YIELD POTENTIAL, FIBER QUALITY AND ADAPTABILITY OF GLANDLESS COTTON IN NEW MEXICO

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Abstract

The prospect of commercial cultivation of glandless cotton (cotton plants without gossypol) will widen the utility of cottonseed beyond the present main use as ruminant animal feed, and this could result in higher income for cotton growers in New Mexico. Previous evaluations of glandless cotton in New Mexico have been unsuccessful due to pressures from insect and vertebrate pests, and poorly adapted cultivars. However, the State of New Mexico is now characterized as a low pest pressure zone for cotton production, with the near eradication of pink bollworm and boll weevil pests. Thus, the environment of New Mexico may now be more favorable to grow glandless cultivars of cotton. An upland cultivar of glandless cotton (Acala-GLS) bred for California conditions was evaluated in New Mexico and compared to conventional glanded Acala cultivars (Acala 1517-08 and Acala 1517-99). A total of four sites (two on-station and two commercial farms) were selected for this study. The on-station trials were located at the NMSU Leyendecker Plant Science Center in Las Cruces and the NMSU Agricultural Science Center in Artesia, NM. The commercial farm sites were located in Anthony and Garfield, NM. The cotton cultivars were planted on beds spaced 40 inches apart and irrigated by furrows and/or sprinklers. After maturity, yield was evaluated in 2-rows that are 20ft long in each plot. Results showed that the Acala-GLS cultivar generally had lower yields when compared to the conventional glanded Acala cultivars of New Mexico. Yield was also variable with sites and management practices. Some damages on the leaves due to beet armyworm feeding were observed in the glandless cotton at the Agricultural Science Center in Artesia, but this does not appear to have significant impact on boll formation. Generally, the conventional cultivars showed more vigor compared to the glandless cultivar. Average boll number per acre was 40% higher and the plant height was 20% higher in the conventional cultivars compared to the glandless cultivar. Conventional glanded cultivars gave 18-36% higher yield than the Acala-GLS cultivar.

Introduction

The glandless cotton is a normal cotton plant but without gossypol. This makes the seeds edible for non-ruminants and humans. Gossypol is a polyphenolic aldehyde, which inhibits several dehydrogenase enzymes (Cherry & Leffler, 1984) and is normally present in glanded cotton plants as a natural defense mechanism against pests. However, this limits the utility of cottonseed as food and feed (Fryxell, 1968). Cotton seeds with gossypol are toxic to non-ruminants and must be fed carefully to ruminants to avoid acute gossypol poisoning. Glandless cottonseed, free of gossypol, can serve as a rich protein source in human food and can also be fed to non-ruminants and aquatic animals such as shrimp and catfish (Yingfan et al. 2010, Lusas & Jividen, 1987). This can constitute a potentially large market. Previous evaluations of glandless cotton in many parts of the cotton belt have been problematic due to its high susceptibility to chewing, piercing and sucking insect pests such as lygus and boll weevil, and vertebrate pests (Benedict et al. 1977, Jenkins et al. 1966). New Mexico may now be more favorable to grow glandless cotton cultivars, with the near eradication of the major cotton pests. The objective of this study is to evaluate and compare the yield and fiber quality of an Acala glandless cotton with the conventional Acala cultivars grown in New Mexico. In this paper, only the yield data is presented.

Materials and Methods

An upland cultivar of glandless cotton (Acala-GLS) was evaluated in New Mexico and compared to conventional Acala cultivars (Acala 1517-08 and Acala 1517-99). A total of four sites (two on-station and two commercial farms)

were selected for this study. The on-station trials were located at the New Mexico State University (NMSU) Leyendecker Plant Science Center in Las Cruces and the NMSU Agricultural Science Center near Artesia. The commercial farm sites were located in Anthony and Garfield, NM.

Planting was done at all sites on 40 inches spaced beds and the plants were furrow irrigated in Garfield, Leyendecker and Anthony sites. In Artesia, irrigation water was applied by furrows and sprinklers. Cultural practices were according to those prescribed by the New Mexico State University. Planting date at all sites varied between first week till 3rd week of May and the harvest varied from first week to 3rd week in November.

The experimental design was a randomized complete block design or paired comparison with four replicates in strip plots. Fifty matured bolls were collected from each plot (2 bolls/plant) for lint percentage and fiber quality determination. Quantitative field yield was assessed on each plot by harvesting 2 rows, 20 feet long.

