THE GROWTH AND YIELD OF ACALA COTTONS DEVELOPED IN NEW MEXICO

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Abstract

An experiment was conducted in 2008 to evaluate the growth and yield of 18 Acala cotton cultivars developed in New Mexico from 1923 to present. A randomized complete block design with two (for growth measurements) or three replications (for yield determination) was employed. Plant growth rates tended to be higher on lately developed Acala cultivars. Boll size tended to be smaller for Acala cotton developed after 1965. Interestingly, two early cultivars Acala 1517C and 1517E2 showed higher lint cotton yield than 1517-99.

Introduction

The Acala 1517 cotton breeding program was established in New Mexico 1930s and has released more than 30 cultivars (Zhang et al., 2005a, b). Through analysis of historical cultivar testing data (Zhang et al., 2005a, b) and field comparative analysis (Gatica-Palermo et al., 2006; Zhang et al., 2007), genetic gains for cotton yield, yield components, and fiber quality traits made by the breeding program over 70 years were assessed. Their responses to salt and Verticillium wilt infection were also evaluated in the greenhouse and/or field (Bajaj et al., 2008; Zhang et al., 2008).

The objective of this experiment was to determine the genetic variations in growth characteristics if there is any under the field conditions.

Materials and Methods

A field experiment was conducted in 2008 on 18 Acala cotton cultivars developed in New Mexico that include 17 Acala 1517 cultivars from 1923 to present and an advanced Acala line (NM 03012). A randomized complete block (RCB) design with two or three replications was employed in this experiment. Seeds were planted on May 12, 2008. The plot size was 2 rows x 12 ft. 10 plants from each genotype were harvested for fresh weight and dry weight on July 7 (early-flowering), July 22 (mid- flowering), and August 13 (late-flowering). Growth rates (GRs) between the sampling dates were calculated for each genotype, using the following formulae.

- GR1 (g/day) = (2nd Dry Wt. – 1st Dry Wt.) (g) / 15 days
- GR2 (g/day) = (3rd Dry Wt. – 2nd Dry Wt.) (g) / 22 days

A 50 boll sample from each plot was taken in October to evaluate the boll size and lint percentage. The seed cotton yield was recorded at machine harvest. Analysis of variance (ANOVA) and GLM procedures from Statistical Analysis System (SAS) software were used for data analyses.

Results

Plant dry weights and plant growth rates failed to show significant difference among the 18 Acala cultivars tested due to high variations of replications (Table 1).

Table 1. Yield and growth characteristics of 18 Acala cotton varieties

Genotype	Year released	Yield (kg/ha)	Boll Size (g)	1st Dry Wt. (g)[1]	2nd Dry Wt. (g)[2]	3rd Dry Wt. (g)[3]	GR1 (g/day)[4]	GR2 (g/day)[5]
Acala Mesilla Valley	1923	1262.5	6.3	7.4	17.6	54.8	0.69	1.69
Acala Original	1925	1373.8	5.4	10.0	16.5	51.7	0.43	1.61
Acala Young's	1929	1218.0	7.0	11.9	22.5	67.3	0.70	2.04
Acala 1517	1939	1158.7	6.8	8.9	20.9	64.3	0.80	1.98
1Acala 1517C	1958	1382.4	6.4	9.0	15.7	56.0	0.45	1.83
Acala 1517D	1960	1220.0	6.6	11.7	20.1	57.2	0.56	1.68
Acala 1517BR2	1965	1135.5	6.3	10.2	22.0	72.1	0.79	2.28
Acala 1517-70	1970	1283.3	6.1	10.5	21.6	65.9	0.74	2.02
Acala 1517-75	1975	1088.5	5.9	9.2	22.4	70.0	0.89	2.17
1517E2	1978	1379.7	5.9	11.5	19.4	61.2	0.53	1.90
1517-77BR	1982	1221.5	5.8	8.8	19.4	64.0	0.71	2.03
1517SR2	1986	1160.2	5.6	9.2	21.0	59.2	0.79	1.74
1517SR3	1990	1247.7	5.8	12.2	20.1	61.4	0.53	1.88
Acala 1517-91	1991	1074.7	6.1	14.1	23.5	74.4	0.63	2.31
Acala 1517-95	1995	1238.3	5.8	10.1	20.8	60.5	0.72	1.81
Acala 1517-99	1999	1315.4	5.3	9.1	20.4	61.3	0.75	1.86
Acala 1517-99W	2005	1372.3	5.2	11.0	25.0	79.8	0.93	2.50
Acala 03 NM03012	2009	1274.9	5.6	10.5	25.1	76.6	0.98	2.35
Mean		1210.0	6.1	10.2	20.9	64.8	0.7	2.0
C.V. (%)		11.9	9.3	24.4	23.4	22.0	38.4	23.0
R^2		0.8	0.6	0.9	0.8	0.8	0.6	0.8
LSD (0.05)		239.4	0.9	5.2	10.3	29.9	0.6	0.9

1 1st Dry Wt. = Dry wt. at early-flowering period (07/07/08);
2 2nd Dry Wt. = Dry wt. at mid-flowering period (07/22/08);
3 3rd Dry Wt. = Dry wt. at late-flowering period (08/13/08).
4 GR1 = Growth rate between early- and mid-flowering period (mean of 15 days);
5 GR2 = Growth rate between mid- and late-flowering period (mean of 22 days).

