APPENDIX 4

Preliminary Report on Growth and Survival of 10 Vegetative Species Planted at the Fourchon Ridge between 2010 – 2014: Effect of Additives

MARCH 22, 2016

FOURCHON MARITIME FOREST RIDGE AND MARSH RESTORATION

BTNEP

Preliminary Report on Growth and Survival of 10 Vegetative Species Planted at the Fourchon Ridge between 2010 – 2014: Effect of Additives

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Executive Summary

This project involved planting multiple species of vegetation on a recently created ridge near Fourchon, Louisiana. The first part of this study evaluated the benefits of adding various forms of supplements to the soil on first year survival and growth. The treatments consisted of a Control (no additives), Bag, Fertilizer, Gypsum, and various combinations of the additives. The additives were added to the hole used to plant the tree at the time of planting. Each planting was conducted in a block, and the mean of each block was used as a replicate. Survival was determined based on the proportion of individuals still alive. Vigor was calculated using an index that ranged from 1 – 9, with 1 being the most vigorous and 9 being dead. Height and Spread were measured in inches and basal stem diameter was measured in mm's.

Growth and survival were quantified approximately 6 months and one 18 months after planting. Analysis of Variance (ANOVA; alpha = 0.05) was used to evaluate the effect soil treatments had on each variable measured for each sample date. Tukeys post hoc analysis was used to delineate among treatments if ANOVA revealed a treatment effect.

It does not appear that any of the soil additives had a positive effect of survival and growth. The only exception is Fertilizer for Matrimony Vine (Figure's 7, 9, and 10). Although there were a few other statistical differences noted, they do not appear to be relevant. One reason why the additives did not have an affect could by the low level of survival. There were several plantings that resulted in 100% mortality. It appears that survival improved as the ridge became older, which may be an indication of a change in overall soil quality of th ridge (i.e., decrease in soil salinity). Therefore, future analysis will pool each species across soil treatments to increase the robustness of the data set to increase our ability to detect soil quality effects on vegetation survival and growth.

At this time, it does not appear beneficial to use additives when planting the species used for this study on newly created maritime ridges. The remainder of this analysis will focus on soil chemistry and planting location.

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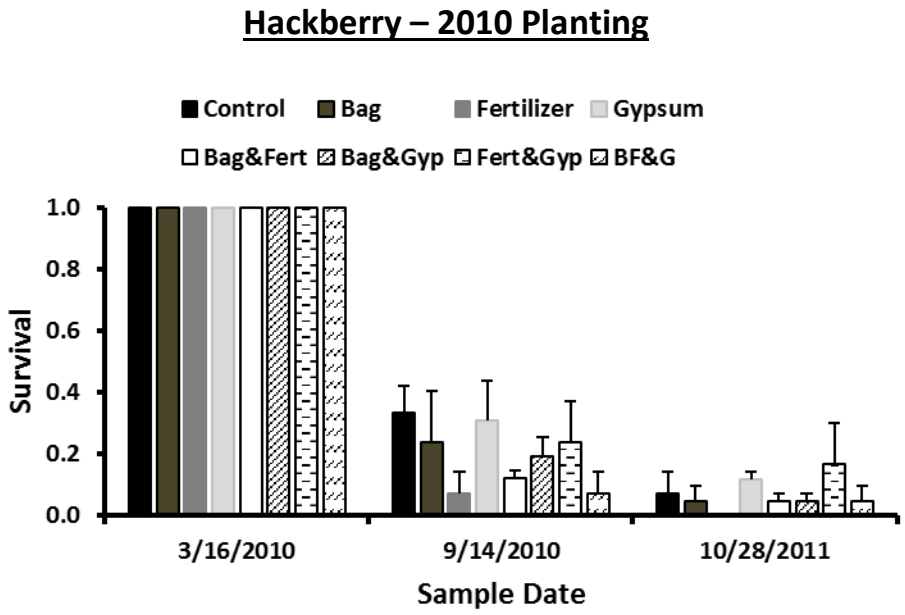

Figure 1. Mean (±SE) survival of Hackberry planted on 16 March 2010 exposed to eight soil treatments. Survival was similar among all treatments for all dates.

