# EFFECTS OF ROLLING/CRIMPING RYE DIRECTION AND DIFFERENT ROW-CLEANING ATTACHMENTS ON COTTON EMERGENCE AND YIELD

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## ABSTRACT

Cover crops have been recognized as a vital part of conservation systems and they should produce maximum biomass to be effective. Because of the large amounts of residue produced by cover crops, they must be managed appropriately and not create problems for producers. Roller-crimpers have been used to manage cover crops by rolling them down and creating a thick cover over the soil surface. This study was conducted to determine the effect of different rolling directions and different commercial row cleaners on cotton emergence and yield. Two locations for this study were chosen (central and northern Alabama) to account for different climate and soil conditions. Each experiment was a completely randomized block design with four replications. Presented results cover the first 2003/2004 growing season. Rye (Secale Cereale L.) was chosen as a cover crop because rye produces a large amount of biomass and is popular with Alabama producers. Rye was rolled at the soft dough stage and terminated using glyphosate. Preliminary data showed that parallel rolling direction with respect to planting direction for cotton produced the highest emergence and yield at both locations. Likewise, the best commercially available row cleaner was the Yetter attachment, at both locations. The worst rolling pattern was perpendicular to cotton rows.

## INTRODUCTION

Cover crops have been known to provide important environmental and economical benefits such as improved soil quality, reduced soil erosion and runoff, weed suppressor, increased infiltration, and improved soil fertility by increasing organic carbon content (Reeves, 1994; Ashford and Reeves, 2003; Dinnes et al., 2002; Kasper et al., 2001). Cover crops must produce large amounts of biomass to create an effective soil cover. Large amounts of cover crop residue can create problems with any tillage practice that must be conducted in the spring, prior to planting operations. Thus, crops must be managed appropriately to prevent planting problems. The most common problem is “hair-pinning”, where residue is pushed into the soil rather than being cleanly sheared. Hair-pinning creates a condition where the seeds are unable to have good seed-soil contact. As a result, skips in rows of the cash crop can occur, thus negatively impacting emergence and yield. Another major problem is accumulation of cover crop residue on planting units, which causes frequent stops to clean the equipment.

One effective way to manage cover crops is mechanical termination using rollers/crimpers. Rolling technology originated in Brazil, and rollers have been used successfully for many years in that region in conservation systems (Derpsch et al., 1991). Rollers consist of a steel drum with attached crimping bars equally spaced on the drum’s perimeter. Using rollers alone to flatten the cover crop and prevent multiple-direction lodging is beneficial. To properly manage the cover crop, in terms of maximizing its benefits and to minimize interactions between planter and cover crop, there is a need to determine the best rolling direction and evaluate different row cleaning attachments installed on the planter. Therefore, the objective of this study was to determine the effect of different rolling directions relative to the planting rows and evaluate different commercially available row-cleaner attachments on cotton emergence and yield.

## MATERIALS AND METHODS

Two experimental sites were chosen for study: The Tennessee Valley Research and Extension Center (TVS) at Belle Mina (northern Alabama) and the E.V. Smith Research and Extension Center at Milstead (central Alabama) with different climates and soils. Rye (Secale cereale L.) was planted at both locations in the fall of 2003 using a small grain planter with row spacing of 7.5 inches. Rye was rolled/crimped in the spring (mid-April) of 2004 at the soft dough growth stage, which is a desirable period for termination (Nelson et al., 1995). A three-section, 13.5-feet wide roller (Bigham Brothers Lubbock, Texas**) with long straight crimping bars was used (Fig. 1).

The experiment was a completely randomized block design with four replications for each treatment (Fig. 2). Four different treatments for rolling directions were used with respect to planting direction of rye and cotton: (1) Parallel, (2) Perpendicular, (3) Diagonal at 45-degrees, and (4) No-roller (standing rye).

Four treatments of commercially available row cleaning attachments were used: (1) No-row cleaner, (2) Dawn TM row cleaner, (3) Dawn TM row cleaner without coulter, and (4) Yetter TM row cleaner.


