DEVELOPMENT AND CUTOUT CURVES FOR ULTRA-NARROW AND WIDE-ROW COTTON IN TENNESSEE

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Abstract

Monitoring of cotton with COTMAN™ is a useful management tool, but data are needed from ultra-narrow-row (UNR) cotton to evaluate the need to recalibrate COTMAN reference curves for this cropping system. The objectives of this study were to compare vegetative growth, reproductive development, cutout, boll set, and lint yields of UNR (7.5-inch) and wide-row (40-inch) cotton. 'Paymaster 1220 RR' was planted in ultra-narrow and wide-rows on May 9, 1998 at the Milan (TN) Experiment Station in a RCB design. Growth and development were monitored with COTMAN. Development and days to cutout (5 nodes above white flower, or NAWF=5) differed markedly between ultra-narrow and wide-row cotton. Plants in UNR were much shorter, earlier maturing, and more determinate than those in wide rows. Plants in wide rows reached cutout during the third week of flowering, when about 35% of first-position sites had set bolls. Plants in UNR reached NAWF=5 during the first week of flowering, when fewer than 20% of first-position sites had set bolls. Most bolls in UNR were set after that time. Thus NAWF=5 did not represent the last effective boll population in this UNR cotton. The cutout reference point used by COTMAN may need to be changed to better represent the last effective boll population in UNR cotton.

Introduction

Cotton is monitored to assure that growth and development are optimized for maximum yields, and to plan field operations. Growth and development data are compared to a standard reference such as the COTMAN™ target development curve (Bourland et al., 1997). This reference curve was developed empirically in wide-row cotton. Comparable data are needed from ultra-narrow-row (UNR) cotton to evaluate the need to recalibrate reference curves for this cropping system, and to characterize growth and development of plants in UNR relative to traditional wide-row cotton.

The objectives of this study were to compare vegetative growth, reproductive development, cutout, boll set, and lint yields of UNR (7.5-inch) and wide-row (40-inch) cotton, using COTMAN data collection methods.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:630-632 (1999)
National Cotton Council, Memphis TN

Materials and Methods

'Paymaster 1220 RR' cotton was planted in ultra-narrow and wide-rows on May 9, 1998 at the Milan (TN) Experiment Station. The soil was a Loring silt loam in long-term no-tillage cotton. Ultra-narrow (7.5-inch) rows were planted with a JD 750 drill, while wide (40-inch) rows were planted with a JD 7100 row planter. Different row spacings were arranged in a RCB design with 4 replications.

Plots were managed using standard no-tillage cotton production recommendations (Shelby and Bradley, 1998). No irrigation was applied. Inputs included 80 lb/ac N broadcast preplant, Roundup Ultra™ applied at the 4-leaf stage, 24 days after planting (DAP); 2 oz/ac Pix at 37 DAP; and 4 oz/ac Pix at 47 DAP. Growth and development were monitored with COTMAN™ 5.0 (University of Arkansas, 1998). Defoliant and boll opener were applied at 125 DAP, desiccant at 135 DAP, and plots were harvested at 143 DAP. Ultra-narrow plots were harvested with an AC 760 finger stripper, while wide-row plots were harvested with a JD 9930 spindle picker. Seedcotton from each plot was weighed, and a sample was ginned at the West Tennessee Experiment Station to determine gin turnout and lint yield. This 20-saw gin was equipped with a stick machine, two incline cleaners, and dual lint cleaners.

Results and Discussion

Vegetative Growth (Fig. 1). Seedling growth was vigorous due to warm temperatures, adequate moisture, and no residual herbicide application. Plant populations averaged 81,400 plants/acre in 7.5-inch rows, and 26,500 plants/acre in 40-inch rows. According to COTMAN data, plants grew at similar rates in ultra-narrow and wide rows through 58 DAP. However, UNR cotton reached terminal plant height of 20 inches by about 58 DAP, indicating the determinate growth of plants in UNR. Wide-row cotton continued to grow through 80 DAP, indicating a more indeterminate growth habit.