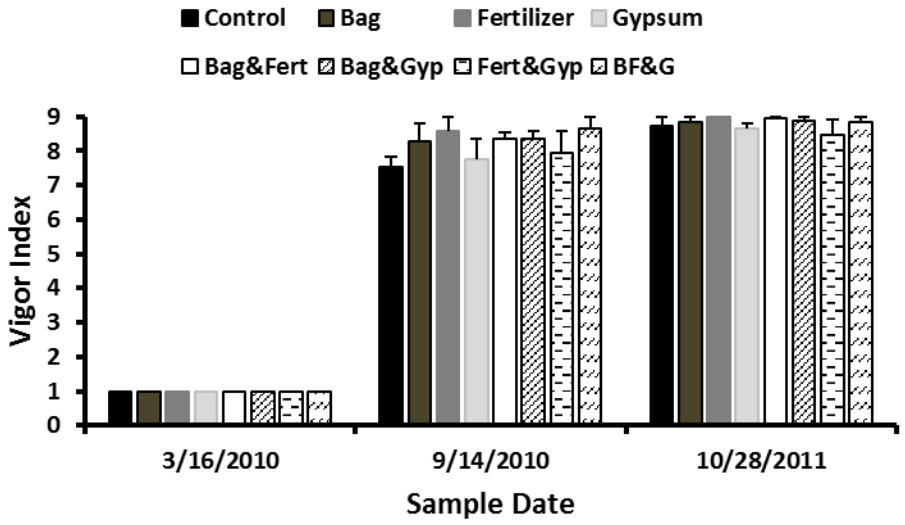

Figure 2. Mean (±SE) vigor of Hackberry planted on 16 March 2010 exposed to eight soil treatments. Vigor was similar among all treatments for all dates.

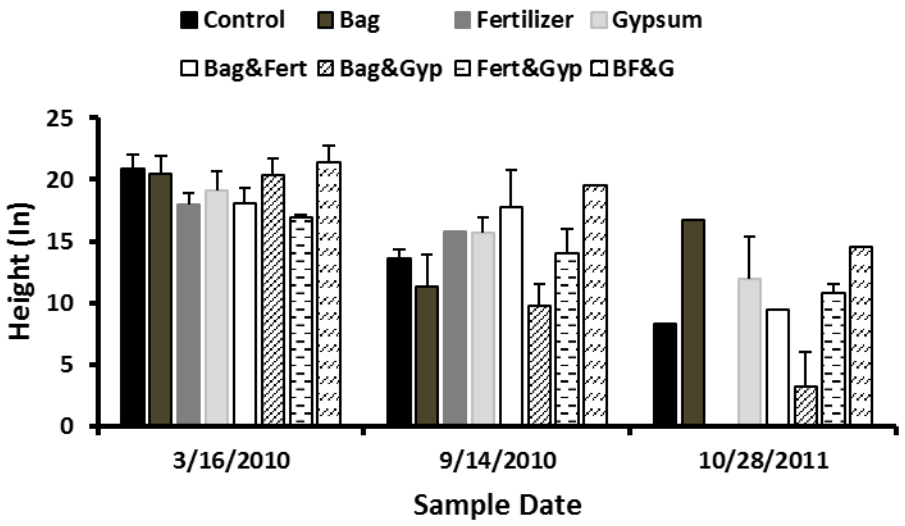

Figure 3. Mean (±SE) height of Hackberry planted on 16 March 2010 exposed to eight soil treatments. Height was similar among all treatments for all dates.

