days after which the towels were re-rolled and placed back in the chamber to be re-counted after 10 days. The same criteria of healthy hypocotyl/radicals with a length of 1.5 inches or greater was used in the WGT. The CWVI is calculated by the numerical addition of the CGT 7 DAP and the WGT 4 DAP. This is a measure of the seedling vigor.

Results and Conclusion

Cool Warm Vigor Index (CWVI) – see Figure 1
In general, within a starch level the CWVI for the 10 minute delinting time was not significantly different from the 20 and 60 minute delinting times or was higher than the 20 and 60 minute delinting times. The only exception was that the 20 minute delinting time with no starch had a higher CWVI than the 10 minute delinting time with no starch.

Cool Warm Vigor Index (CWVI) – see Figure 2
The CWVI for the 10 minute delinting time within each of the fractions was not significantly different, or was higher, than the values for the 20 and 60 minute delinting times. Therefore, based upon the CWVI data, the 10 minute delinting time was selected to evaluate the effects starch levels and density fractions had on the seed quality parameters.

Cool Germination Test (CGT) – see Figure 3
The Cool Germination Percentage for the starch coated seed (80%) was significantly higher than the Cool Germination Percentage for the non-treated seed (62%).

Warm Germination Test (WGT) – see Figure 4
The starch coated seed had a significantly higher Warm Germination Percentage when counted 4 days after planting (81%) than did the non-coated seed (69%).

Cool Warm Vigor Index (CWVI) – see Figure 5
The starch treated seed had elevated CWVI values (161) when compared to the treatments without starch (130).

Cool Germination Test (CGT) – see Figure 6
The light fraction had a significantly reduced Germination Percentage (56%) when compared to the control (73%), medium (76%), and heavy (78%) fractions. No differences were noted among the control, medium, and heavy fractions.

Warm Germination Test (WGT) – see Figure 7
The medium and heavy fraction seed performed significantly higher on the WGT 4 DAP (81 and 83%, respectively) than both the control (73%), and light (64%) fractions. The light fraction performed significantly lower than the control.

Cool Warm Vigor Index (CWVI) – see Figure 8
The light fraction seed showed a reduced CWVI value (120) compared to the control (146), medium (156), and heavy (161) fractions. The control had a reduced CWVI value compared to the medium and heavy fractions.

The seed quality data suggested that the 10 minute delinting time was generally equal to or superior to the 20 and 60 minute delinting times. Test results indicated that starch treated seed had increased germination and vigor ratings when compared using the CGT, WGT, and CWVI tests. Data showed that starch-coated seed can be separated into fractions of different seed qualities – also presumably of differing densities. In general the light fraction performed significantly lower than the medium and heavy fractions for the three seed quality tests.

Acknowledgement

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Table 1. Summary of treatments.

10 minute + 0% starch
10 minute + 3% starch
20 minute + 0% starch
20 minute + 2% starch
60 minute + 0% starch
60 minute + 1% starch

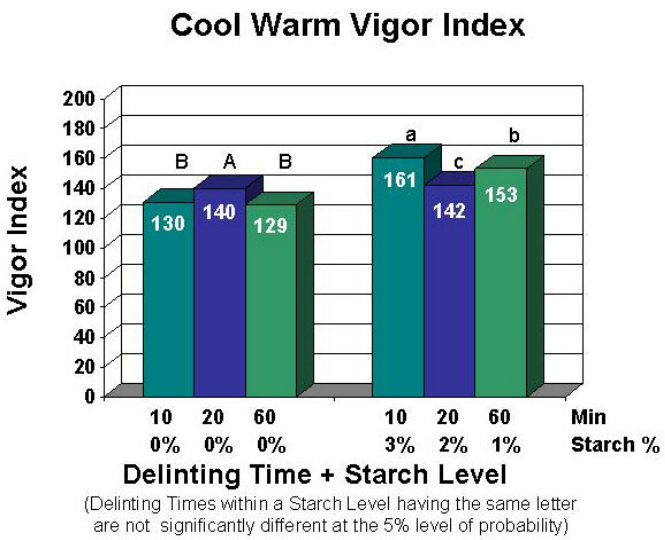

Figure 1. Cool Warm Vigor Index – Delinting Time + Starch Level.

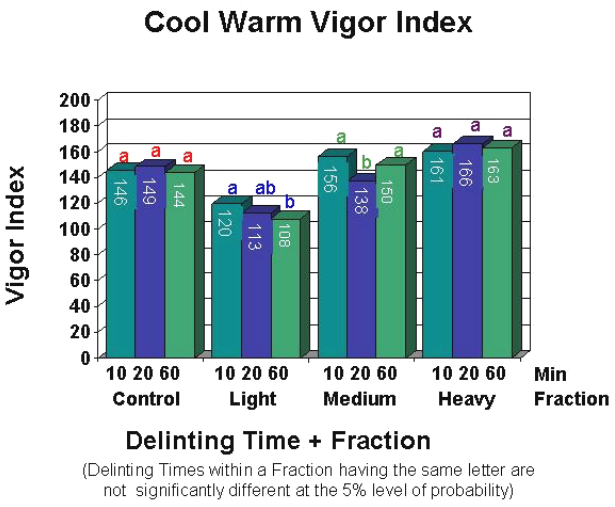

Figure 2. Cool Warm Vigor Index – Delinting Time + Fraction.

