Grain Sorghum Ratoon Cropping System for SEMO: Final Report

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Project Summary Statements:

- Starter fertilizer did decrease the number of days to 50% bloom in the early season ratoon variety.
- Starter fertilizer did not effect days to 50% bloom in the full season variety.
- Grain yield response to starter was variable among soil types and production system.
- Total grain yield was greater in the grain sorghum ratoon cropping system than in the conventional grain sorghum system.
- Ratoon cropping may prove to be a successful alternative to traditional grain sorghum production systems in SEMO.

Objectives and Goals:

The objectives of this research were:

1) To quantify the affect of starter fertilizer on grain sorghum development and grain yield.
2) To quantify the optimal fertility requirements for a ratoon cropping system.
3) To determine the feasibility of introducing a grain sorghum ratoon cropping system into SE Missouri.

Procedures:

- The experiment was located on two soil types in each year in SE Missouri
  - 2003
    - Pemiscot County: The University of Missouri Lee Farm at Portageville
      - Tiptonville silt loam
    - Dunklin County: The University of Missouri Rhodes Farm at Clarkton
      - Malden fine sand
  - 2003
    - Pemiscot County: The University of Missouri Lee Farm at Portageville
      - Tiptonville silt loam
      - Sharkey silty clay

- Experimental Design: Randomized complete block design
    - Seeding rate: 110,000 plants per acre
    - Two cultivars:
        - Early season ratoon: KS-310 (55 to 59 days to 50% bloom)
        - Full season check: KS-955 (74 to 78 days to 50% bloom)
    - Starter treatment:
        - 45# N and 30# P_2O_5 applied at planting (dribble placement)
    - First planting Nitrogen rate (pounds per acre):
        - 120 pounds total
    - Ratoon Nitrogen rate (pounds per acre, side-dressed):
        - 0, 30, 60, 90, 120
    - Ratoon Phosphorus rate (pounds per acre, side-dressed):
        - 0 or 30
    - Four replications:
    - Data collected:
        - Days to 50% bloom
        - Maturity and harvest date
        - Grain yield

Full treatment list:

Treatment	Starter	Ratoon N rate	Ratoon P rate
Mid to late season cultivar (KS-955)	Y	-	-
Mid to late season cultivar (KS-955)	N	-	-
Early season cultivar (KS-310)	Y	0	0
Early season cultivar (KS-310)	Y	30	0
Early season cultivar (KS-310)	Y	60	0
Early season cultivar (KS-310)	Y	90	0
Early season cultivar (KS-310)	Y	120	0
Early season cultivar (KS-310)	Y	0	30
Early season cultivar (KS-310)	Y	30	30
Early season cultivar (KS-310)	Y	60	30
Early season cultivar (KS-310)	Y	90	30
Early season cultivar (KS-310)	Y	120	30
Early season cultivar (KS-310)	N	0	0
Early season cultivar (KS-310)	N	30	0
Early season cultivar (KS-310)	N	60	0
Early season cultivar (KS-310)	N	90	0
Early season cultivar (KS-310)	N	120	0
Early season cultivar (KS-310)	N	0	30
Early season cultivar (KS-310)	N	30	30
Early season cultivar (KS-310)	N	60	30
Early season cultivar (KS-310)	N	90	30
Early season cultivar (KS-310)	N	120	30

Results:

The experiment was planted on April 14th, 2003 and April 5th, 2004. The early season ratoon variety (KS 310) was first harvested on July 28th, 2003 and July 22nd, 2004. The ratoon (second cutting) grain sorghum crop was harvested on November 21st, 2003 and November 19th, 2004. The full-season single crop variety (KS 955) was harvested on August 14th, 2003 and August 17th, 2004. Based on environmental conditions in 2003 we estimate that we lost two full weeks of growing conditions for the ratoon grain sorghum crop; whereas growing conditions were optimal in 2004.

Grain Sorghum Bloom Date and Yield Response to Starter Fertilizer

In each year and on each soil type the addition of starter fertilizer decreased the number of days to 50% bloom by an average of 3 days in the ratoon variety (Figures 1 and 2). However, the addition of starter fertilizer to the ratoon crop (second growth and cutting) did not affect bloom date. Starter fertilizer also did not affect bloom date in the full season check variety.

