Large Scale Comparison of Acid Delinted and Polymer Coated Cottonseed

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Abstract

Historically preparing cottonseed for planting purposes involved the use of an acid delinting process, which allows the seed to flow in a single seed manner required for planting. This process is very effective and inexpensive, yet it could potentially be very hazardous to the seed, workers and the environment. This study evaluates the performance of a polymer starch coating applied to partially mechanical delinted fuzzy cottonseed as an alternative method of preparing cottonseed for planting purposes. The seed treatments were evaluated in the field comparing the performance of acid delinted seed to that of the alternative polymer starch coated seed. This study was performed in a large scale plot trial using a producers land and equipment. The following data were collected: Cool Germination Test - CGT, Warm Germination Test -WGT, Cool Warm Vigor Index - CWVI, Seed Index, Seeding Rate, Establishment Percentage – EP, Emergence Rate Index - ERI, and Lint Yield. There was no significant difference between the acid delinted and coated seed in the CGT and WGT 4 and 10 DAP. There was however a significant difference in the CWVI which was probably due to a slightly slower rate of imbibition by the coated seed. There was also a significant increase in seed weight of the coated seed. This was due to a combination of residual linters and the coating that was applied to the seed. In the field parameters tested we observed no difference in the seeding rate between the coated seed and the acid delinted seed. The coated seed did have a lower actual number of seeds planted per acre but this was not significantly different from that of the acid delinted seed. The EP and Final Stand count did not show a significant difference between the two treatments. For the ERI there was no difference, but we did see the same trend as in the laboratory where the coated seed had a lower absolute number, possibly due to a slightly slower rate of imbibition by the coated seed. For the Lint Yield parameter we observed no difference between the acid delinted and coated seed. From this one study conducted at one location in 2004 we observed no difference between the performance of the acid delinted and starch coated seed.

Introduction

Historically cottonseed intended for planting purposes has been exposed to one of two acid delinting processes. The importance of having cottonseed that will flow in a singulated manner has increased through the years with the development of modern planting equipment. The reason that cottonseed intended for planting is exposed to one of the delinting processes is to facilitate this flowing action which is restricted by liners and small amounts of long fibers that remain on the seed after the ginning process. These linters that remain on the seed cause the seed to clump together and prevent the seed from flowing in a singulated manner required for mechanical planting. There are currently two acid delinting processes in use: one uses anhydrous hydrochloric acid in the form of a gas and the second diluted sulfuric acid in a liquid form. Both these acid delinting processes provide cottonseed with excellent flowability characteristics necessary for mechanical planting. Even though both methods of delinting are very effective and inexpensive, there are certain concerns associated with these processes. These include: potential seed damage, worker safety, waste disposal and deterioration of equipment. Therefore, the use of an alternative method could address some of theses concerns. Alternative methods that have been looked at in the past include flame burner; this process is associated with the use of high heat which could cause heat damage to the seed. Mechanical brush, previously a very abrasive method of preparing seed which could have the potential of causing mechanical damage to the seed. This process also generated high heat which could cause damage to the seed. More recently polymer coatings of fuzzy cottonseed have come to the attention of the seed industry with the development of the E*asiflo* process used in the cattle industry for feed. The objective of this study was to evaluate the performance of a polymer starch coating applied to partially mechanical delinted fuzzy cottonseed as an alternative method of preparing cottonseed for planting purposes. The seed treatment was evaluated in the field and laboratory comparing the performance of acid delinted seed to that of the alternative polymer starch coated seed.

Materials and Methods

PM 2379 RR was selected as the variety to be used in this study. A sample of commercially acid delinted and mechanically graded seed was obtained from Delta and Pine Land Co., in Aiken TX. In addition a sample of fuzzy

seed of the same lot was also obtained from the Aiken location. The fuzzy seed was exposed to a proprietary mechanical delinting process for approximately 10 minutes. This process reduced the residual linters on the seed to about 1.5% by weight. The mechanical delinted samples were then treated with a gelatinized corn starch at a rate of 0.5% by weight of total product. The seed were then dried in a rotary drum for 20 minutes at 125˚F. The starch coated seed were then graded by removing ± 13% of the light density seed. This process was done to simulate what was done to the acid delinted seed in the commercial mechanical grading process. Both the acid delinted and starch coated seed were then treated with a standard fungicide treatment and Cruiser, an insecticide treatment for early season insect problems.