Results and Discussion

Seed-cotton, lint and seed yields were variable across the trial sites (Figures 1-3). There were no significant differences in seed-cotton, lint and seed yields in Garfield and Leyendecker sites (Figures 1-3). However, these variables were significantly different in Anthony and Artesia sites with conventional cultivars (Acala 1517-99 & Acala 1517-08) having higher yields than Acala-GLS (Figures 1-3). The lint yield was 18 to 36% higher in the conventional Acala cultivars compared with Acala-GLS (Figure 2). The average lint yield across all sites was 1051 Ibs/ac for the Acala-GLS; 1169 Ibs/ac for Acala 1517-99 and 1438 Ibs/ac for Acala 1517-08.

Yield data at the Garfield site was much lower than expected (Figures 1-3) and this may have been due to the soil fertility constraints observed in the land used. The highest yields of the Acala-GLS were observed at Leyendecker (Figures 1-3). The relative high yields observed at the Leyendeker site might be related to the land used for the experiment, which had not been in cotton for over 10 years and had been left to fallow for several years. One of the conventional Acala cultivars (Acala 1517-99) recorded the highest yield in Anthony (Figures 1-3).

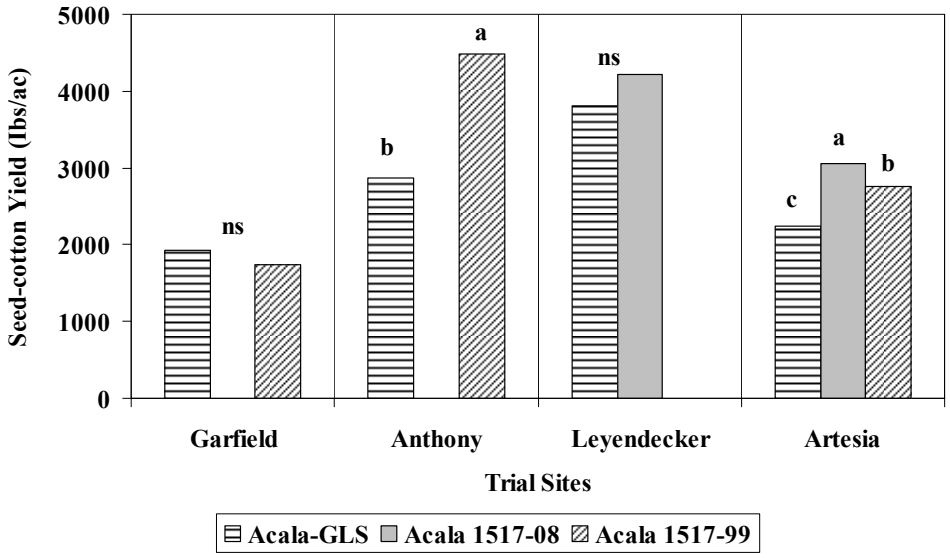

Figure 1. Seed-cotton yield of the cultivars tested at different trial locations.

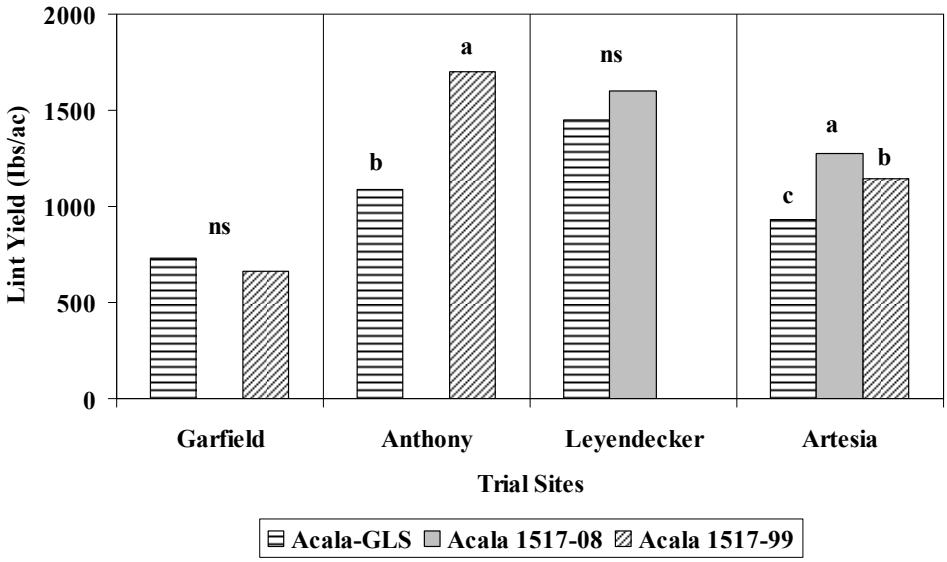

Figure 2. Lint yield of the cultivars tested at different trial locations.