Starter decreased grain yield in the ratoon variety when grown on the Tiptonville silt loam in 2003 and 2004 (Figures 3 and 4). However, starter did not affect grain yield in the full season check variety on the Tiptonville silt loam in 2003 or 2004. Starter also did not affect grain yield in either the ratoon or full season check variety when grown on Malden fine sand in 2003. In contrast, starter increased grain yield in both the ratoon and full season check variety when grown on Sharkey silty clay in 2004. Our results suggest that the application of starter fertilizer may prove beneficial in ratoon grain sorghum production systems; whereas data does not support the application of starter to full season grain sorghum varieties.

Ratoon (Second Cutting) Yield Response to Nitrogen and Cropping System Summary

Ratoon N rate did not affect the ratoon grain sorghum bloom date in 2003 or 2004 (data not shown). In each year and at each location grain yield increased linearly as nitrogen rate increased (Figures 5-8). Grain yield in the ratoon system ranged from 12 to 60 bushels acre^{-1} depending upon soil type, N rate, and year. In each year and on each soil type grain yield was greater in the ratoon grain sorghum production system when compared to the conventional full season variety production system (Figures 9 and 10). Our results indicate a 44 to 104% increase in grain yield in the ratoon production system.

Conclusions

The application of starter fertilizer decreased the number of days to 50% bloom in the early season variety. This may decrease the number of days until harvest and allow growers to capture more growing degree units for the ratoon crop. Starter fertilizer did not affect the 50% bloom date in the full season check variety. Though crop yield was variable among locations; at each location the total crop yield of the ratoon system out performed the full season check system. Our results indicate that the application of starter fertilizer may prove beneficial in a ratoon cropping system and that ratoon cropping may prove to be a successful alternative to conventional grain sorghum production systems in SEMO.

Figure 1. Grain Sorghum Bloom Date Response to Starter Fertilizer in 2003.

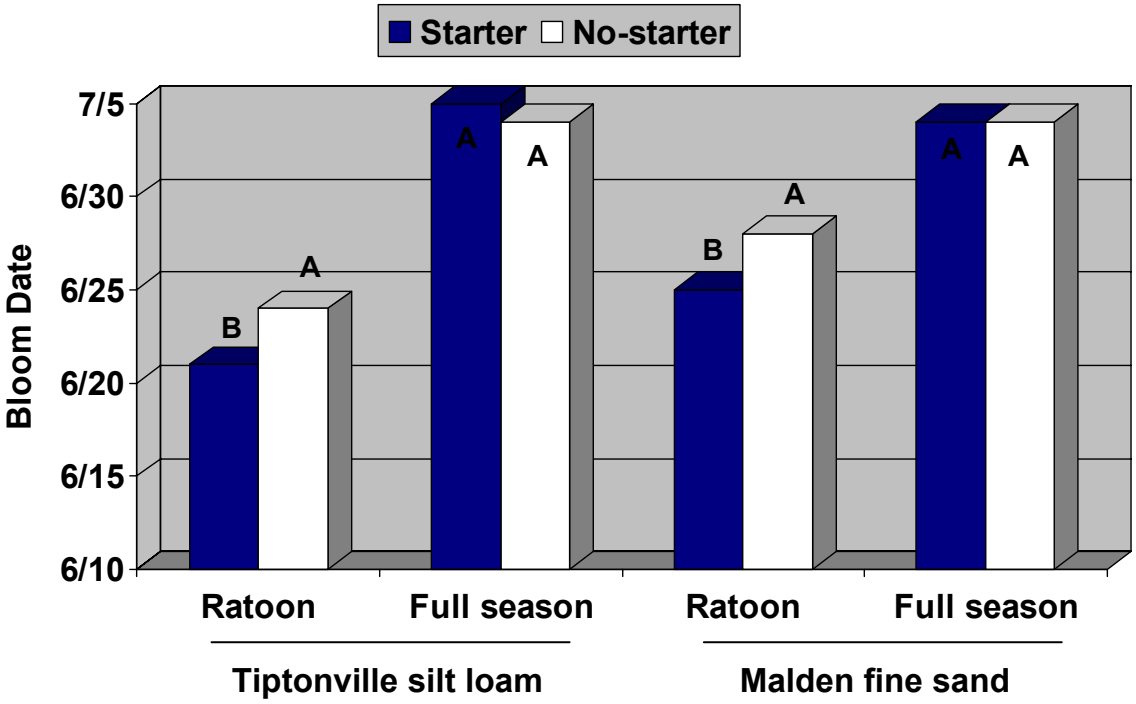

Figure 2. Grain Sorghum Bloom Date Response to Starter Fertilizer in 2004.