The seed treatments were evaluated in the laboratory by subjecting the seed to the following tests: Warm Germination Test 4 and 10 DAP – WGT 4 and 10 DAP, Cool Germination Test – CGT, Cool Warm Vigor Index – CWVI, and 100 seed weight. In the WGT and the CGT, 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 hypocotyl / 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 hypocotyl / radicle lengths of 1.5 inches or greater were used in the WGT. The CWVI was calculated by the numerical addition of the CGT 7 DAP and the WGT 4 DAP. This is a measure of the seedling vigor. The following parameters were evaluated in the field: Seeding Rate, Establishment Percentage - 28 DAP, Emergence Rate Index, Establishment Percentage - Final, and Lint Yield. The field study planted on May 13, 2004, was conducted on a producer's field equipped with a center pivot set up on 30" rows. The trial was planted with his 16 row International air planter equipped with a Computrol Seed Monitor to give the exact seeding rate for each one of the sixteen row units on the planter. The planter was equipped with two hopper boxes each feeding eight of the sixteen rows separately. This enabled us to place the two treatments, acid delinted and starch coated seed, in separate hoppers and plant eight rows right next to one another. The trial consisted of a total of 7 acres, 3.5 acid delinted and 3.5 starch coated. The emergence counts were taken on 100 ft sections randomly selected through the field. The final stand count was taken from theses same locations in the field. The field was harvested with an eight row John Deere 7460 stripper. We randomly selected 500 ft sections replicated six times through the field to strip out for lint yield. The 500 ft strips were dumped into a Crust Buster weigh wagon to get the seed cotton weight. Grab samples were taken to calculate the gin turnout. Two separate modules were also built; one consisted of the acid delinted seed and one of starch coated seed. The modules consisted of all the cotton harvested in the 3.5 acre sections of both treatments.

Results and Conclusion

Warm Germination Test – 4 DAP – see Figure 1.
The acid delinted treatment had a 95% warm germination test 4 DAP percentage and the coated treatment was not significantly different with an 88.5% germination. The lower absolute number of the coated treatment is possibly due to a slightly slower rate of imbibition.

Warm Germination Test – 10 DAP – see Figure 2.
There was no significant difference between the acid delinted (99%) and the coated (94%) treatments in the warm germination test 10 DAP.

Cool Germination Test – see Figure 3.
For the cool germination test the acid delinted treatment had a 90.5% germination and the coated treatment 82%. This was not a significant difference and the lower absolute number for the coated treatment is possibly due to a slightly slower rate of imbibition.

Cool Warm Vigor Index – see Figure 4.
There was a significant difference between the two treatments. The acid treatment had a CWVI of 185.5 and the coated 170.5. Although there was a significant difference, both the treatments fell in the excellent category, indicating that it was very high quality seed.

100 Seed Weight – see Figure 5.
There was a significant difference between the acid delinted and the coated treatment seed. The acid had a weight of 9.72 g per 100 seed and the coated 10.76 g per 100 seed. The coated seed showed a 10 % increase in weight which resulted from a combination of the residual linters and the coating applied to the seed. This is what would be expected from applying the coating to the seed

Seeding Rate – see Figure 6.
The planter was calibrated to plant 65,000 seeds per acre. The acid delinted treatment was actually planted at 64,476 seeds per acre or 3.69 seeds per foot and the coated treatment at 62,675 seeds per acre or 3.59 seeds per foot. This was not a significant difference between the two treatments.

Establishment Percentage – 28 DAP – Actual – see Figure 7.
Since the number of seeds planted per acre was different from the calibrated number, the actual number of seeds planted per acre was used to calculate the establishment percentage for the two treatments. There was no significant difference between the two treatments with the acid delinted treatment at 83.8% and the coated at 85.6%.

Emergence Rate Index – see Figure 8.
The acid treatment showed an emergence rate index of 11,470.8 and the coated slightly lower but not significantly different at 10,518. The same trend was observed in the field as in the laboratory test, where the coated treatment had a slightly lower absolute number. This is possibly due to a slightly slower rate of imbibition by the coated treatment.