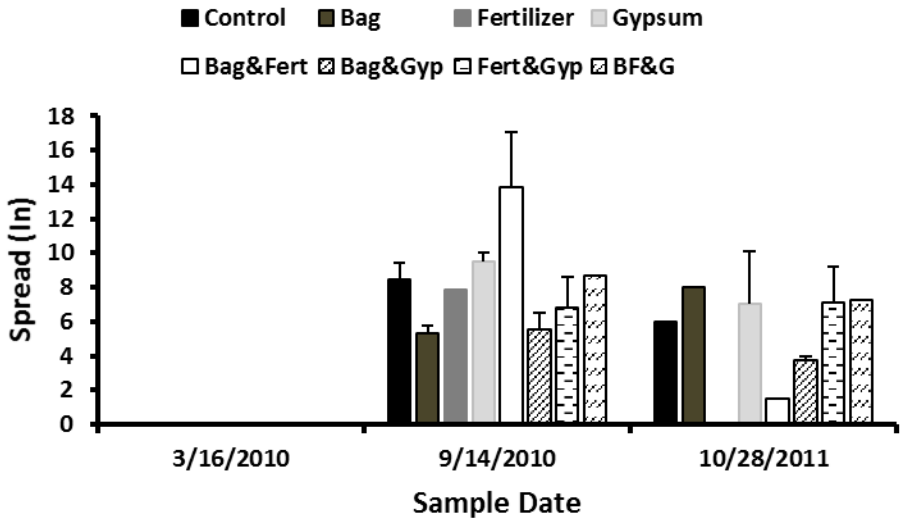

Figure 4. Mean (±SE) spread of Hackberry planted on 16 March 2010 exposed to eight soil treatments. Spread was similar among all treatments for all dates. There was no data available for 16 March 2010.

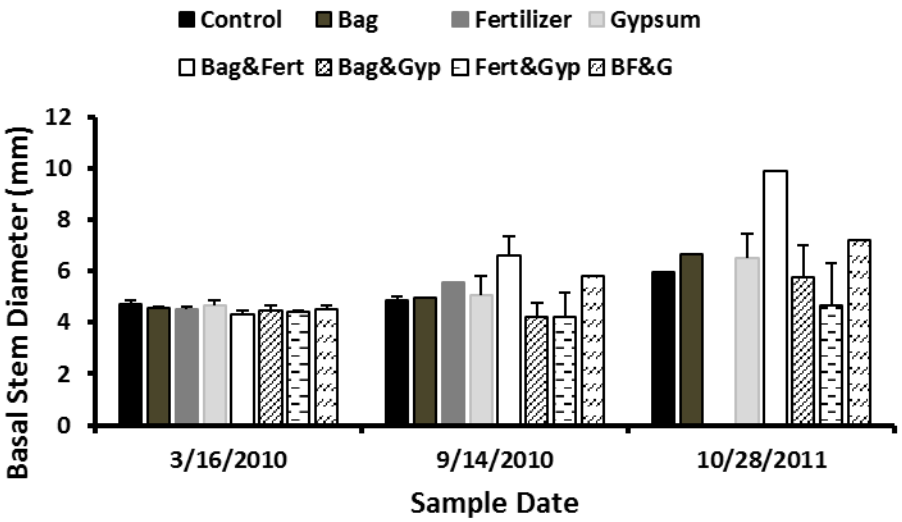

Figure 5. Mean (±SE) basal stem diameter of Hackberry planted on 16 March 2010 exposed to eight soil treatments. Basal stem diameter was similar among all treatments for all dates.