Plant growth rates during early- (Fig. 1) and late- flowering (Fig. 2) tended to be higher on lately developed cultivars. 1517SR3 (1990) possessed significantly larger boll size than 1517-99 (Table 1). Boll size tended to be smaller for the cultivars developed after 1965 (Fig. 3). Interestingly, two earlier cultivars, Acala 1517C (1958) and 1517E2 (1978) showed higher lint cotton yield than 1517-99 (Table 1).

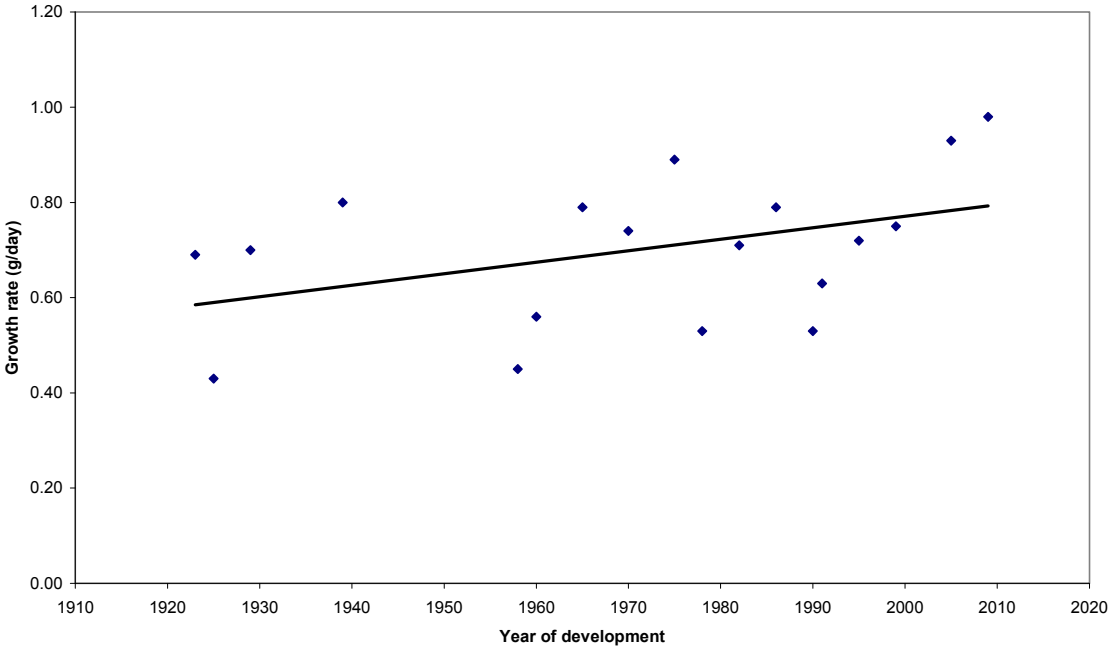

Fig. 1. Plant growth rate during early-flowering of 18 Acala varieties developed from 1923 to present.

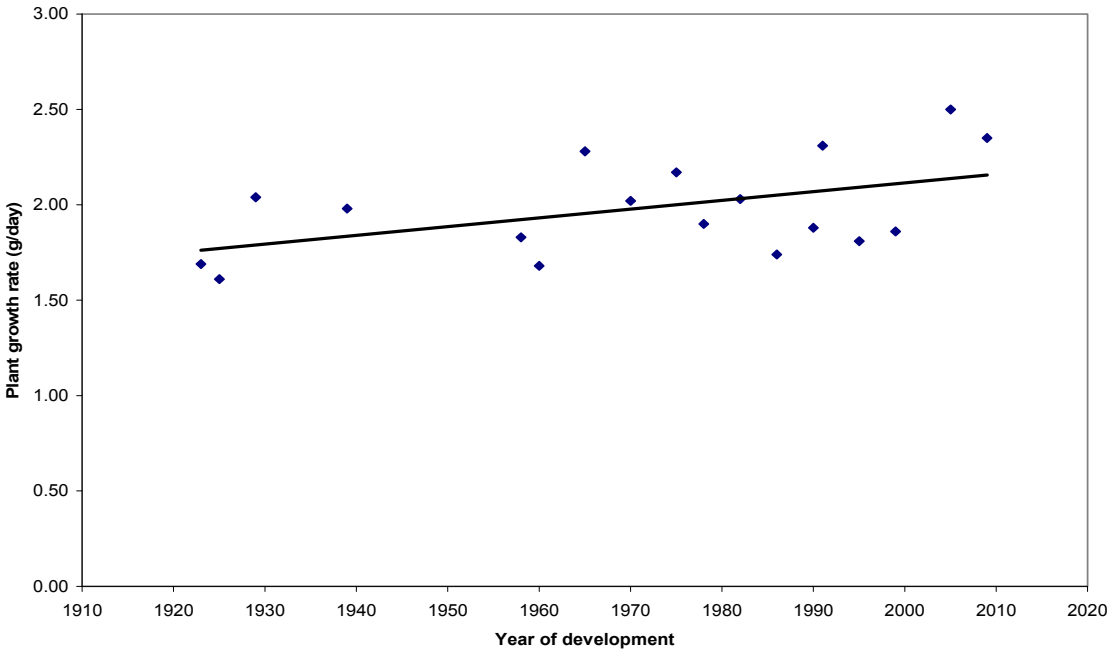

Fig. 2. Plant growth rate during late-flowering of 18 Acala varieties developed from 1923 to present.

