Row Pattern Configuration and Seeding Rate Effects on Cotton Growth and Yield

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Highlights

- Lint yield was not affected by seeding rate or row pattern, indicating sufficient yield compensation across configurations.
- Low seeding rates and wide row patterns resulted in taller plants (up to 19%) with greater boll formation (58-81%) and lint accumulation (15-23%).
- Wide rows increased fiber staple length by ~1.3 32^{nds} (0.04 in.) compared to solid planted and skip-row.
- Lower seeding rates or wider row patterns increased loan value by 2.5 to 4 cents/lb.

Soil moisture availability in semi-arid West Texas cotton production systems remains a critical concern. Soil profile water storage and availability to the cotton at critical crop growth stages during the often hot and dry mid-season therefore has tremendous implications on the fate and productivity of the crop. In addition, increasing input costs (*i.e.,* seeds, chemicals), low or stagnant commodity prices, limited water availability due to seasonal rainfall variability and climatic uncertainty, crop insurance and government programs all drive the need to evaluate the effects of different seeding rates and row pattern configurations. Alternate wide row patterns including skip row configurations offer potential benefits of enhanced drought stress tolerance and lower input costs by reducing seeds planted per hectare while maintaining seeds planted within the row. Achieving the same yield with wider row spacings could result in significant cost savings. Therefoe, it is critical to understand the implications of seeding rate and row spacing to enhance production efficiency, management, and net return in semi-arid west Texas conditions.

- A cotton field trial was established in June 2025 at Wall, Texas.
- Six row patterns based on two different base planter configurations (30″ and 40″) with low vs high seeding rates were evaluated.
- Within 30″ configurations, row patterns were 30″, 60″ and a skip row on 30” (2 planted, 1 skipped).
- Within 40″ configurations, row patterns were 40″, 80″ and a skip row on 40″.
- Cotton variety PHY 332 W3FE was planted at two different seeding rates i) low: 2 seeds and ii) high: 4 seeds per ft in each row pattern.
- Variations in planting depth due to planter operation and soil moisture availability influenced cotton germination timing and overall crop stand establishment leading to earlier emergence, but ~50 reduction in crop stand with the 30″ planter (Figure 1).
- Cotton was hand-picked and plant height, number of bolls, cotton yield, and lint turnout were measured.

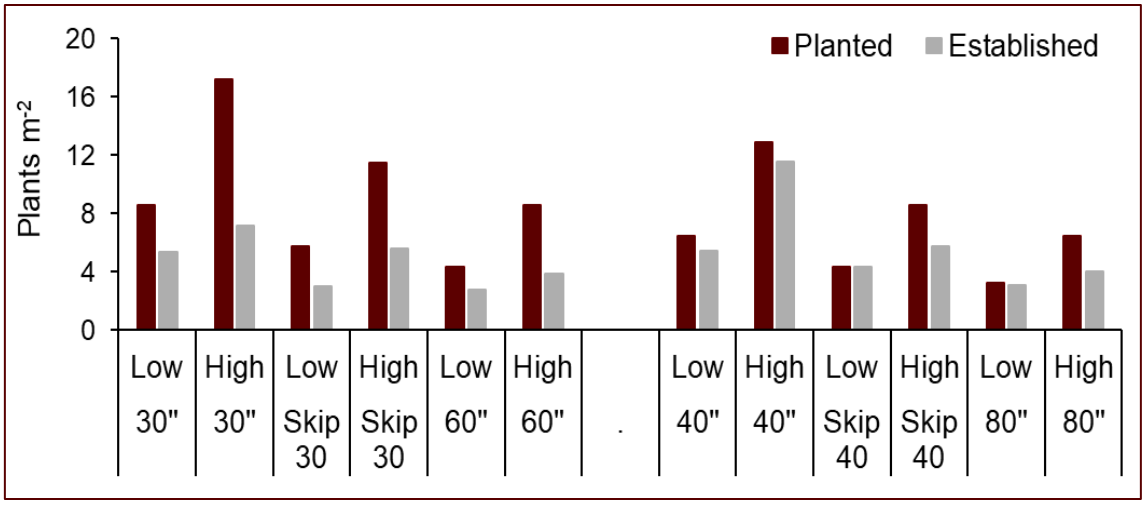

Figure 1. Actual seeds planted *vs* stand established at low and high seeding rates in 30″ (30″, 60″ and a skip row in 30″) and 40″ (40″, 80″ and a skip row in 40″) planting configurations.