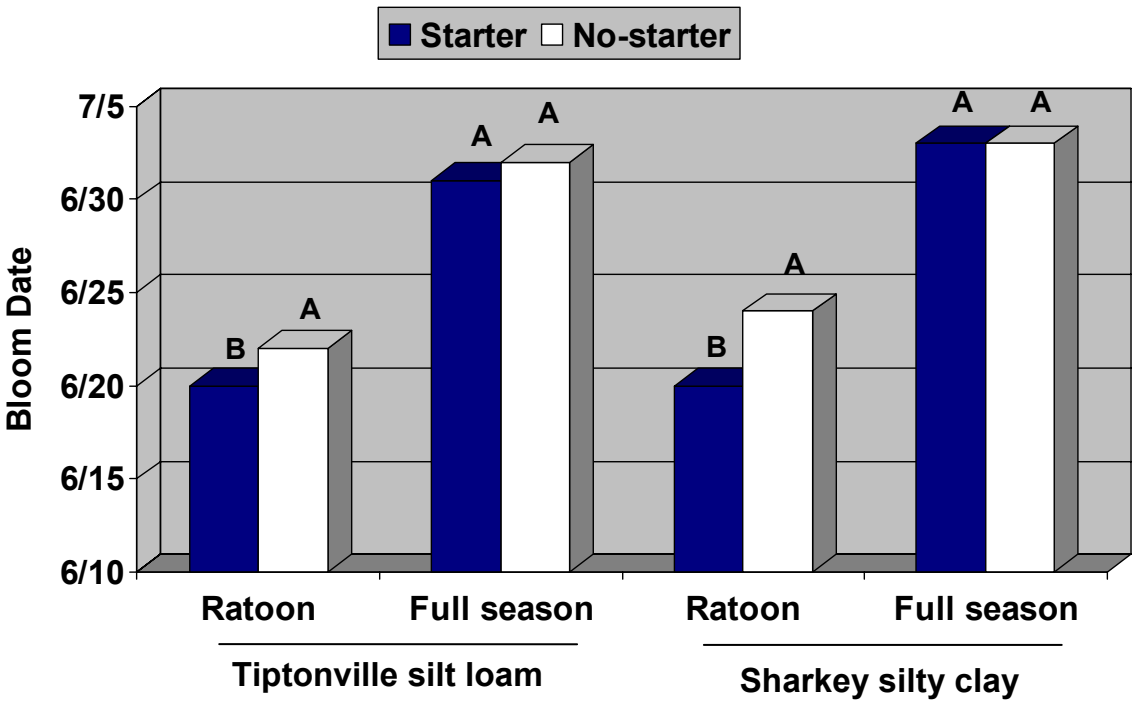

Figure 3. Grain Sorghum Yield Response to Starter Fertilizer in 2003.