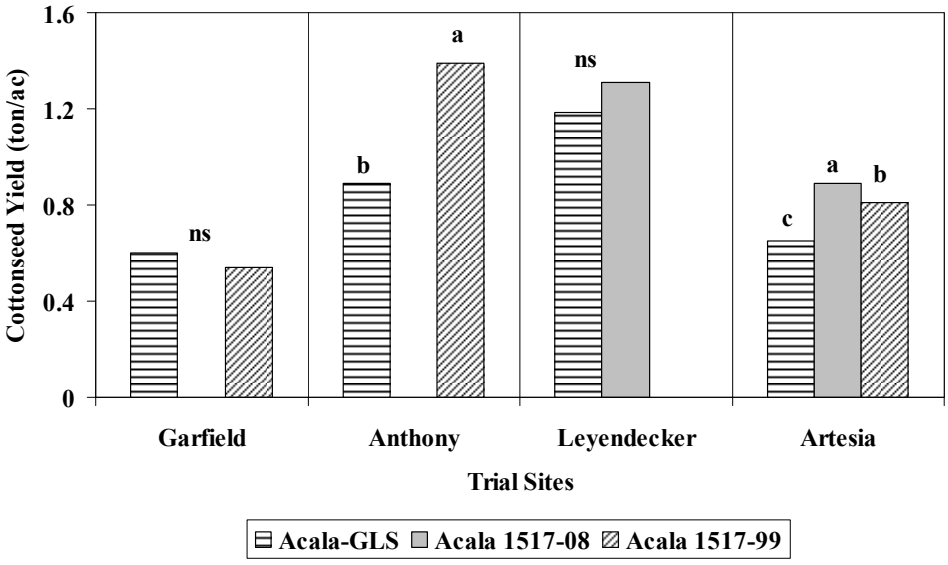

Figure 3. Cottonseed yield of the cultivars tested at different trial locations.

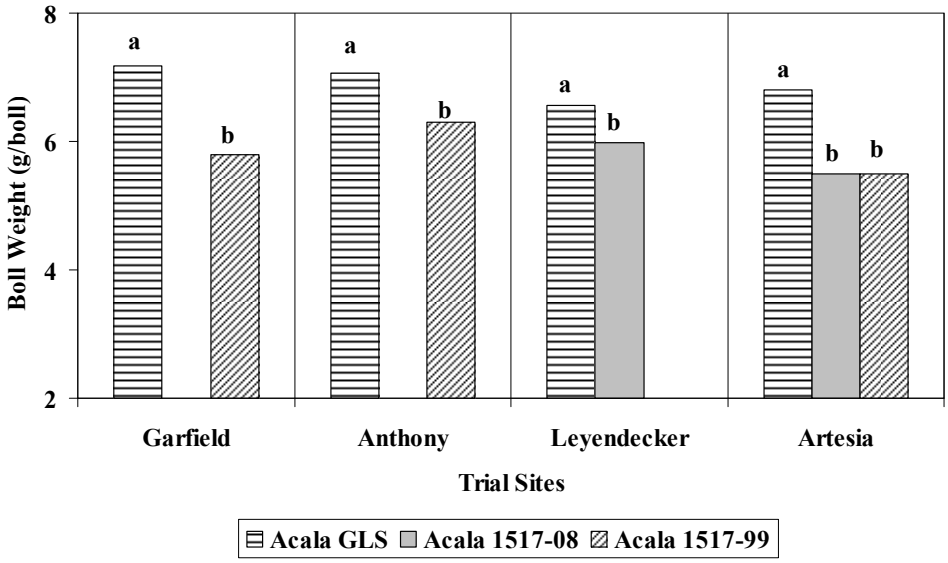

Figure 4. Boll weight of the cultivars tested at different trial locations.

Another observation was the significant higher boll weight of the Acala-GLS compared with the conventional cultivars (Figure 4). However, this higher boll weight did not translate into higher yields because the total number of bolls was 20 – 60% fewer in the Acala-GLS compared with the conventional cultivars.

Incidence of pest and diseases were minimal on all the cultivars tested, except that some damages were observed due to beet armyworm feeding in the glandless cotton at the Agricultural Science Center in Artesia. However, this does not appear to have had significant impact on boll retention and yield.

Summary

The New Mexico trial that compared an Acala glandless cultivar with two conventional Acala cultivars that are glanded showed that:

i. Average seed cotton, lint and cottonseed yields of the conventional cultivars across four sites were higher compared with the glandless cotton.
ii. Yield reductions for the Acala glandless varied between 18 and 36% (depending on site) when compared with the conventional glanded cultivars.
iii. Insect pressure was minimal across the locations tested. The glandless cultivar was not preferentially attacked except for an incident of beet armyworm feeding on the leaves at one of the sites. However, this did not affect boll retention or yield.
iv. The Acala glandless cultivar will be evaluated for at least two more seasons to determine it's suitability for New Mexico farmers.
v. New high yielding glandless cotton adapted to the southwest needs to be developed.

References

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