Matrimony Vine – 2010 Planting

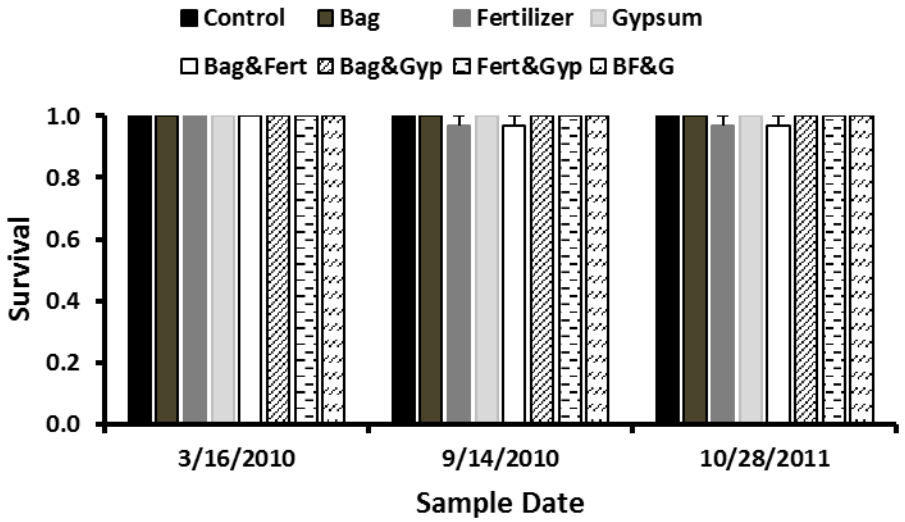

Figure 6. Mean (±SE) survival of Matrimony Vine planted on 16 March 2010 exposed to eight soil treatments. Survival was similar among all treatments for all dates.

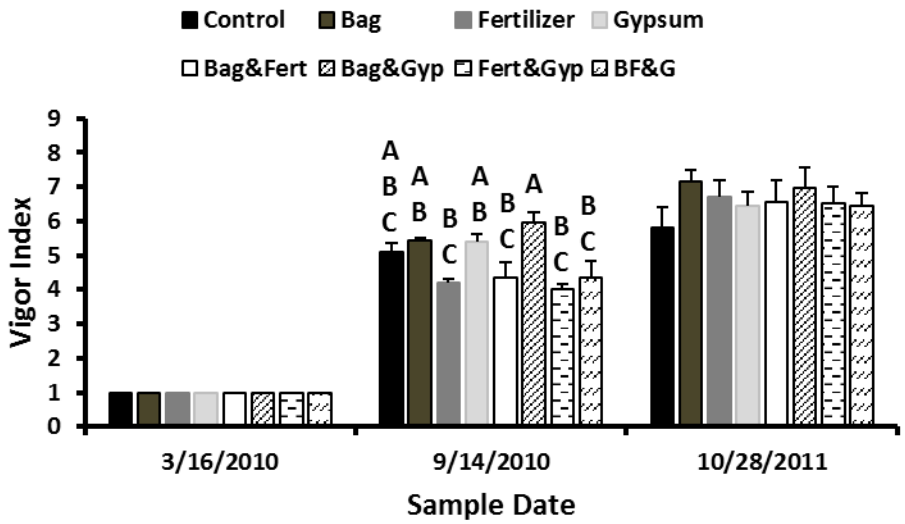

Figure 7. Mean (±SE) vigor of Matrimony Vine planted on 16 March 2010 exposed to eight soil treatments. Vigor varied among treatments on 14 September 2010 but was was similar among all treatments on 28 October 2011. Means with a similar letter are not different.

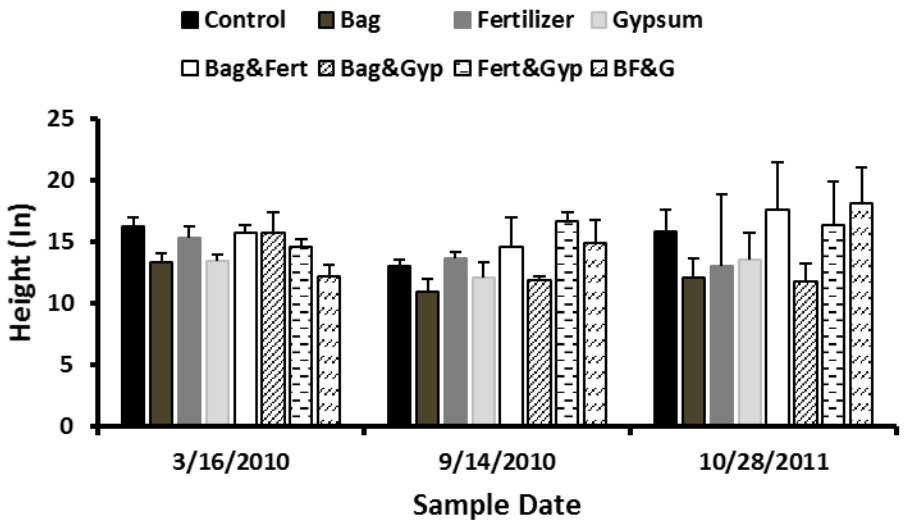

Figure 8. Mean (±SE) height of Matrimony Vine planted on 16 March 2010 exposed to eight soil treatments. Height was similar among all treatments for all dates.