Effect of seeding rate on cotton traits

- Plant height: Influenced by seeding rate within the 40″ configurations where low seeding rate resulted in >4 cm taller plants (Table 1).
- Boll production: Low seeding rates resulted in more bolls per plant in both 30″ and 40″ configurations.
- Lint per boll, lint yield, lint turnout and seed turnout were not influenced by the effect of seeding rate.
- On solid-planted row patterns, the lower seeding rate resulted in greater fiber strength and greater loan value.

Table 1. Cotton yield and yield components under low vs high seeding rates.

Cotton traits	30″ planting configurations		40″ planting configurations	
	Low	**High**	**Low**	**High**
Boll count (no. m^{-2})	30.2	29.3	22.8	25.4
Plant height (cm)	55.7	54.8	55.9 a	51.3 b
Bolls per plant (no.)	8.6 a*	5.8 b	5.6 a	4.0 b
Lint per boll (g)	1.8	1.6	1.8 a	1.6 b
Lint yield (kg ha^{-1})	536	463	404	397
Lint turnout	0.41	0.42	0.41	0.42
Seed turnout	0.54	0.54	0.53	0.54

* Different letters indicate significance between low *vs* high seeding rates within each planting configuration.

Effect of row patterns on cotton traits

- Plants were taller and produced 58% and 81% more bolls per plant in 60″ and 80″ compared to 30″ and 40″ row spacings, respectively (Table 2). However, overall boll number per unit area was higher with narrow patterns (30″ and 40″).
- Lint per boll was only different among the 40″ configurations where wide patterns resulted in 23% more lint per boll compared to 40″.
- Lint yield, lint turnout and seed turnout were not influenced by different row patterns in either configuration.
- **Table 2.** Effect of row patterns on yield and yield components.

Cotton traits	30″ planting configurations			40″ planting configurations		
	30″	60″	skip 30″	40″	80″	skip 40″
Boll count (no. m^{-2})	34.1 a*	27.6 b	27.6 b	26.6 a	21.9 b	23.8 ab
Plant height (cm)	49.5 b	59.2 a	57.1 a	49.0 b	57.7 a	54.0 a
Bolls per plant (no.)	5.7 b	9.0 a	7.0 b	3.5 b	6.4 a	4.4 b
Lint per boll (g)	1.5	1.8	1.7	1.6 b	1.9 a	1.6 ab
Lint yield (kg ha^{-1})	532	486	479	395	418	388
Lint turnout	0.41	0.42	0.42	0.42	0.42	0.41
Seed turnout	0.54	0.54	0.53	0.54	0.53	0.53

* Different letters indicate significance among the three row patterns within each planting configuration.

Fiber Quality

- Wide row patterns resulted in greater micronaire, fiber length and fiber strength compared to solid or skip-row (Table 3).
- Wide row patterns resulted in higher loan value (Table 3)

Table 3. Effect of row patterns on fiber quality.

	30″ planting configurations			40″ planting configurations		
Traits	**30″**	**60″**	**skip 30″**	**40″**	**80″**	**skip 40″**
Micronaire	4.43 a*	4.53 a	4.47 a	4.32 b	4.70 a	4.37 b
Length (in)	1.06 b	1.10 a	1.06 b	1.04 b	1.08 a	1.04 b
Strength (g/tex)	28.18	29.43	28.73	28.64 b	29.70 a	28.03 b
Loan value (¢/lb)	51.91	52.81	51.35	50.35 b	52.18 a	50.68 b

* Different letters indicate significance among the three row patterns within each planting configuration.