**Figure 1.** Three-section roller with straight crimping bars 13.5 feet wide.

On the day of rolling the cover crop, the standing height of rye was measured and samples of biomass were collected. The average height of rye was 47-in with an average dry mass of 2.9 tons/acre. Cotton was seeded into rolled rye residue using a John Deere 4-row Max Emerge Plus Vacuum Planter to which different row cleaners were attached. Cotton was harvested in the fall of 2004 and cotton yield was determined.

Data were analyzed with SAS (2001) using the ANOVA procedure. A significance level of $P \leq 0.05$ was chosen to separate treatment effects.

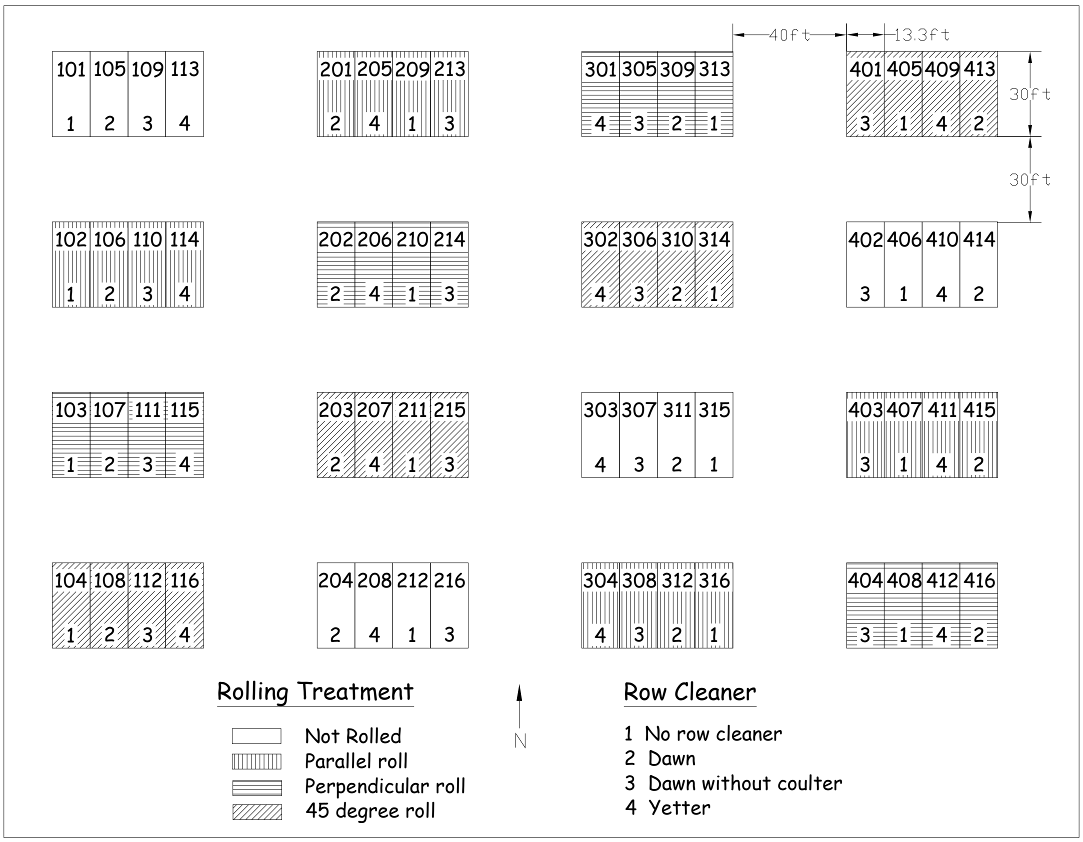


**Figure 2**. Experimental layout: a completely randomized block design with four replications for each location.

## RESULTS AND DISCUSSION

Results were based on the first year of data. Preliminary data showed consistency in cotton emergence for rolling treatments and row type cleaner at both locations.