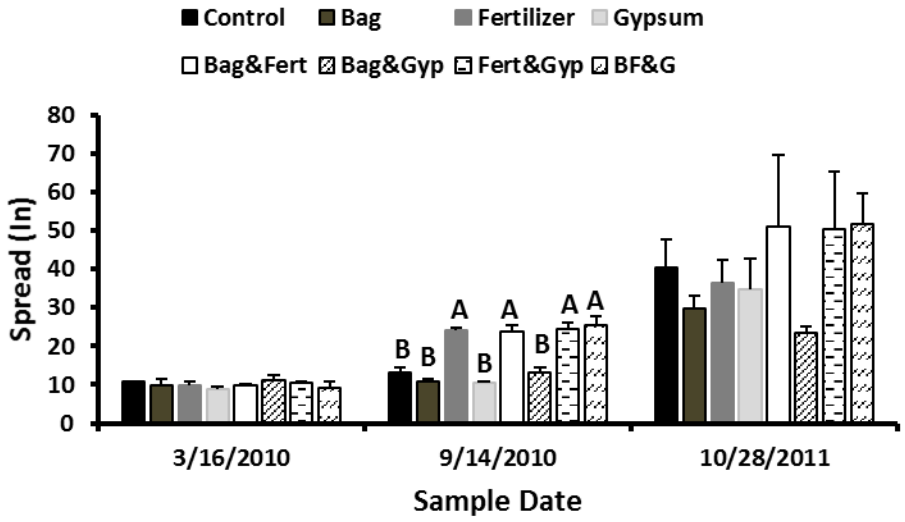

Figure 9. Mean (±SE) spread of Matrimony Vine planted on 16 March 2010 exposed to eight soil treatments. Spread was greater for treatments that contained fertilizer on 14 September 2010 but was was similar among all treatments on 28 October 2011. Means with a similar letter are not different.

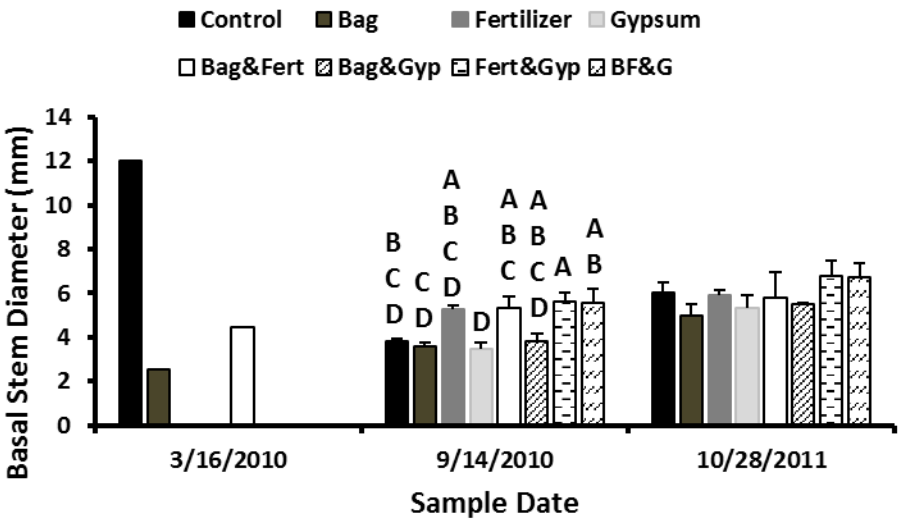

Figure 10. Mean (±SE) basal stem diameter of Matrimony Vine planted on 16 March 2010 exposed to eight soil treatments. Basal stem diameter varied among treatments on 14 September 2010, but fertilizer appears to be beneficial. Basal stem diameter was similar among all treatments on 28 October 2011. Means with a similar letter are not different.