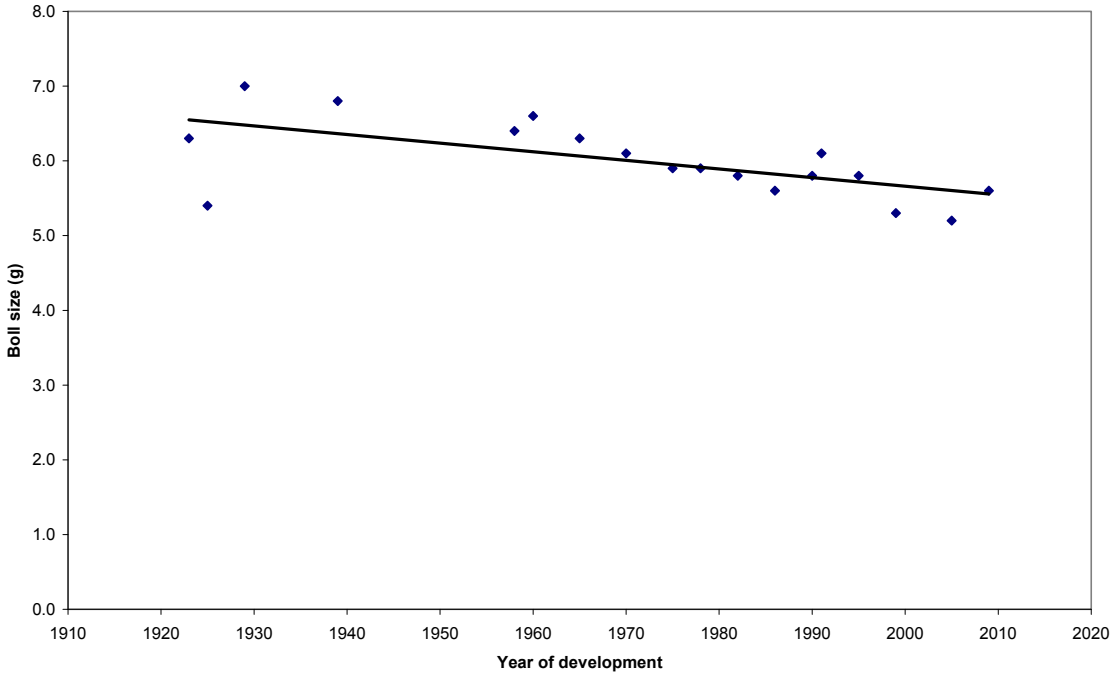

Fig. 3. Boll size of 18 Acala varieties.

Conclusions

The growth and yield characteristics of 18 Acala cotton cultivars developed in New Mexico were evaluated in the field in 2008. More recently released cultivars tended to have higher growth rate and smaller bolls. However, significantly high variation among replications resulted in dependent variables to be non- significant, especially, on growth characteristics. This experiment will be repeated in 2009 with modifications to reduce environmental variation among replications.

References

Bajaj S., W. Wang, E. Hughs, R. Percy, M. Ulloa, and Jinfa Zhang. 2008. Evaluation of cotton germplasm and breeding populations for salt tolerance. Proc. Beltwide Cotton Conf. p876-880

Gatica-Palermo H., E. Hughs, Roy G. Cantrell and Jinfa Zhang. 2006. Fiber quality and agronomic traits of New Mexico Acala cotton released since 1930s: 2005 results. Proc. Beltwide Cotton Conf. p752-755

Zhang Jinfa, Y. Lu, H. Adragna, E. Hughs and R. G. Cantrell. 2005a. Genetic improvement of New Mexico Acala cotton germplasm and their genetic divergence. Proc. Beltwide Cotton Conf. p886-891

Zhang Jinfa, Y. Lu, H. Adragna and E. Hughs. 2005b. Genetic improvement of New Mexico Acala cotton germplasm and their genetic diversity. Crop Sci. 45: 2363-2373

Zhang Jinfa, H. Gatica, S. Bajaj, R. P. Flynn, C. A. French, E. Hughs and R. G. Cantrell. 2007. Comparative field performance of Acala 1517 cultivars released since the 1930s. Proc. Beltwide Cotton Conf. p625-636

Zhang Jinfa, W. Wang, S. Bajaj, H. Gatica, S. Sanogo, R. Flynn, C. French, R. Percy, M. Ulloa, and E. Hughs. 2008. Verticillium wilt resistance in cotton: germplasm evaluation and inheritance. Proc. Beltwide Cotton Conf. p838-855