Direct effects of cotton traits on lint yield

- Path analysis (Figure 2) for the cotton traits between solid (30″) and wide (60″ and skip 30″) patterns indicated varying direct effects of cotton traits in narrow and wide spacing.
- With the solid pattern (30″), lint per boll had the strongest positive effect on lint yield (0.73, $p < 0.001$) indicating that lint accumulation per boll was key determinant of yield under narrow spacing or high plant density.
- Boll counts also had a significant direct effect on lint yield (0.50, $p = 0.019$).
- Compared to solid (30″), lint per boll (0.63, $p < 0.001$) and boll count (0.60, $p < 0.001$) remained strong direct contributors to lint yield in wide pattern (60″ and skip 30″).
- In contrast, under wide (60″ and skip-30″) row patterns, stand count had a significant negative direct effect on lint yield indicating that in wide rows, yield was more sensitive to stand count, and interplant competition could reduce yield per plant limiting yield compensation.
- Similar trends were observed for 40″ planting configurations.
- Maintaining optimal plant density within the row is important to ensure yield compensation when adopting wide spacing.

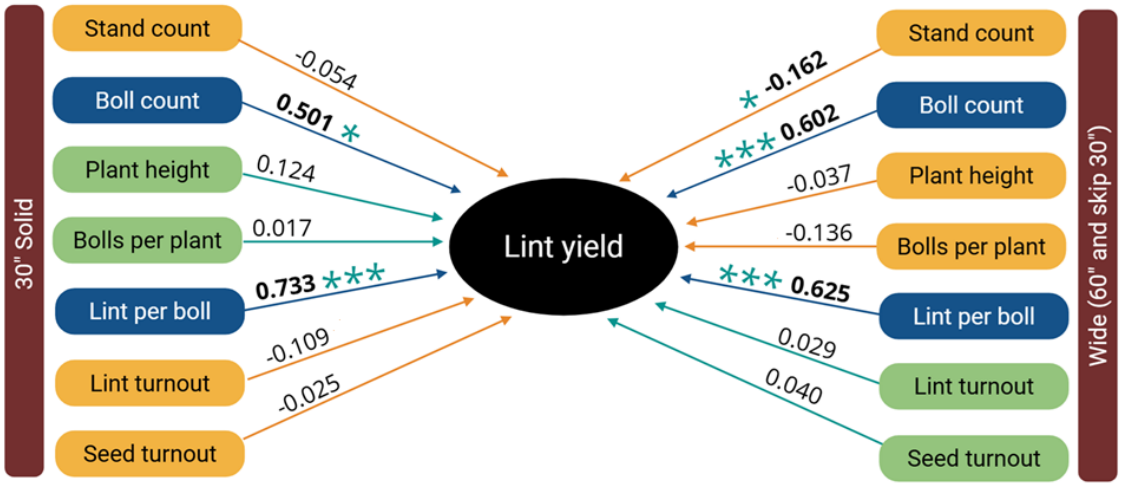

Figure 2: Direct effects of cotton traits on lint yield under solid planting in 30″ (left) *vs* wide (right) planting 60″ and skip-row patterns.

Summary and Future Directions

- Within base planter setups, lint yield was not affected by seeding rate or row pattern, resulting in sufficient yield compensation across configurations.
- Cotton yield compensation across different row patterns was supported by cotton trait patterns.
- Cotton compensated for reduced density under wide row patterns through enhanced boll formation and lint development per boll.
- Wide row patterns resulted in greater micronaire, fiber length, fiber strength and higher loan value compared to solid or narrow patterns.

- Wide row spacing may allow cost saving on seed as well as chemical applications (in-furrow nematicides, fungicide etc.) without compromising yield potential.
- Optimal density may enable plants to fully compensate for yield but with the condition of increased individual plant growth and overall greater canopy (and opportunity for vegetative branching) which may reduce harvest efficiency, especially for stripper-harvested cotton.
- Planting slightly higher-than-necessary seeding rates may limit excessive individual plant growth and optimize harvest efficiency and can also help ensure successful crop establishment.

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