Fruiting Node Development (Fig. 2). First sympodial mainstem node occurred on about node 6 in both UNR and wide rows. During squaring (44-58 DAP), the average development rate was 0.24 nodes/day in wide rows, and 0.16 nodes/day in UNR. Both development rates were lower than target rate of 0.37 nodes/day established by COTMAN, indicating crop stress. Plants in UNR developed a maximum of about 6 mainstem fruiting nodes by 58 DAP, then stopped producing new nodes. Nodal development continued in wide rows, averaging 0.13 nodes/day from 58 to 86 DAP, and producing more than 10 fruiting nodes by 80 DAP.

Cutout (Fig. 3). Physiological cutout is defined by COTMAN as the flowering date of the last effective boll population at 5 nodes above white flower (NAWF=5) (Oosterhuis et al., 1996). Plants in UNR reached NAWF=5

at 59 DAP, during the first week of flowering. Premature cutout indicates plant stress. Plants in 40-inch rows reached cutout at 76 DAP, 17 days after UNR plants and 4 days before the target development curve reached NAWF=5. Plants in UNR and wide rows reached cutout before the last effective flower date for Milan TN of August 8 (91 DAP in this study). Early cutout and the type-1 growth pattern indicated crop-oriented rules for late-season management (Oosterhuis et al, 1996).

Fruit Shedding (Fig. 4). First position fruit retention remained greater than 80% though 68 DAP in UNR and through 72 DAP in wide rows. Extensive fruit shedding began after cutout (NAWF 5) in UNR, but it began before cutout in wide-row cotton. By 80 DAP, stress-induced shedding of fruit (squares and/or bolls) reduced fruit retention to less than 55% at first-position sites in UNR and to less than 70% retention in wide rows. Greater extent of fruit shedding in UNR may indicate greater abiotic stress due to more competition for resources in UNR, or possibly more insect-induced fruit loss in UNR than in wide rows, despite similar pest control measures.

Boll Set (Fig. 5). Flowering began about 5 days earlier in UNR than in wide rows. Plants in UNR reached cutout (NAWF 5) during the first week of flowering, when less than 20% of first-position sites had set bolls. Plants in wide rows reached cutout (NAWF 5) after three weeks of flowering, when about 35% of first-position sites had set bolls. By 72-80 DAP, however, the percentage of first-position sites with bolls was higher in UNR than in wide rows. Plants in wide rows continued to flower and set bolls through 86 DAP, but these were near the last effective flower date. This reflects a more indeterminate growth habit in wide rows than in UNR.

Lint Yields (Table 1). Virtually all harvestable bolls were open in both UNR and wide rows at harvest, 143 DAP. The lint yield in UNR was 290 lb/acre higher than in wide rows, despite lower gin turnout of cotton harvested from UNR plots.

Conclusions

Development and cutout differed markedly between ultra-narrow and wide-row cotton. Plants in UNR were much shorter, earlier maturing, and more determinate than those in wide rows. The UNR cotton yielded more lint than did wide rows, despite indications of crop stress in the UNR cotton of a slower growth rate and hastened cutout. Plants in UNR reached NAWF=5 during the first week of flowering, and most bolls in UNR were set after that time. Thus NAWF=5 did not represent the last effective boll population in this UNR cotton. The cutout reference point used by COTMAN may need to be changed to better represent the last effective boll population in UNR cotton.

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Table 1. Lint yield and gin turnout of Paymaster 1220 RR cotton grown in ultra-narrow and wide rows at the Milan Experiment Station in 1998.

Row spacing	Harvester	Lint Yield lb/acre	Gin Turnout %
7.5-inch rows	AC 760	978 a	36.3 b
40-inch rows	JD 9930	688 b	40.3 a

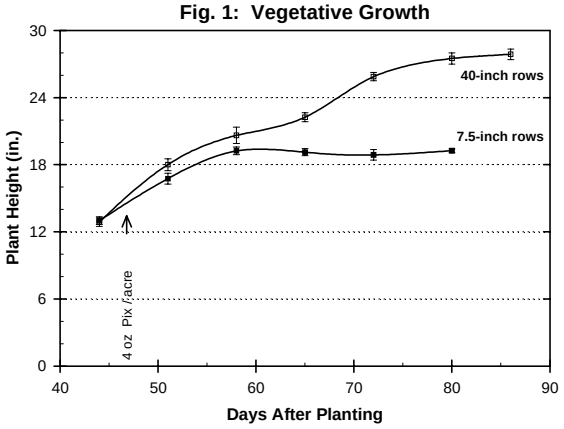

Figure 1. Vegetative growth of UNR and wide-row cotton at the Milan Experiment Station in 1998. Bars = standard error of the mean.

