# IMPACT OF DEFICIT IRRIGATION ON SELECTED GLANDLESS CULTIVARS IN NEW MEXICO

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## Abstract

Water availability for irrigation is a challenge in the Southwest. Therefore, it is important to evaluate the performance of existing cultivars to different levels of irrigation. Glandless cotton cultivars, (Acala GLS and STV Glandless) were subjected to deficit irrigation and compared to two conventional cultivars (Acala 1517-08, a public variety bred for NM conditions and PHY 499, a leading commercial cultivar grown throughout the cotton belt). Irrigation treatments consisted of four (IRR4), five (IRR5) and six irrigations (IRR6). Each irrigation event consisted of an application of 3.5 inches of water through furrow irrigation. The experimental design was a split plot with irrigation regimen as the main plot and cultivar as the subplot, and the treatments were replicated four times. Results showed a significant irrigation effect on the cotton yield, with IRR4 treatment having lower seedcotton, lint and seed yields compared to IRR5 and IRR6. Irrigation treatment also significantly affected four out of the six fiber quality measurements. However, IRR5 and IRR6 did not significantly differ for the yield parameters and the fiber quality traits. Although cultivar effect was not significant on yields, and there was no interaction effect of irrigation x cultivar on yield, cultivar had significant effect on all the six measured fiber quality parameters. Generally, Acala-GLS had the best fiber quality among the tested cultivars, while IRR6 treatment had better fiber quality measurements than IRR4.

## Introduction

Water availability in the southwestern United States is limited and has become a major constraint for agricultural production and sustainability (MacDonald, 2010). With the recurrent drought that is common in this region, optimization of water resources for agricultural production has become imperative (Cayan et al., 2010). Therefore, studies that focus on the productivity of cotton cultivars under limited irrigation have become necessary. Glandless cotton is currently being tested in New Mexico, since this can widen the utility of cotton seeds beyond the current predominant use as cattle feed. Recent trials have shown that the glandless cotton production could be viable in New Mexico (Idowu et al., 2014; Zhang et al., 2014a, b). With the prospect of reduced availability of irrigation water, there is need to evaluate the performance of the glandless cultivars under deficit irrigation condition in order to optimize the water use efficiency.

The objectives of this current study were to evaluate the effects of deficit irrigation on the yield and fiber quality of two glandless cotton lines, in comparison with two selected commercial cultivars that are grown in New Mexico.

## Materials and Methods

Cotton Cultivars tested included two glandless cultivars (Acala GLS & STV Glandless) and two conventional cultivars (Acala 1517-08 & Phytogen 499WRF).

The trial was planted in mid-May, 2014 at the NMSU Fabian Garcia Plant Science Center in Las Cruces and seed planting took place on 40 inches spaced beds. The experimental design was a split- plot design with irrigation regimen as the main plot and cultivar as the subplot and the experimental units were replicated four times. The irrigation treatments were 4, 5 and 6 irrigation events, designated as IRR4, IRR5 and IRR6, respectively. The trial was furrow irrigated, with each irrigation event consisting of about 3.5 inches of applied water and about 5 inches of rain fell during the growing season.

Harvest took place in December 2014. Data collected included 25 matured bolls from each plot (2 bolls/plant) for seed/lint ratio and fiber quality determination. Quantitative field yield was assessed on each plot by harvesting 2 rows, 20 feet long and fiber quality was analyzed by High Volume Instrument (HVI) at Cotton, Inc., Cary, NC.

## Results and Discussion

Irrigation treatment effect was significant for seedcotton, lint and cottonseed yields (Figure 1A).

While there were no significant differences in cotton yield parameters between IRR5 and IRR6 treatments, there were significant reductions in yield measurements of IRR4 compared to the two other treatments (Figure 1A).

