2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

EFFECTS OF POLYMER COATINGS AND DENSITY SEPARATIONS ON COTTONSEED VIABILITY AND VIGOR

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

Abstract

Preparing cottonseed for planting involves the use of an acid delinting process. Planting equipment requires cottonseed to flow in a single seed manner to function properly. After the ginning process linters and small amounts of long fibers that remain on the seed 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. The 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 objectives of this study were to evaluate various polymer starch coatings and density separations on several measures of seed quality (Cool Germination Test – CGT, Warm Germination Test – WGT, Cool Warm Vigor Index – CWVI, and Environmental Control Chamber Warm Establishment Percentage - EP). The data from the seed quality tests showed that within each treatment across all cultivars, the medium and heavy seed performed significantly higher than the light fraction seed. Generally in the laboratory the mechanical delinted seed performed lower than the acid delinted seed; however, when the polymer coatings were applied the seed performed equal to the acid delinted seed. There were no differences noted among any of the polymer treatments and results indicated that it is possible to separate coated seed into various density fractions. Establishment data in a growth chamber using sand indicated that the acid delinted seed performed lower than the mechanical delinted seed but no differences were noted between mechanical delinted and starch coated seed. The density separations within each treatment kept the same trend in the sand as in the laboratory test, where the medium and heavy fractions performed higher than the light fraction.

Introduction

Preparing cottonseed for planting involves the use of an acid delinting process. Currently two processes are being used; Anhydrous Hydrochloric Acid as a gas and Diluted Sulfuric Acid as a liquid. Cottonseed has to be exposed to an acid delinting process prior to planting to facilitate a single seed flowing action. After the ginning process linters and small amounts of long fibers remaining on the seed prevents this flowing action required for mechanical planting by causing the seed to clump together. Even though both mentioned processes are very inexpensive and effective, there are certain concerns associated with the processes. These concerns include: potential seed damage, worker safety, waste disposal, and deterioration of equipment exposed to acid. Another potential problem arises as commercial gins strive to increase their capacity by more aggressive ginning. The increase in aggressiveness adds the potential of causing more damage to the seed coat. An increase in damage to the seed coat could allow 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 can damage 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 coatings have come to the attention of the seed industry with the development of the *Easi*flo method of coating cottonseed for cattle feed. Therefore, the objectives of this study were to evaluate various polymer starch coatings and density separations on several measures of seed quality (Cool Germination Test – CGT, Warm Germination Test – WGT, Cool Warm Vigor Index – CWVI, and Environmental Control Chamber Warm Establishment Percent - EP).

Materials and Methods

Samples of fuzzy cottonseed from three commercially available cultivars were selected for this study – Fiber Max 966 RR (FM 966 RR), Paymaster 2326 RR (PM 2326 RR), and Paymaster 2379 RR (PM 2379 RR). The samples were exposed to a proprietary Rotary Drum Mechanical delinter developed by Tom Wedegaertner from Cotton Incorporated for 10 minutes (currently being patented). It was previously determined that delinting seed for up to 60 minutes resulted in no mechanical damage (Olivier et al. 2003; Hopper et al. 2003). The seed samples were then polymer coated in a modified Hege seed treater and subsequently dried with 40ºC forced air blowing on the seed. The addition of 10% by weight of water thoroughly wets the seed and help to mat down the remaining fibers on the seed. Once the seed has been thoroughly wetted the dry polymer and talc powder mixture is added to the seed. The seed were then dried in a modified seed blower with 40ºC air. Six treatments were evaluated – see Table 1. Bulk samples from each of the six treatments were density separated by using a Fractionating Air separator from Carter Day resulting in three fractions: 1- light fraction, 2 – medium fraction and 3 – heavy fraction. Adjustments to the separator were such that the light fraction consisted of 15% (±5%) of the total sample weight. 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 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 were taken 7 days after planting. Only seedlings with a healthy hypocotyls / radicle 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 at 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 hypocotyls / radicle 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. In addition to the lab tests the samples were also planted in a growth chamber using sand instead of standard germination towels. The walk-in chamber was set at a constant temperature of 30°C and emergence counts were taken at fourteen days after planting. Sand was used in this test because the sand provides mechanical resistance to the emerging seedlings.

Results and Conclusion

Cool Warm Vigor Index – FM 966 RR – See Figure 1
Fraction comparisons within all the treatments indicated that the medium and heavy seed performed better than the light seed.