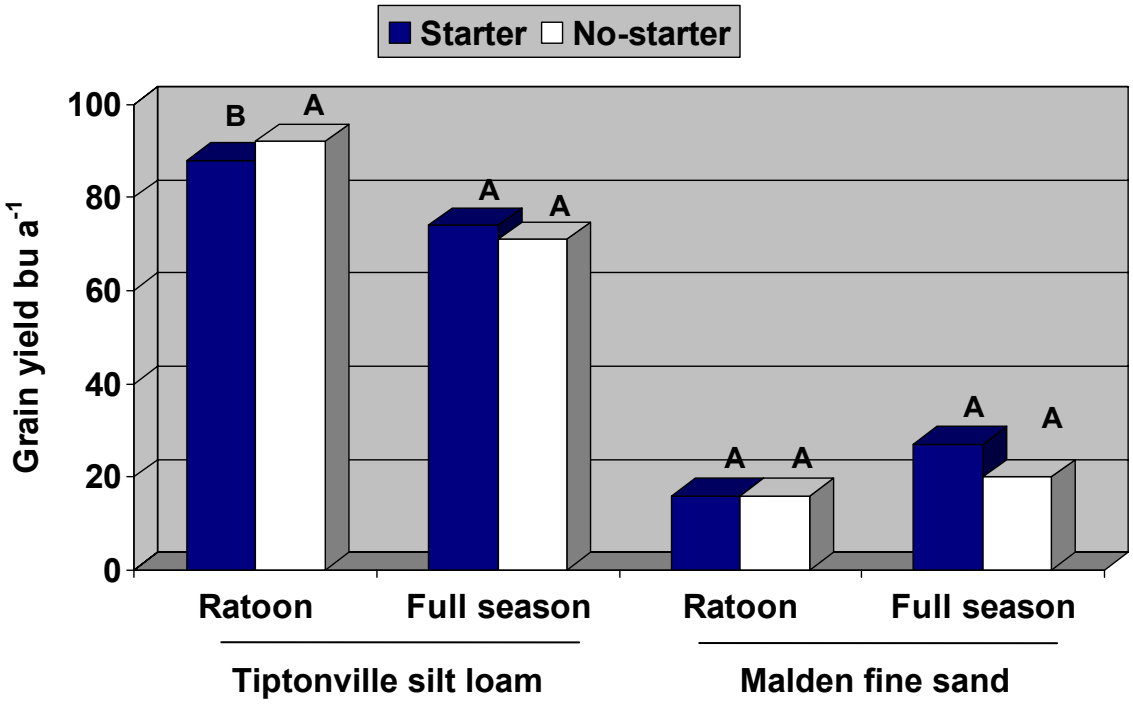

Figure 4. Grain Sorghum Yield Response to Starter Fertilizer in 2004.