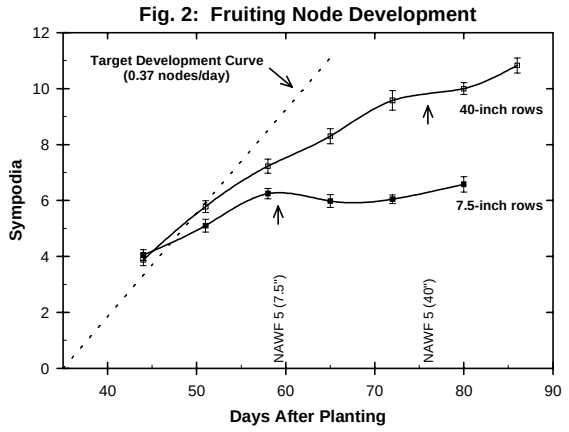

Figure 2. Fruiting node development of UNR and wide-row cotton relative to the COTMAN target development curve.

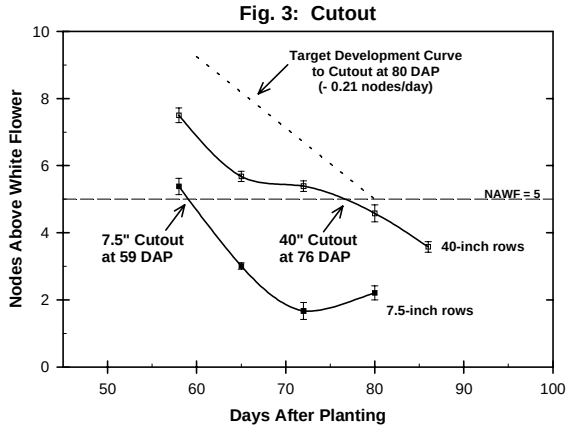

Figure 3. Cutout of UNR and wide-row cotton relative to the COTMAN target development curve.

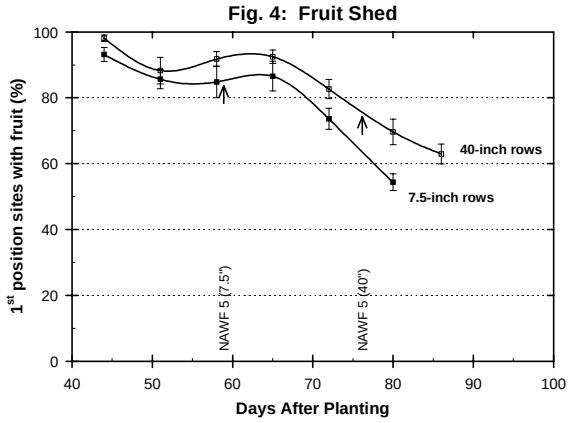

Fig. 4. First-position fruit shedding of UNR and wide-row cotton at the Milan Experiment Station in 1998, relative to cutout (NAWF=5).

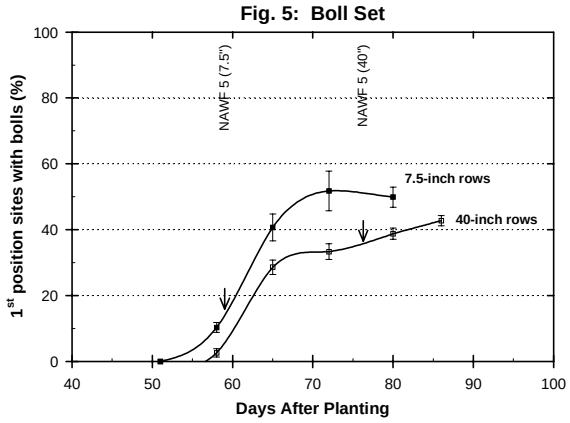

Figure 5. First-position boll set of UNR and wide-row cotton at the Milan Experiment Station in 1998, relative to cutout (NAWF=5).