### *a. Cotton emergence and rolling direction*

Significant differences in cotton emergence were found for all rolling direction treatments at E.V. Smith (LSD=1.46). The highest cotton emergence was found with the parallel rolling direction and the worst direction was perpendicular (Fig. 3). At TVS, the highest emergence was found with parallel and no-rolled cover crop, however there were no significant differences (LSD=1.59) between these rolling treatments (Fig 4). The perpendicular pattern had the worst cotton emergence, similar to the EV Smith location.

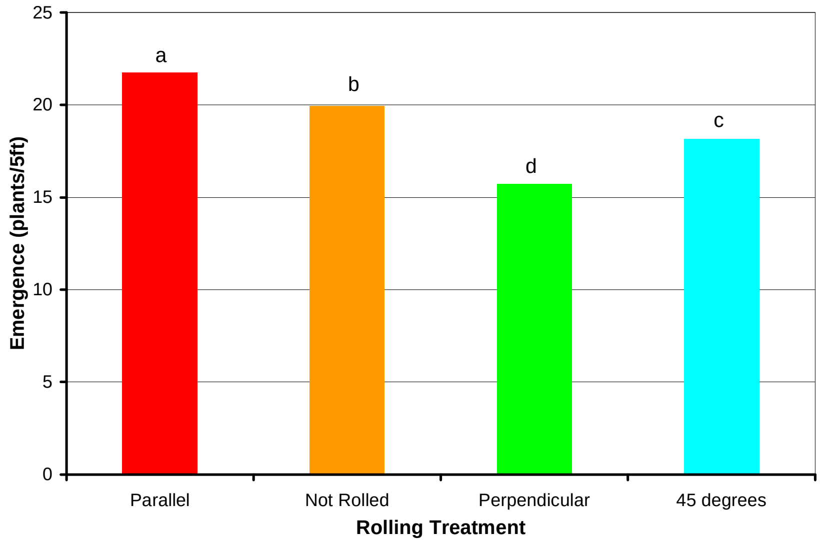


**Figure 3.** Rolling pattern direction and cotton emergence relationship at the E.V. Smith location (LSD = 1.46).

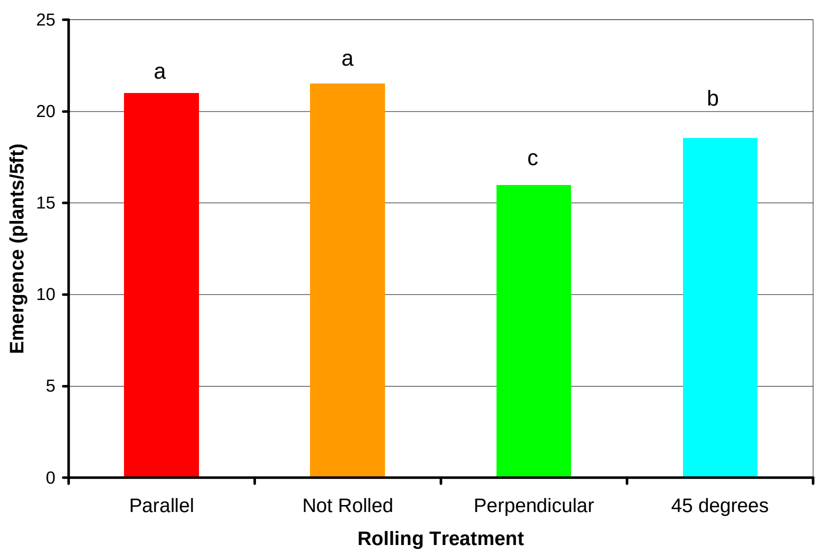


**Figure 4**. Rolling pattern direction and cotton emergence relationship at the TVS location (LSD=1.59).

***b. Cotton yield and rolling direction***

At the E.V. Smith location, the highest and significantly different cotton yield (857 lbs/Ac) was found with the parallel rolling direction when compared with other rolling patterns (LSD = 72.9). However, yield was severely reduced by Hurricane Ivan in 2004 which occurred during the harvesting period. The yield at the EV Smith station was only 25% of the yield that was recorded at TVS. The worst rolling pattern was the diagonal (45$^{o}$) rolling direction (Fig 5). At TVS, the highest cotton yield (3354 lbs/Ac) was observed with the parallel and no-rolling treatments, and no significant difference was found between these treatments (LSD = 103.96). Significantly lower cotton yield was found with perpendicular and diagonal (45$^{o}$) rolling patterns, however, there was no significant yield difference between these patterns (Fig 6).

