IMPACTS OF POTASSIUM FERTILIZATION ON NEW GLANDLESS COTTON CULTIVARS DEVELOPED FOR NEW MEXICO

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Abstract

New glandless cotton cultivars have been developed for New Mexico environments, with the intent to optimize lint and seed yields, as well as the fiber quality. However, these new cultivars need to be tested for their response to agricultural inputs such as fertilizers and irrigation water, since these are very critical limiting resources for arid crop production. Three new glandless cotton cultivars (NuMex COT 15 GLS, Acala 1517-18 GLS and NM 13P1117), were evaluated and compared with two old glandless cotton cultivars (Acala-GLS and STV Glandless) at two potassium fertilizer application rates (120 kg K_2O/ha and 240 kg K_2O/ha). Results show significant effects of cultivar on lint yield, with NM 13P1117 having the highest lint yield. Potassium rate effect was significant for all the yield parameters, with the potassium rate of 240 kg K_2O/ha leading to an average of 42% higher yields compared to the rate of 120 kg K_2O/ha. Fiber quality was significant with cultivar, with the Acala cultivars (Acala 1517-18 GLS and Acala GLS) generally having better fiber qualities than the rest of the cultivars tested. However, potassium rate effect was not significant on fiber quality, and the interaction effect between cultivar and potassium rate was mostly not significant on both yield and fiber quality.

Introduction

Field tests have shown that glandless cotton cultivars are well adapted to the New Mexico environment, due in part to low pest pressure. Our studies have highlighted the need to develop new glandless cotton cultivars due to lower yields of the older cultivars (Idowu et al., 2014; Zhang et al., 2014).

Recently, two new glandless cultivars have been released in New Mexico (Zhang et al., 2016; Zhang et al., 2017) and a third cultivar is being released. These new cultivars need to be optimized for their nutrient requirements and other agronomic inputs.

Potassium is an important nutrient element that affects yield and fiber quality of cotton. Several studies have demonstrated significant cotton yield responses to K fertilization (Cassman et al., 1990; Gormus, 2002). Testing these new cotton cultivars for adaptability to New Mexico and responses to soil nutrients will enhance the productivity of glandless cotton. We have studied the performance of new glandless cotton lines as a function of soil types and nitrogen rates (Idowu et al., 2016)

The objectives of this study were, (1) to evaluate the yield and fiber quality of the new glandless cultivars developed for New Mexico; and (2) to assess the impacts of two potassium rates on yield and fiber quality of glandless cultivars.

Materials and Methods

Five glandless cultivars were evaluated. Three of the cultivars are the new glandless cotton lines developed in New Mexico (NM 13P1117, NuMex COT 15 GLS, and Acala 1517-18 GLS) and the remaining two are already existing glandless cultivars (Acala GLS and STV Glandless). Two potassium fertilizer application rates (120 kg K_2O/ha and 240 kg K_2O/ha) was tested and applied in the form of muriate of potash

The experiment was conducted at the New Mexico State University (NMSU) Leyendecker Plant Science Center in Las Cruces, NM. The experimental design was split plot, with cultivars as the main plots and potassium rates as the subplots. The trial was established on beds spaced about 1 m apart with a seeding rate of 10 seeds/m and furrow

irrigated. Plot size was 15 m x 4 m. Cultural practices were according to those prescribed by NMSU. Planting was done in middle of May 2017, while harvest took place during the first week of December 2017.

Agronomic parameters monitored during the season included plant height, number of fruiting branches, number of squares, and number of bolls formed. At maturity, 25 open bolls were collected from each plot (1bolls/plant) for lint percentage and fiber quality evaluation. Quantitative field yield was assessed for each plot by harvesting 2 rows, 10 feet long. Fiber quality was analyzed by High Volume Instrument (HVI) at Cotton, Inc. (Cary, NC). The analysis of variance (ANOVA) was performed on different measurements to evaluate the significance of cultivar and potassium rates effects.

Results and Discussion

The new cultivars (NM 13P1117, NuMex COT 15 GLS, and Acala 1517-18 GLS) generally had higher yields than the older cultivars (Acala GLS and STV Glandless); however, only the lint yield produced statistically significant differences among the cultivars, with NM 13P1117 having the highest yield (Figure 1 A-C).