Cool Warm Vigor Index – FM 966 RR – See Figure 2
In the light fraction, differences were noted; however this fraction will be discarded and not used in commercial planting, therefore the light fraction will not be discussed for the rest of the cultivars. For the medium fraction, treatment 2 performed lower than all the other treatments, but no differences were noted among treatment 1, 3, 4, 5 and 6. In the heavy fraction, treatment 2 had the lowest CWVI and treatment 4 the highest. The other treatments (1, 3, 5, and 6) were intermediate and not different from each other.

Cool Warm Vigor Index – PM 2326 RR – See Figure 3
Within treatments 1, 2, 3, and 4 the medium and heavy seed had higher CWVI values than did the light fraction seed. Within treatments 5 and 6, there was a stepwise improvement in the CWVI values as seed density increased.

Cool Warm Vigor Index – PM 2326 RR – See Figure 4
For the medium fraction seed there were no differences except that treatment 2 was lower than treatments 1, 4, 5, and 6. In the heavy fraction, treatments 2 and 3 performed lower than seed from treatments 1, 5, and 6.

Cool Warm Vigor Index – PM 2379 RR – See Figure 5
Within treatments 1, 2, 3, 4, and 5, the medium and heavy fractions performed better than the seed from the light fraction. For treatment 6 there was a stepwise increase in the CWVI with the increase in seed density.

Cool Warm Vigor Index – PM 2379 RR – See Figure 6
For the medium fraction, treatments 2 and 4 performed lower than treatments 1, 5, and 6. Treatments 3, 5 and 6 were statistically the same as treatment 1, for the heavy fraction, treatments 5 and 6 were statistically the same as treatment 1 and treatments 2, 3, and 4 were lower.

Environmental Control Chamber Warm Establishment Percentage – See Figure 7
In the establishment test in sand, treatments 2, 4, 5, and 6 performed significantly higher than treatment 1. Treatment 3 performed statistically the same as treatment 1.

Environmental Control Chamber Warm Establishment Percentage – See Figure 8
For the establishment in sand, the medium and heavy fractions performed significantly higher than the light fraction.

Conclusion

For the seed quality parameters tested in the laboratory, the mechanical delinted seed (treatment 2) showed a lower performance than the acid delinted seed (treatment 1). However, when the seed were coated with the polymer the performance equaled that of the acid delinted seed. There were no differences noted in seed performance among the various polymer coatings. Our data indicated that it is possible to separate polymer coated seed into various density fractions.

Acknowledgement

We would like to thank Cotton Incorporated for the financial assistance in conducting this study Stoneville Seed for allowing us to use their Carter Day separator and Delta and Pine Land Co. for donating the seed used in the study.

References

Becker, D., N.W. Hopper, and T.C. Wedegaertner. 2001. The effects of polymer coating on undelinted cottonseed. Proc. of the Beltwide Cotton Conf. 549-551.

Hopper, N. W., D. Olivier, D. Becker, and T. Wedegaertner. 2003. Polymer coating effect on seed quality ratings of cotton. Proc. Of the World Cotton Research Conference -3.

Hopper, N.W, D. Becker, T. Wedegaertner, and D. Olivier. 2002. Performance in the laboratory and field of polymer coated fuzzy cottonseed. Proc. Of the VII International Workshop on Seed Biology, p. 182.

Laird, J.W., and T.C. Wedegaertner. 1999. Quality of lint obtained in cleaning cottonseed to facilitate seed coating process. Proc. Of the Beltwide Cotton Conf. 1415-1418

Olivier, D.B., N.W. Hopper, and T.C. Wedegaertner. 2003. Effect of mechanical delinting and starch coating on laboratory and field performance of cottonseed. Agronomy Abstract CD-Rom (C04-olivier 850900– poster).

Olivier, D. B., N. Hopper, D. Becker, and T. Wedegaertner. 2003. The effect of polymer seed coatings on seed quality ratings. Proc. Of the Beltwide Cotton Conf – CD ROM Computer file.

Olivier, D.B., D. Becker, N.W. Hopper, and T. Wedegaertner. 2002. Effect of planting dates on germination, emergence, and yield of polymer coated fuzzy cottonseed. Agronomy Abstracts CD-Rom (C04-olivier 174153 – oral)

Olivier, D., D. Becker, N.W. Hopper, T.C. Wedegaertner. 2002. Laboratory and field performance of polymer coated fuzzy cottonseed. Proc. Of the Beltwide Cotton Conf – CD ROM Computer file.

Williams, K.D., N.W. Hopper, and T.C. Wedegaertner. 1999. The germination and emergence responses of polymer-coated fuzzy cottonseed. Proc. Of the Beltwide Cotton Conf. 623-625

Williams, K.D., N.W. Hopper, and T.C. Wedegaertner. 2000. The imbibition and emergence responses of polymer-coated fuzzy cottonseed. Proc. Of the Beltwide Cotton Conf. 601-603.