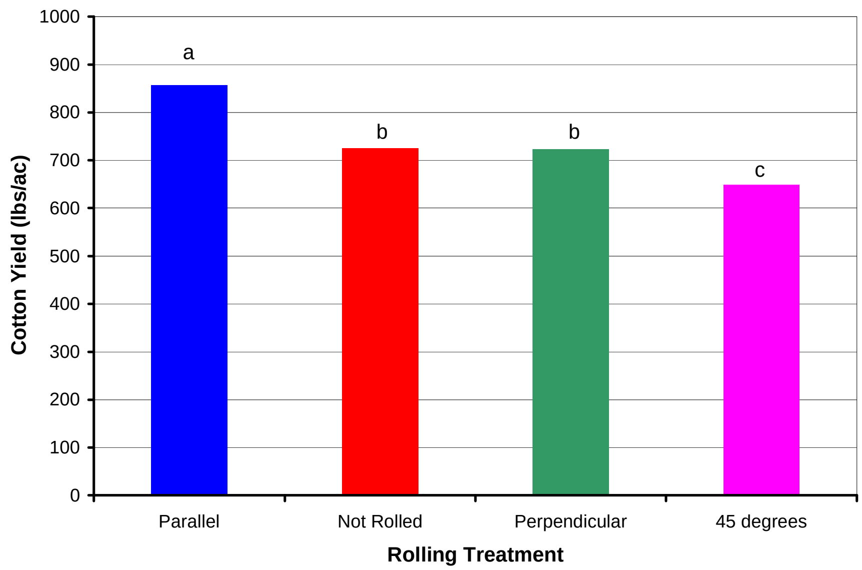


**Figure 5**. Rolling pattern direction and cotton yield relationship at the E.V. Smith location (LSD = 72.9).

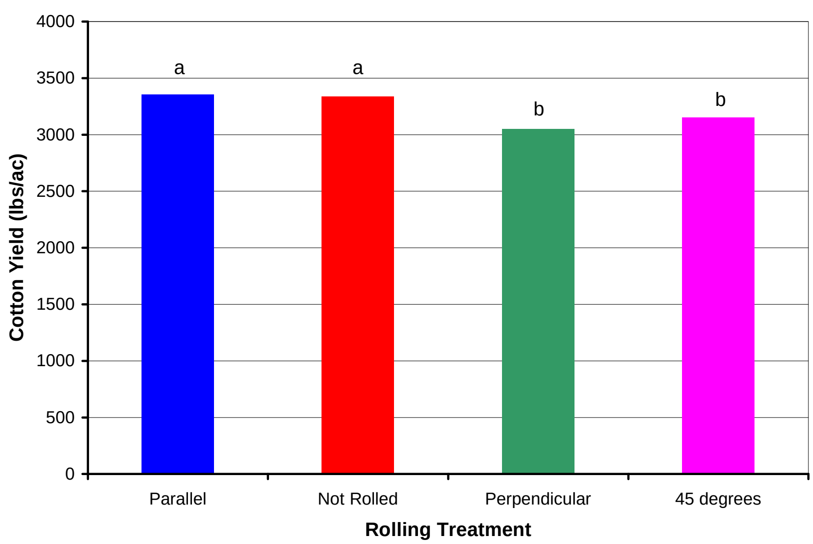


**Figure 6**. Rolling pattern direction and cotton yield relationship at the TVS location (LSD = 103.96).

### *c. Cotton emergence and type of row cleaner*

No significant differences were found among the Yetter, Dawn and Dawn with no-coulter at E.V. Smith (Fig. 7), however the highest cotton emergence was found with the Yetter attachment. The lowest cotton emergence was found with no-row cleaner attachment (LSD = 1.45). At TVS, the highest and significantly different seed emergence rate was found with Yetter in comparison with other row cleaner treatments (Fig 8).