Sand Oak – 2010 Planting

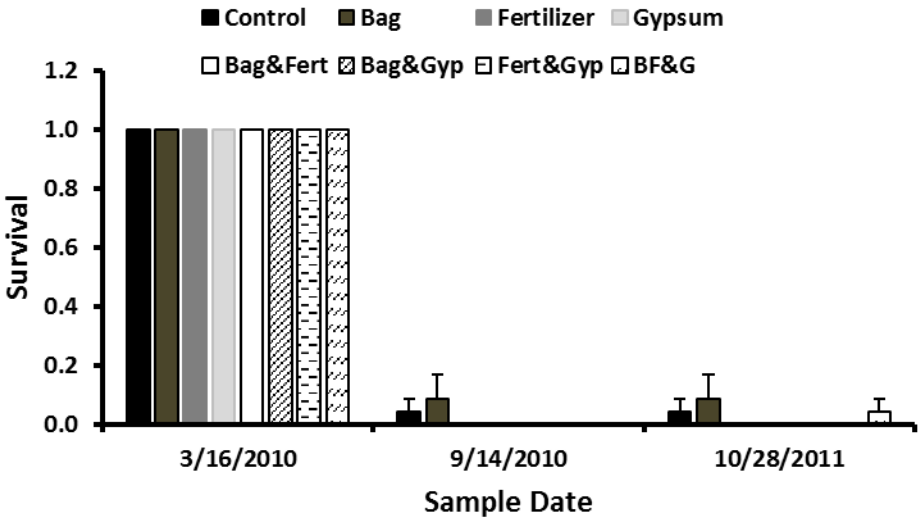

Figure 11. Mean (±SE) survival of Sand Oak planted on 16 March 2010 exposed to eight soil treatments. Survival was very low among treatments, but was similar all dates.

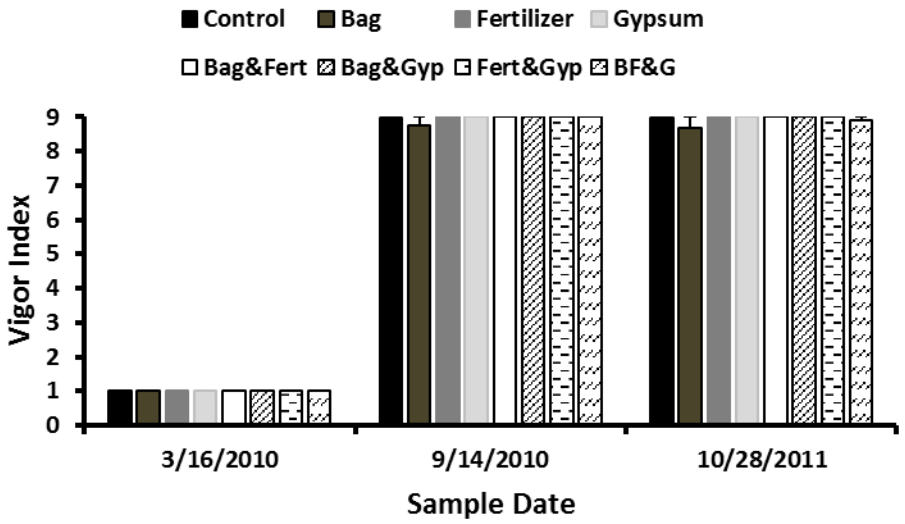

Figure 12. Mean (±SE) vigor of Sand Oak planted on 16 March 2010 exposed to eight soil treatments. Vigor was similar among all treatments for all dates.