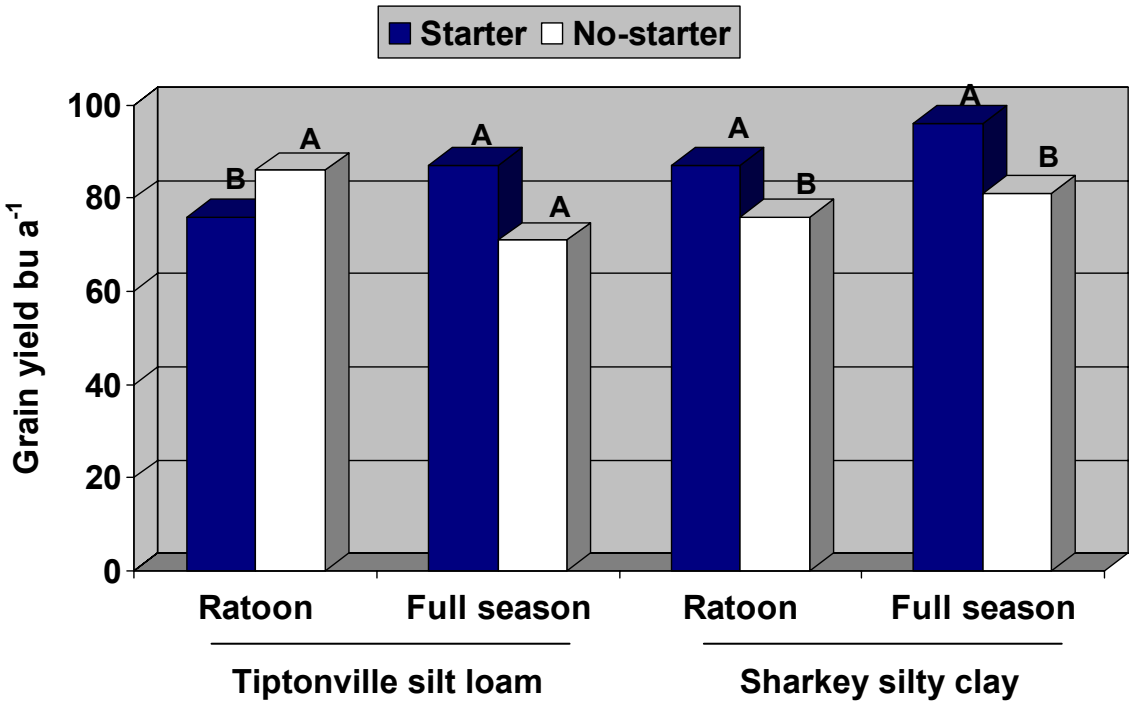

Figure 5. Grain Sorghum Yield Response to Ratoon N on a Tiptonville Silt Loam in 2003.