Potassium application at the rate of 240 kg K_2O/ha produced significantly higher seedcotton, lint and cottonseed yields, as compared to the rate of 120 kg K_2O/ha (Figure 2 A-C).

However, there were no significant interactions between cultivar and potassium rate for yield components. There were also no significant interactions between cultivar and potassium rate for the fiber quality parameters except for fiber elongation at the 5% significance level.

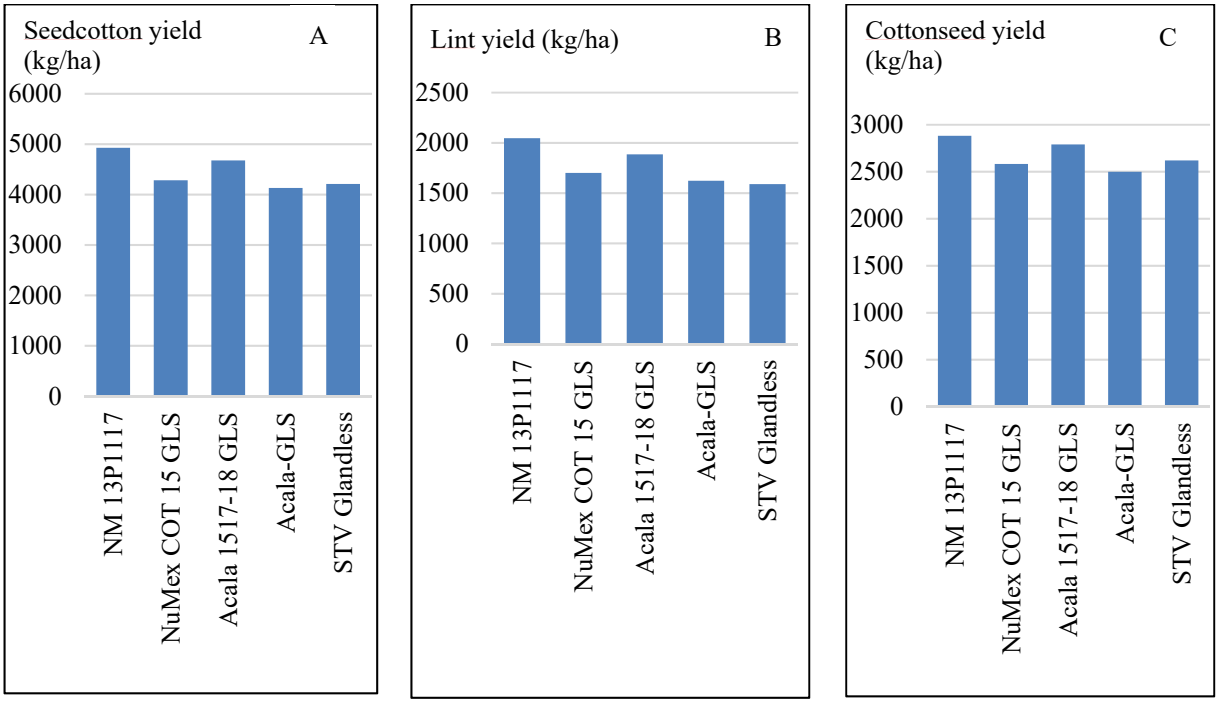

Figure 1 A-C. Seedcotton, lint and cottonseed yields of the glandless cotton cultivars in NM.
a, b - bars with the same letter are not significantly different; ns: no treatment difference.

Potassium application at 240 kg K_2O/ha gave an average of about 41.5% more seedcotton, lint and cottonseed yields compared to the rate of 120 kg K_2O/ha.

NM 13P1117 had the highest lint percentage which was not significantly different from NuMex COT 15 GLS, but significantly higher than all the other cultivars tested (Table 1). However, potassium application rates did not affect the lint percentage.

Cultivar effect was significant on boll weight, with Acala 1517-18 GLS and Acala GLS having heavier bolls than the rest of the cultivars (Table 1), but the boll weight was not significantly affected by the potassium application rates.