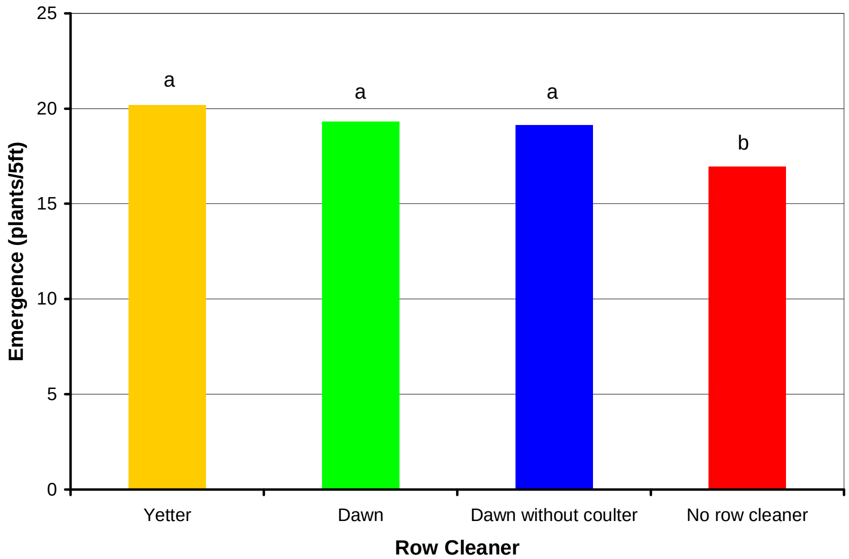


**Figure 7**. Row cleaner type and cotton emergence relationship at the E.V. Smith location (LSD = 1.46).

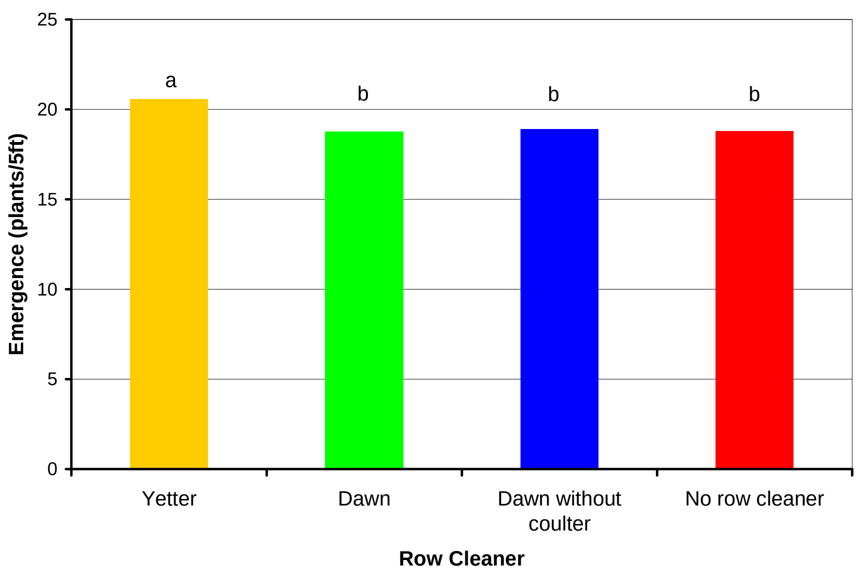


**Figure 8**. Row cleaner type and cotton emergence relationship at the TVS location (LSD = 1.59).

### *d. Cotton Yield and type of row cleaner*

At the E.V. Smith location, no significant differences were found between the Yetter, Dawn, and Dawn with no-coulter attachments, with the highest cotton yield found with Yetter (LSD = 72.9). The no-row cleaner on the planter produced the lowest cotton emergence and yield (Fig 9). As mentioned previously, the yield at E.V. Smith was severely reduced by Hurricane Ivan in 2004 harvesting season. Because the Hurricane Ivan significantly reduced cotton yield, no comparison was made between the two locations. At TVS, the highest yield was found with Yetter and Dawn without coulter row cleaners (LSD = 103.96). The lowest and significantly different cotton yield was found with Dawn and no row cleaner (Fig 10).