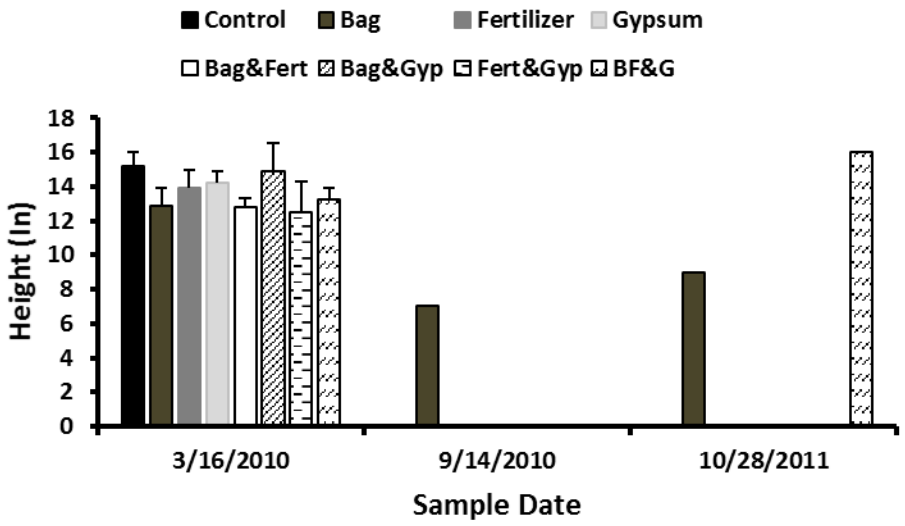

Figure 13. Mean (±SE) Height of Sand Oak planted on 16 March 2010 exposed to eight soil treatments. Height was similar among all treatments for all dates.

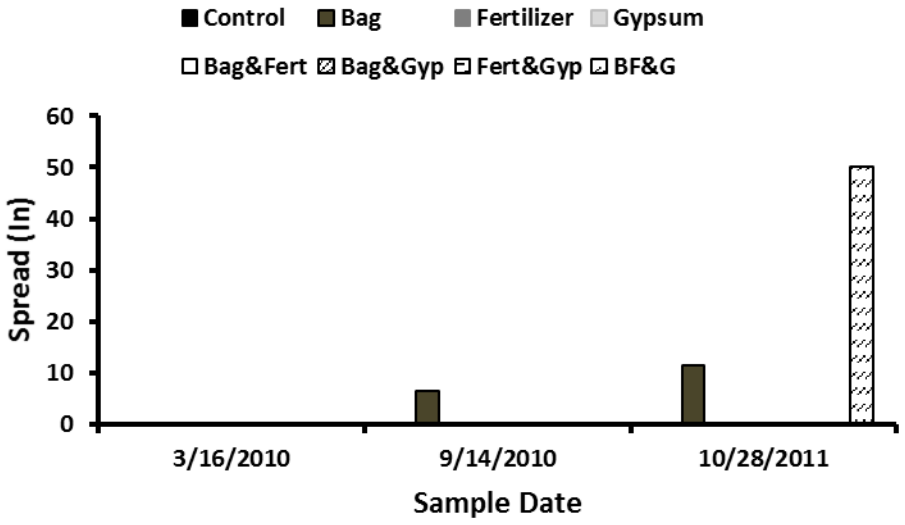

Figure 14. Mean (±SE) Spread of Sand Oak planted on 16 March 2010 exposed to eight soil treatments. There was no data available for 16 March 2010.

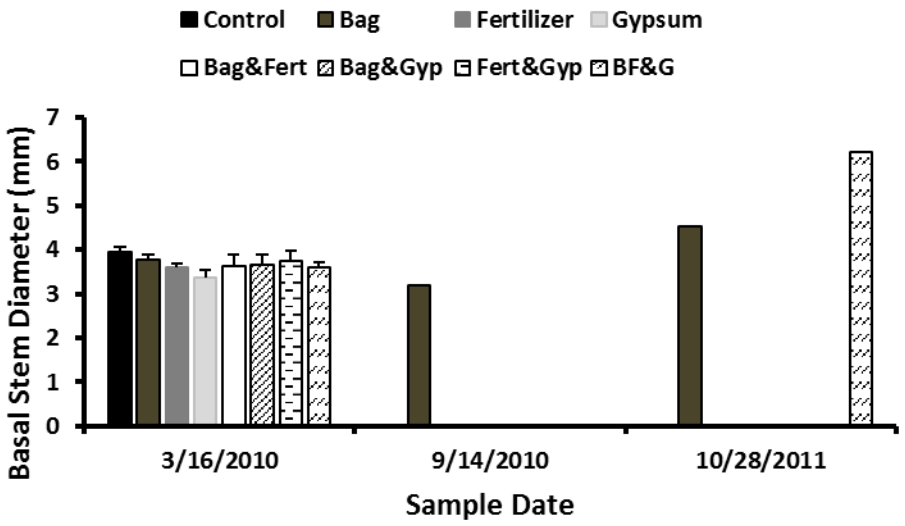

Figure 15. Mean (±SE) Basal Stem Diameter of Sand Oak planted on 16 March 2010 exposed to eight soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