Establishment Percentage – Final Stand Count – see Figure 9.
The final stand count taken after harvest showed no significant difference between the two treatments. The acid delinted showed that 86.4% of the seeds planted became established plants remaining at the end of the season and that 86% of the coated seeds planted were established plants at the end of the season.

Lint Yield (Plot) – see Figure 10.
In the 500 ft sections the lint yield for the acid delinted treatment was 1363.6 lb per acre or 2.82 bales pre acre and for the coated treatment 1231.9 lb per acre or 2.55 bales per acre. This was not a significant difference between the two treatments.

Lint Yield (Field) – see Figure 11.
The lint yield for the field was derived from the weight of the two separate modules. The acid delinted treatment yielded 1357.9 lb per acre or 2.81 bales per acre and the coated yielded 1300.5 lb per acre or 2.70 bales per acre.

Conclusion

From this one study conducted at one location in 2004, we saw no significant difference between the performance of the acid delinted and starch coated seed.

Acknowledgement

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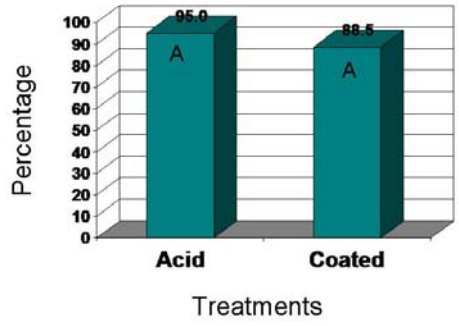

Treatments with the same letters are not significantly different (P>0.05)

Figure 1: Warm Germination Test 4 DAP

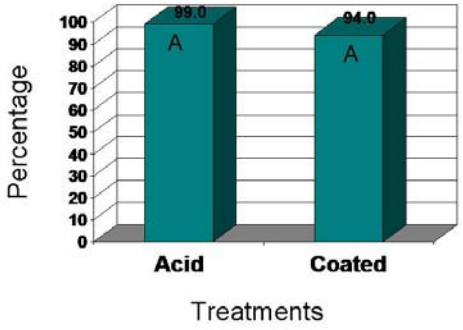

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Figure 2: Warm Germination Test 10 DAP

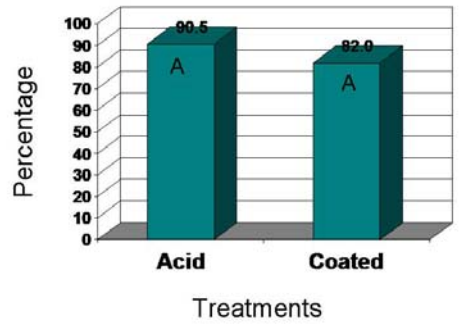

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Figure 3: Cool Germination Test