Table 1. Summary of treatments.

1)	Acid delinted seed
2)	10 minute Mechanical delinted seed
3)	2.0:1.0*
4)	1.0:1.0*
5)	CI -1 (Cotton Inc. proprietary treatment)
6)	CI-2 (Cotton Inc. proprietary treatment)

* % by weight polymer / % by weight talc

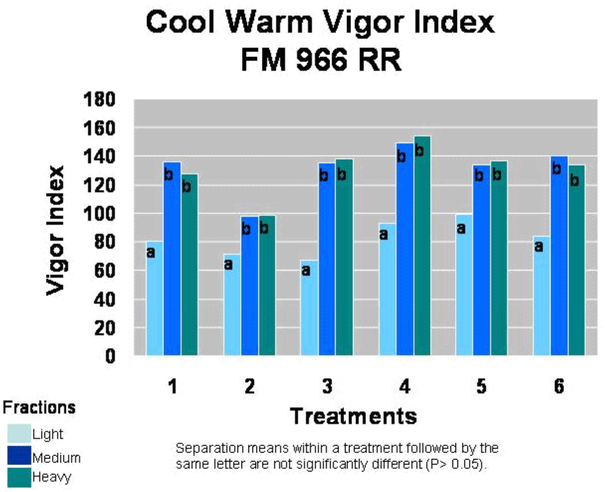

Figure 1. Cool Warm Vigor Index – FM 966 RR – Density Separations.

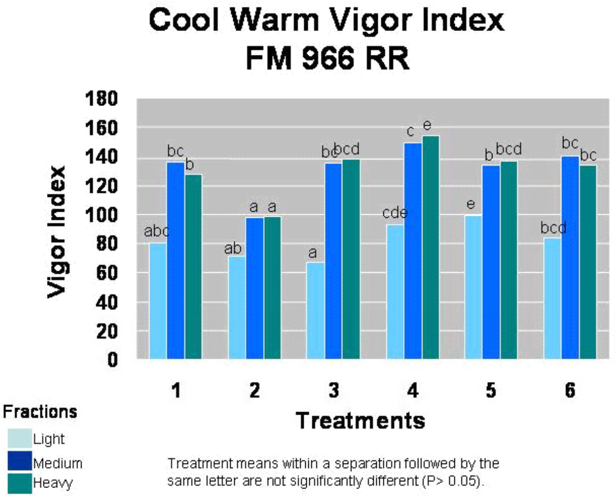

Figure 2. Cool Warm Vigor Index – FM 966 RR – Treatment Separations.

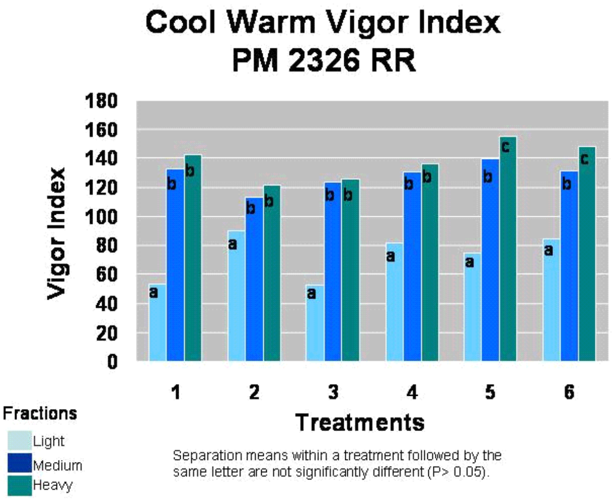

Figure 3. Cool Warm Vigor Index – PM 2326 RR - Density Separations.

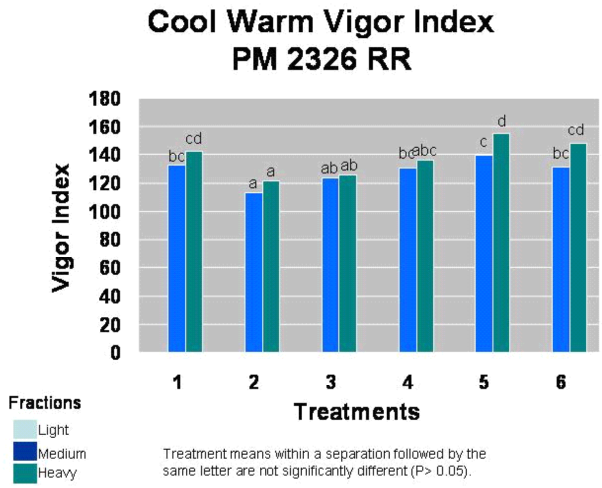

Figure 4. Cool Warm Vigor Index – PM 2326 RR - Treatment Separations.