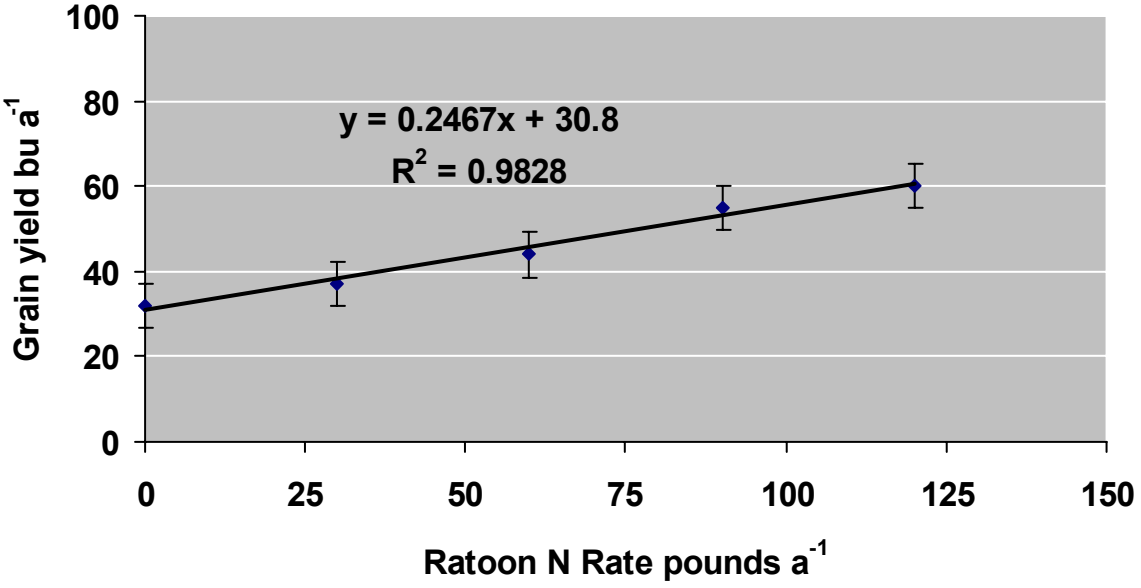

Figure 6. Grain Sorghum Yield Response to Ratoon N on a Malden Fine Sand in 2003

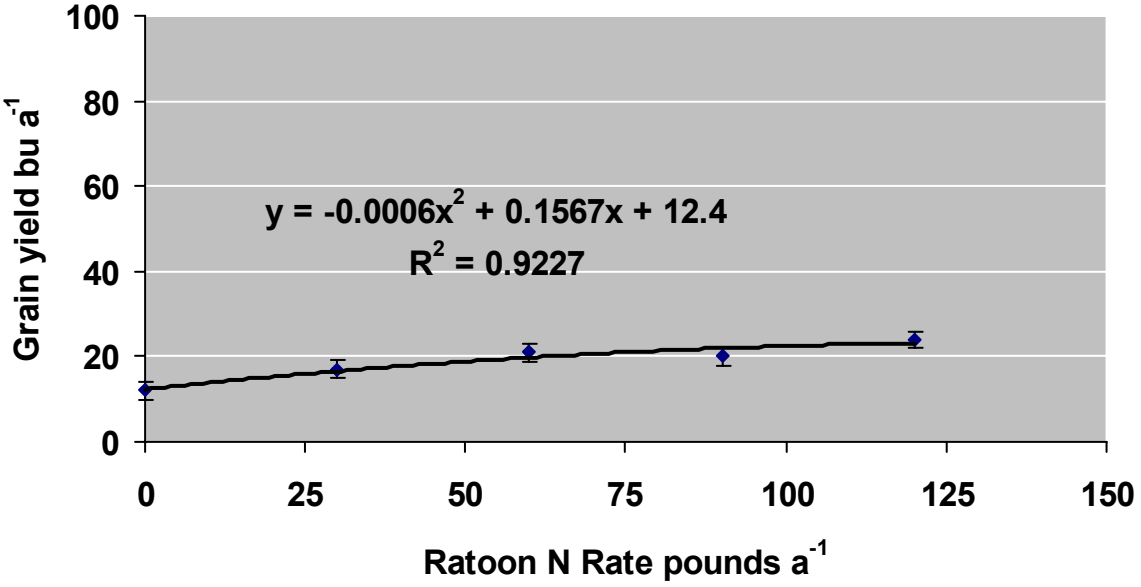

Figure 7. Grain Sorghum Yield Response to Ratoon N on a Tiptonville Silt Loam in 2004

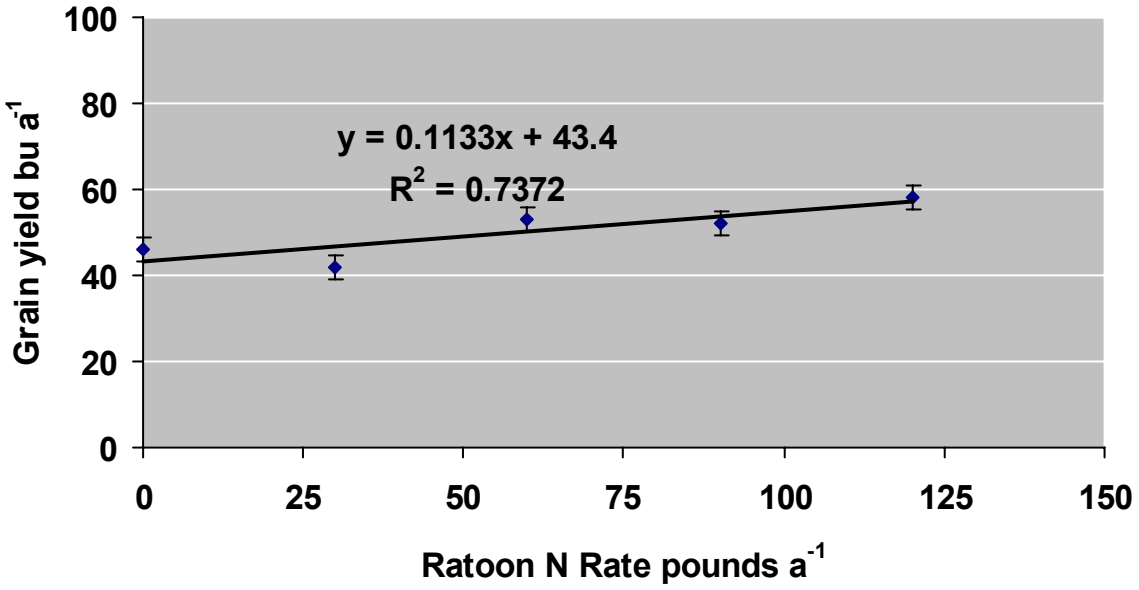

Figure 8. Grain Sorghum Yield Response to Ratoon N on a Sharkey Silty Clay in 2004