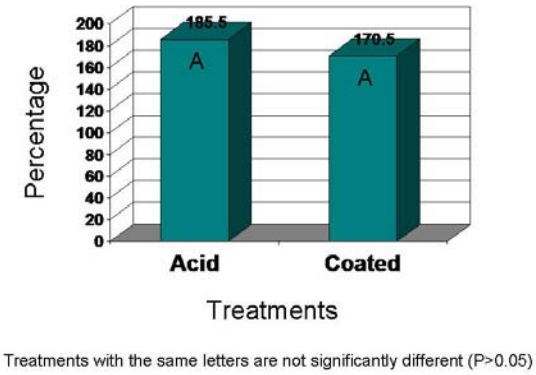


Figure 4: Cool Warm Vigor Index

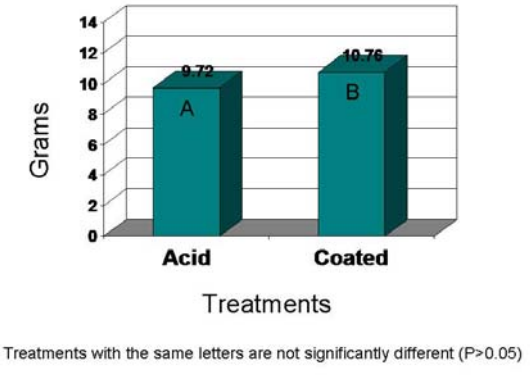


Figure 5: 100 Seed Weight

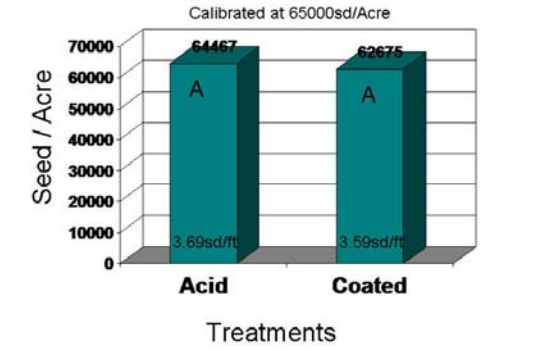


Figure 6: Seeding Rate

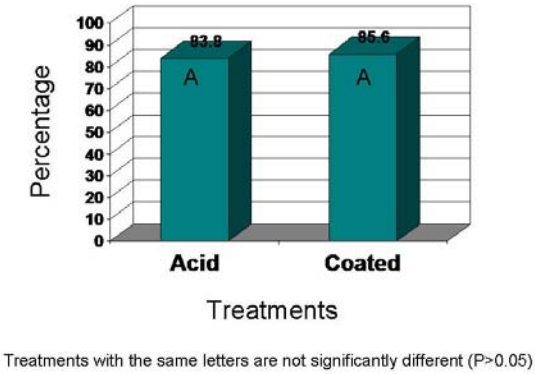


Figure 7: Establishment Percentage 28 DAP – Actual

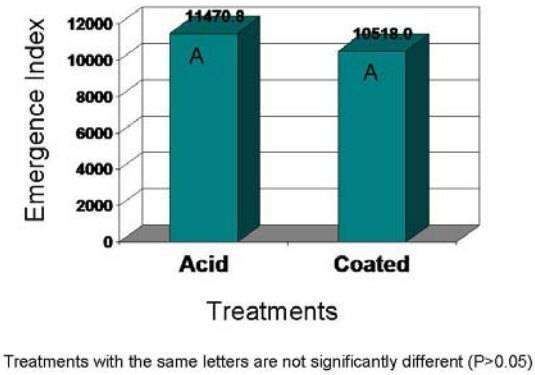
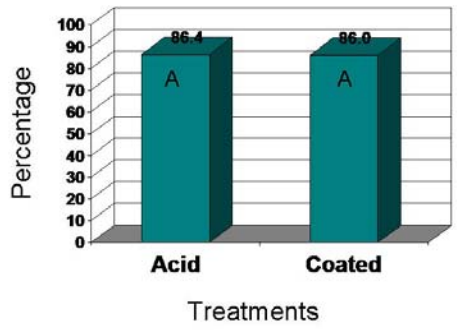
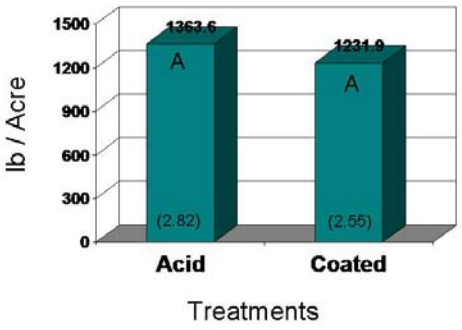


Figure 8: Emergence Rate Index



Treatments with the same letters are not significantly different (P>0.05)

Figure 9: Establishment Percentage Final Stand Count



Treatments with the same letters are not significantly different (P>0.05)

Figure 10: Lint Yield (Plot)

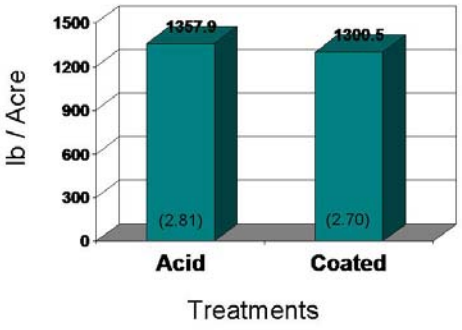


Figure 11: Lint Yield (Field)