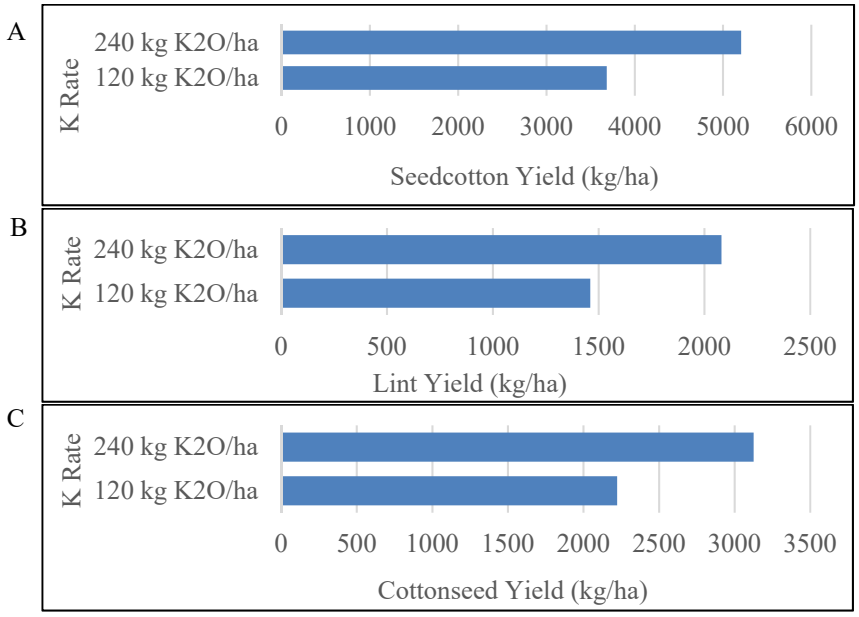

Figure 2 A-C. Seed cotton, lint and cottonseed yields of the glandless cotton cultivars as a function of two potassium rates.

All the fiber quality parameters tested were significantly affected by cultivar, but not by K application rate. Generally, Acala GLS and Acala 1517-18 GLS appeared to have the best fiber quality traits among the tested cultivars (Table 1).

Table 1. Lint percentage, boll weight and fiber quality measurements for the evaluated cultivars.

Measurements	NM 13P1117	NuMex COT 15 GLS	Acala 1517-18 GLS	AcalaGLS	STV Glandless	LS
Lint percentage (%)	41.1a	40.5ab	39.5b	39.5b	37.6c	1%
Boll weight (g)	6.13b	6.04b	6.75a	6.78a	5.85b	1%
Micronaire	4.11	4.09	3.70	3.78	3.93	ns
Fiber length (in)	1.15c	1.18bc	1.30a	1.28a	1.20b	1%
Fiber uniformity (%)	83.5b	83.8b	86.9a	86.9a	83.5b	1%
Fiber strength (g/tex)	27.2bc	29.6b	33.6a	35.8a	26.5c	1%
Fiber elongation (%)	6.15ab	6.59a	5.69b	5.60b	5.59b	1%
Short fiber content (%)	8.83a	8.48a	7.04b	7.10b	8.96a	1%

a, b, c: means within a row followed by the same letter are not significantly different; LS: level of significance; ns: no treatment difference.

Summary

The evaluation of new glandless cotton cultivars under two K rates shows a significant response of cotton yields to the higher K fertilizer rate, despite the fact that the soil test results suggesting sufficient K nutrient in the soil. Both K rates tested (120 kg K_2O/ha and 240 kg K_2O/ha) did not lead to significant differences in fiber quality parameters tested.

Although the new glandless cultivars have quantitatively higher yields than the older cultivars, only the lint yield was statistically significant during 2017 season, but most of the fiber quality parameters were significant for the cultivars tested.

One of the new cultivars NM 13P1117 appears to be a strong performer in terms of yields, while Acala 1517-18 GLS gave promising fiber quality.

These cultivars will be re-evaluated for their performance in New Mexico in 2018.

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