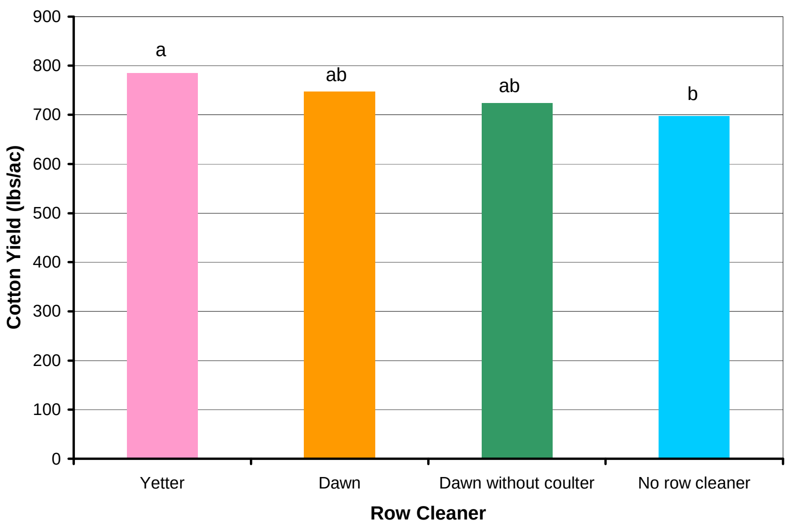


**Figure 9**. Row cleaner type and yield relationship at the E.V. Smith location (LSD =72.9).

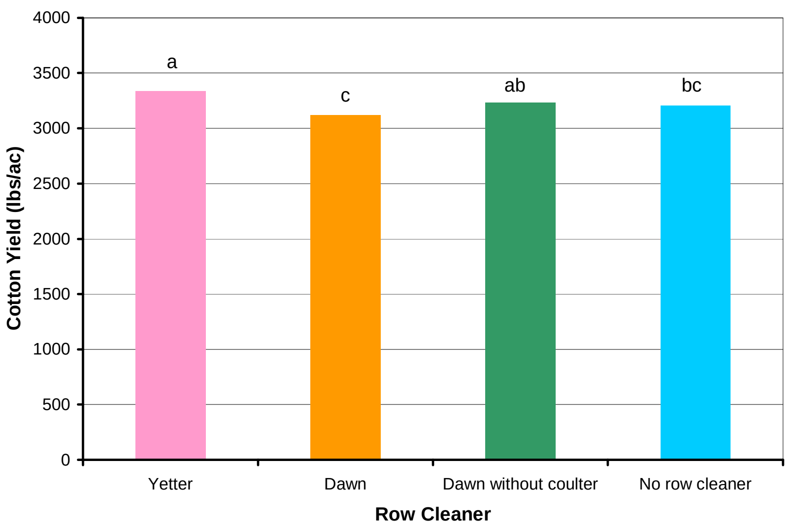


**Figure 10**. Row cleaner type and cotton yield relationship at the TVS location (LSD = 103.96)

To determine the correlation between seed emergence and cotton yield, simple regression analyses were performed. There was a poor correlation between seed emergence and cotton yield for the E.V. Smith location (Fig. 11). This poor correlation can be explained by reduction of cotton yield that was caused by Hurricane Ivan. In contrast, at TVS there was a strong correlation between seed emergence and cotton yield for rolling direction treatments (Fig. 12).