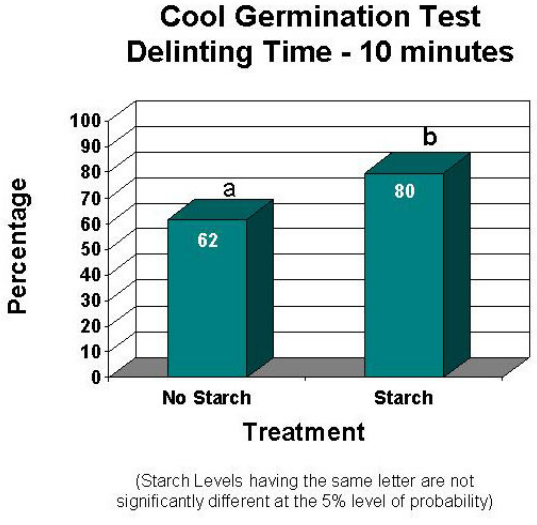

Figure 3. Cool Germination Test – Starch levels.

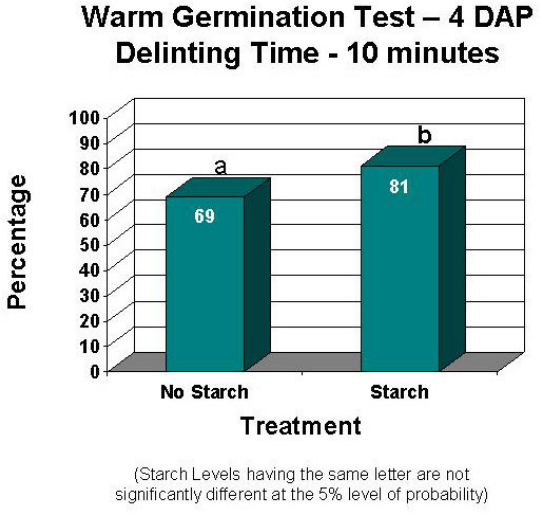

Figure 4. Warm Germination Test – 4 DAP – Starch levels.

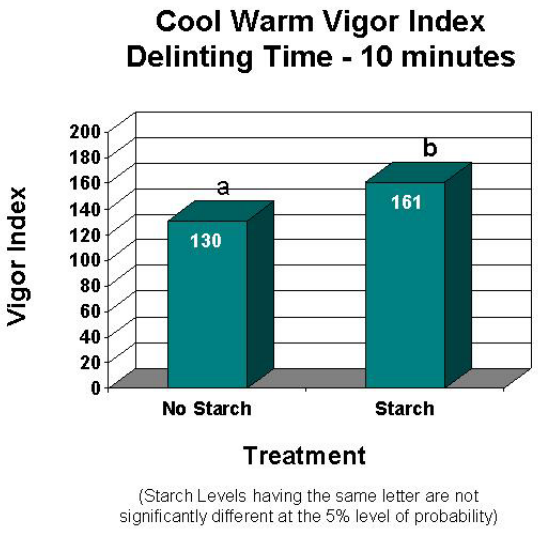

Figure 5. Cool Warm Vigor Index – Starch levels.

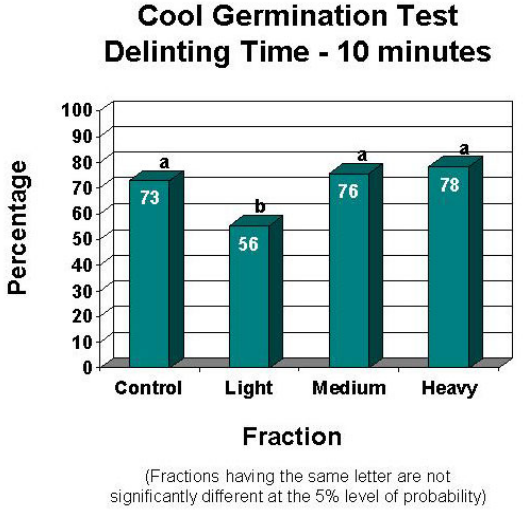

Figure 6. Cool Germination Test - Fractions.

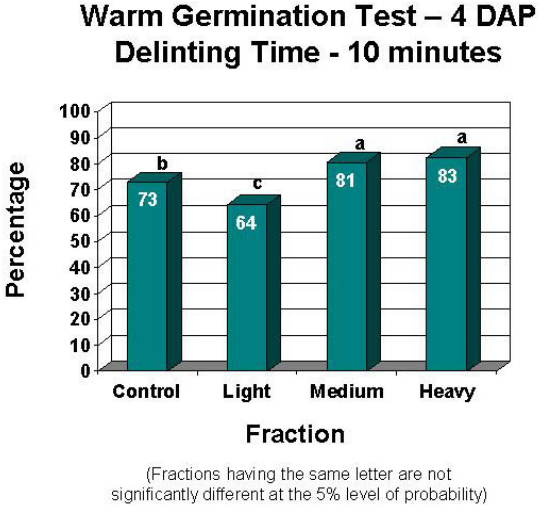

Figure 7. Warm Germination Test – 4 DAP - Fractions.

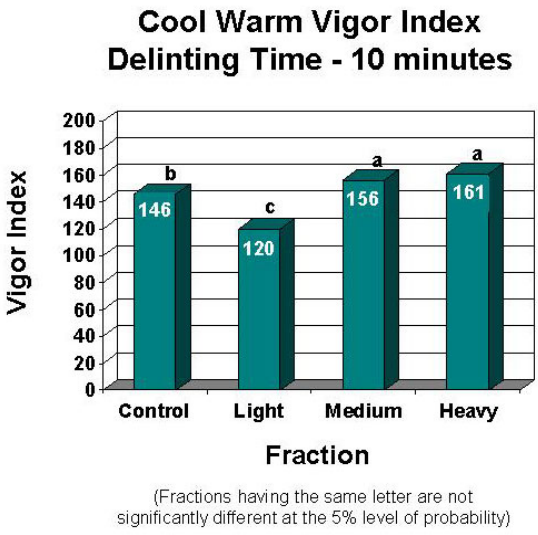

Figure 8. Cool Warm Vigor Index - Fractions.