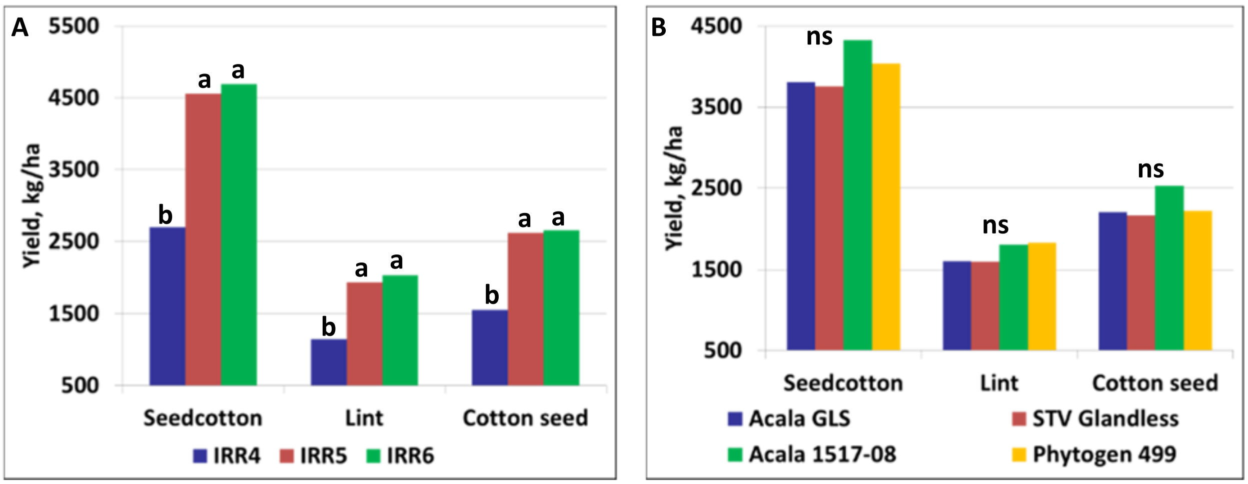


Figure 1A & B. Yield of cotton as a function of irrigation regimen (A) and cultivars (B)
IRR4: four irrigation; IRR5: five irrigation and IRR6: six irrigations.
a, b: bars with the same letter for a given yield parameter are not significantly different; ns: no treatment difference

Cultivar effect was not significant for all the yield parameters (Figure 1B), and there was no significant interaction effect (irrigation x cultivar) for all the yield parameters.

Cultivar and irrigation treatment effects were significant on micronaire, uniformity index, fiber strength and short fiber content (Table 1), while fiber length and elongation showed only significant cultivar effect and no significant irrigation effect (Table 1).

Table 1. ANOVA results of the fiber quality measurements

| Effects | Micronaire | Fiber length (in) | Uniformity index (%) | Fiber strength (g/tex) | Fiber Elongation (%) | Short fiber content (%) |
|---|---|---|---|---|---|---|
| Cultivar | * | ** | ** | ** | ** | ** |
| Irrigation | * | ns | * | * | ns | * |
| Cultivar x Irrigation | ns | ns | * | ns | ** | ns |

**: significance at 1% level, *: significance at 5% level; ns: not significant

Uniformity index and fiber elongation had a significant interaction effect between irrigation treatment and cultivar (Table 1).

All of the fiber quality measurements except micronare were more favorable for IRR6 treatments compared to IRR4 treatment (Table 2). However, most of the fiber quality measurements were not significantly different between IRR6 and IRR5 (Table 2).

Table 2. Fiber quality measurements under different irrigation regimen

| | IRR4 (Four Irrigations) | IRR5 (Five Irrigations) | IRR6 (Six Irrigations) |
|---|---|---|---|
| Micronaire | 4.03 b | 4.00 b | 4.50 a |
| Fiber length (in) | 1.16 b | 1.19 ab | 1.23 a |
| Uniformity index (%) | 83.48 b | 84.27 b | 85.57 a |
| Fiber strength (g/tex) | 31.48 b | 32.93 a | 33.84 a |
| Fiber Elongation (%) | 4.67 b | 4.81 ab | 4.98 a |
| Short fiber content (%) | 8.00 a | 7.87 a | 7.13 b |

a, b, c: means within a row followed by the same letter are not significantly different

Generally, Acala GLS, which is a glandless cultivar, appears to have the most favorable fiber quality compared to other cultivars that were tested, while STV Glandless had the poorest fiber quality (Table 3). The glanded Acala 1517-08 had similar fiber quality to Acals GLS, but with significantly longer and stronger fibers than the other glanded cultivar PHY 499,

Table 3. Fiber quality measurements of the tested cultivars.

| | Acala GLS | STV Glandless | Acala 1517-08 | PHY 499 WRF |
|---|---|---|---|---|
| Micronaire (units) | 3.92 b | 4.35 a | 4.23 a | 4.20 a |
| Fiber length (in) | 1.22 a | 1.16 b | 1.23 a | 1.16 b |
| Uniformity index (%) | 85.67 a | 82.32 c | 84.71 b | 84.80 b |
| Fiber strength (g/tex) | 36.42 a | 28.88 d | 34.94 b | 30.33 c |
| Fiber Elongation (%) | 4.06 c | 4.14 c | 4.90 b | 6.11 a |
| Short fiber content (%) | 7.13 c | 8.57 a | 7.31 c | 7.78 b |

a, b, c, d: means within a row followed by the same letter are not significantly different

## Summary

Irrigating 4 times significantly decreased seedcotton, lint and seed yields by about 42%, compared to 6 irrigations, but there were no yield differences between 5 and 6 irrigations.

Irrigating 4 times also significantly reduced fiber length, strength, elongation, uniformity, and micronaire, but increased short fiber content, while 5 and 6 irrigations did not differ in the above fiber quality traits. Cultivar however, had significant effect on fiber quality with the Acala GLS generally having better fiber quality than the other cultivars.

Although the four cultivars tested did not differ significantly in yield, the two glandless cotton cultivars produced 87-94% seedcotton yield and 87-89% lint yield, as compared to the two glanded cultivars. This is the first year of this study. Multiple season trials are needed to validate the observations made in this study.

## References

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