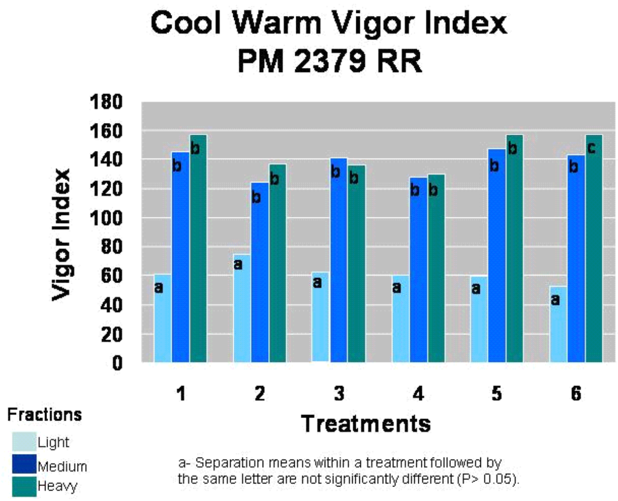

Figure 5. Cool Warm Vigor Index – PM 2379 RR – Density Separations.

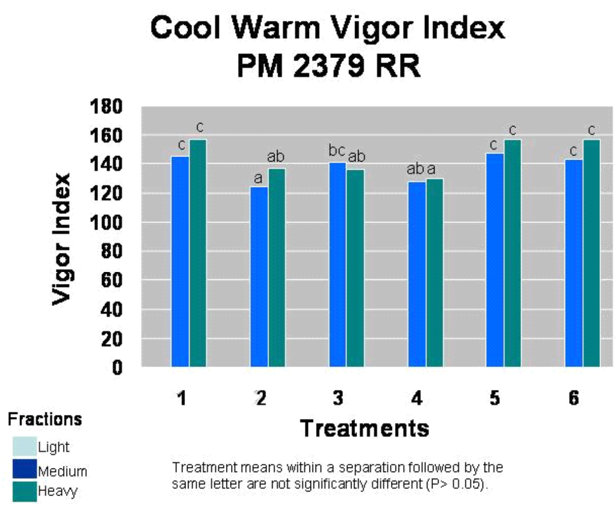

Figure 6. Cool Warm Vigor Index – PM 2379 RR – Treatment Separations.

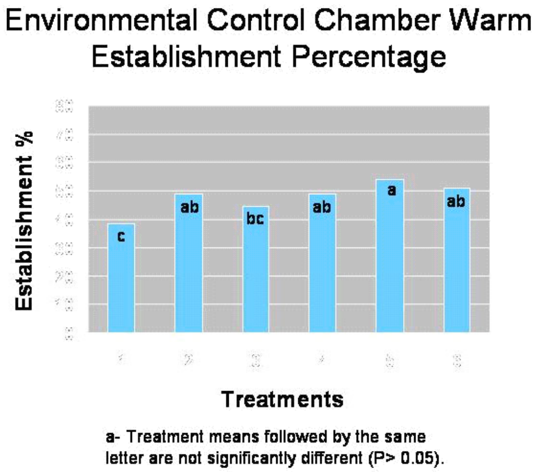

Figure 7. Environmental Control Chamber Warm Establishment Percentage.

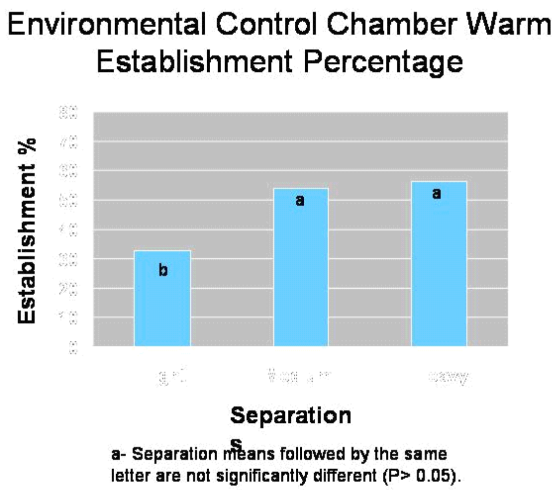

Figure 8. Environmental Control Chamber Warm Establishment Percentage.