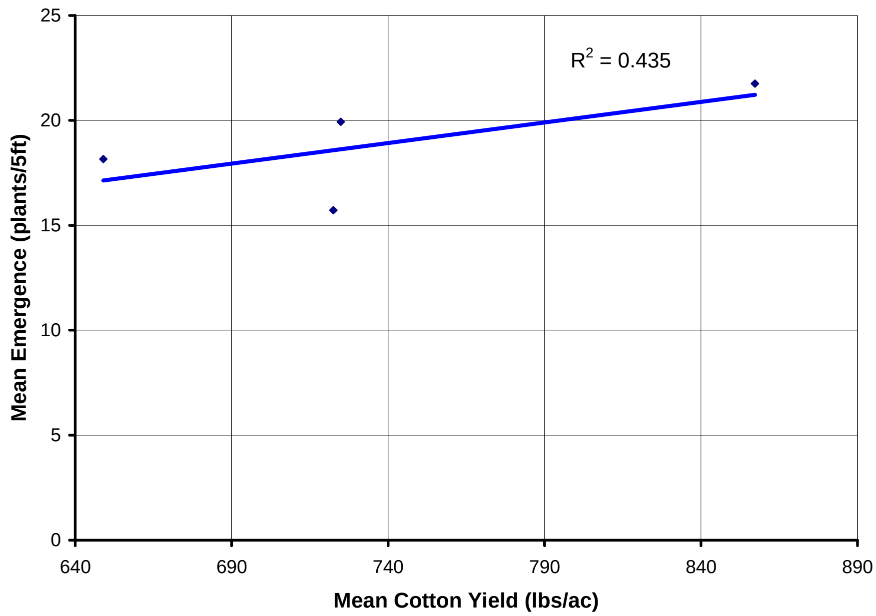


**Figure 11**. Mean cotton yield vs mean emergence at the EV Smith.

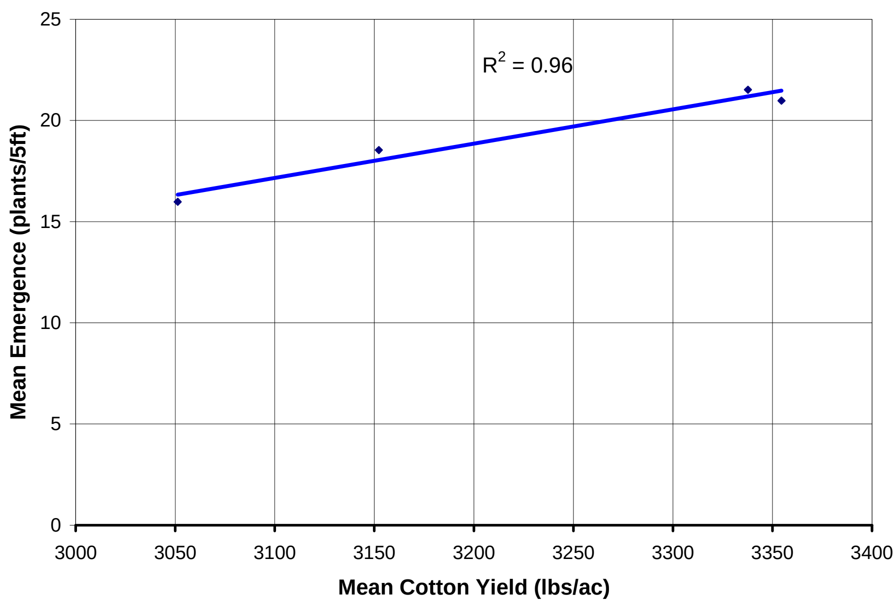


**Figure 12.** Mean cotton yield vs mean emergence (rolling direction) at theTVS location.

## Conclusion

Based on preliminary results (2004 data), the greatest plant emergence and the highest yield were found with parallel rolling pattern and Yetter row cleaner at E.V. Smith and TVS.

The worst results came with the perpendicular and 45 degree rolling patterns, and no–row cleaner, also at these two locations.

Poor correlation between seed emergence and cotton yield was found at the E.V. Smith, whereas a strong correlation between seed emergence and cotton yield was found at the TVS location.

DISCLAIMER

**The use of trade names or company names does not imply endorsement by USDA-ARS.

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