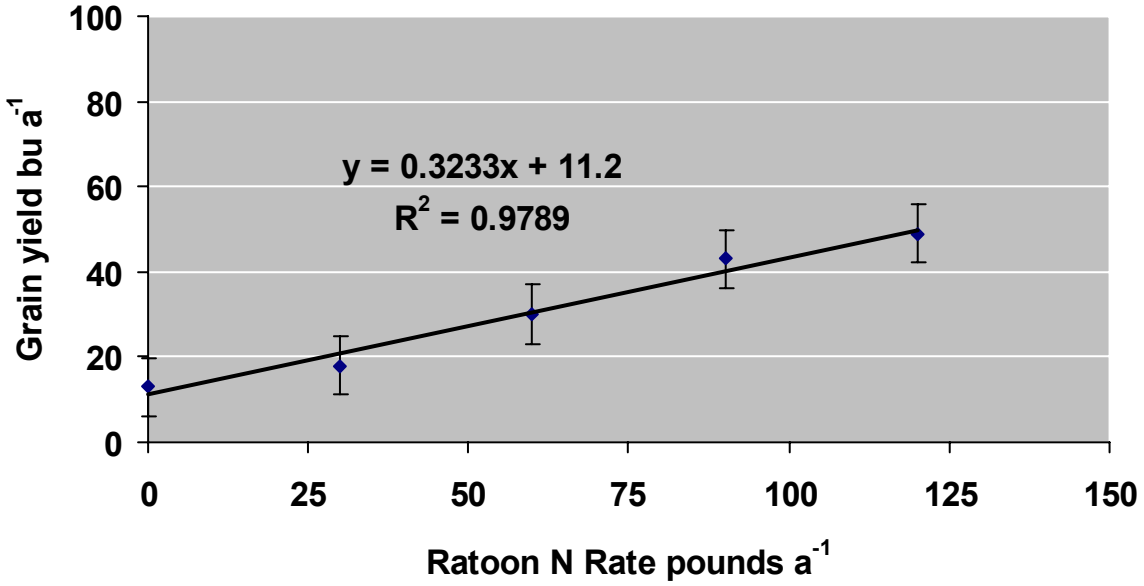

Figure 9. Grain Yield Comparison Between the Ratoon Grain Sorghum Cropping System and the Conventional Full Season Grain Sorghum Production System in 2003.

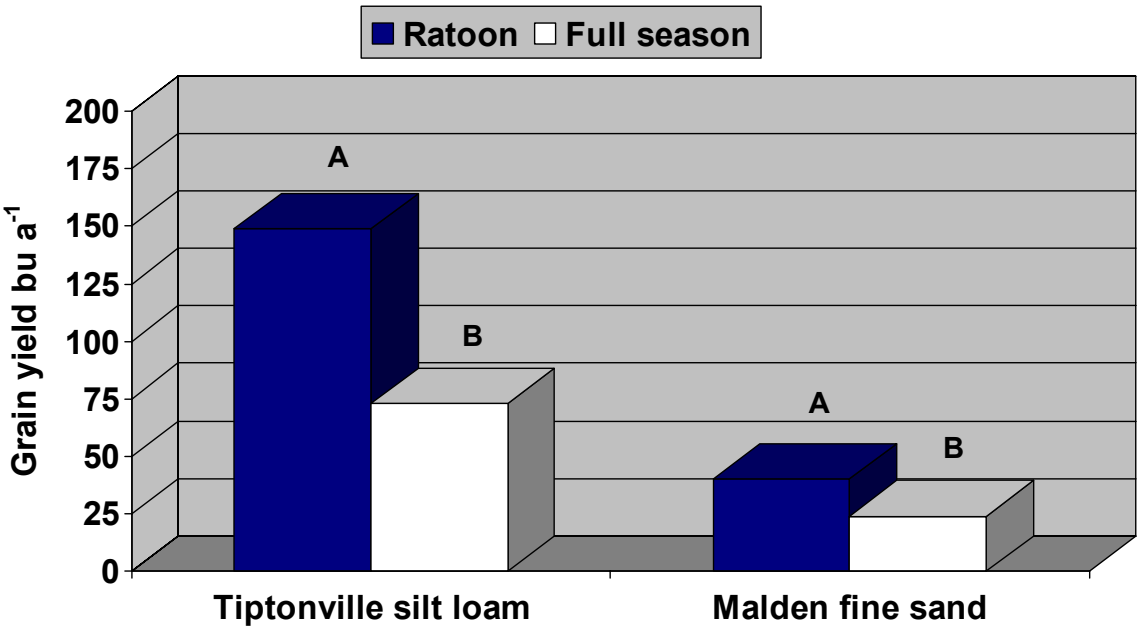

Figure 10. Grain Yield Comparison Between the Ratoon Grain Sorghum Cropping System and the Conventional Full Season Grain Sorghum Production System in 2004.