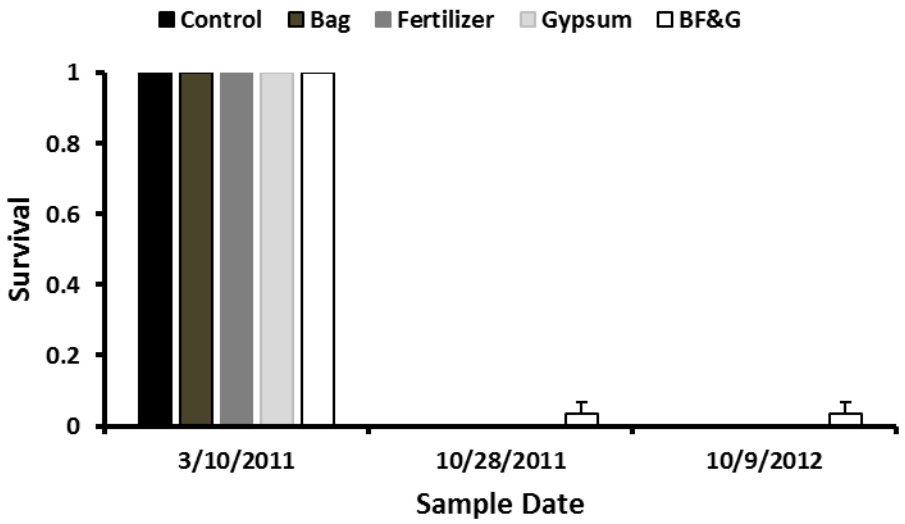

Figure 16. Mean (±SE) survival of Beautyberry planted on 10 March 2011 exposed to five soil treatments. Only the BF&G treatment had survivors post planting.

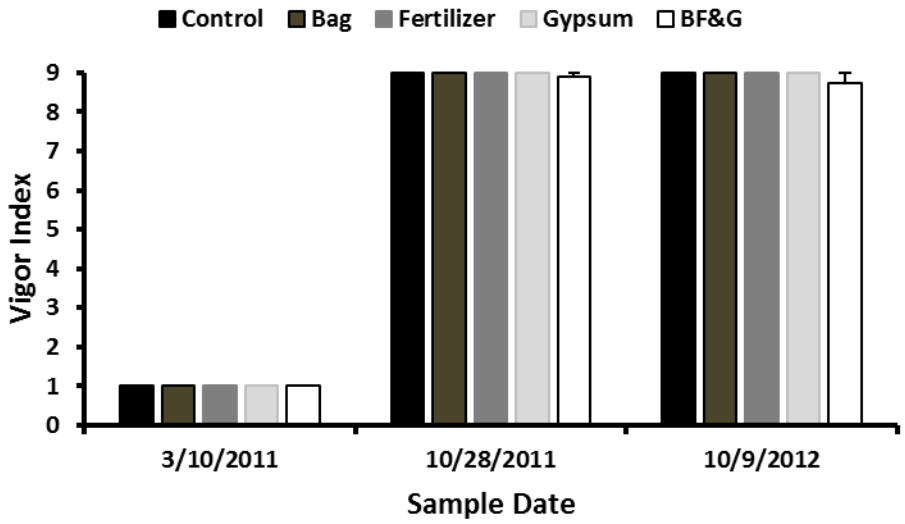

Figure 17. Mean (±SE) vigor of Beautyberry planted on 10 March 2011 exposed to five soil treatments. Only the BF&G treatment had survivors post planting.

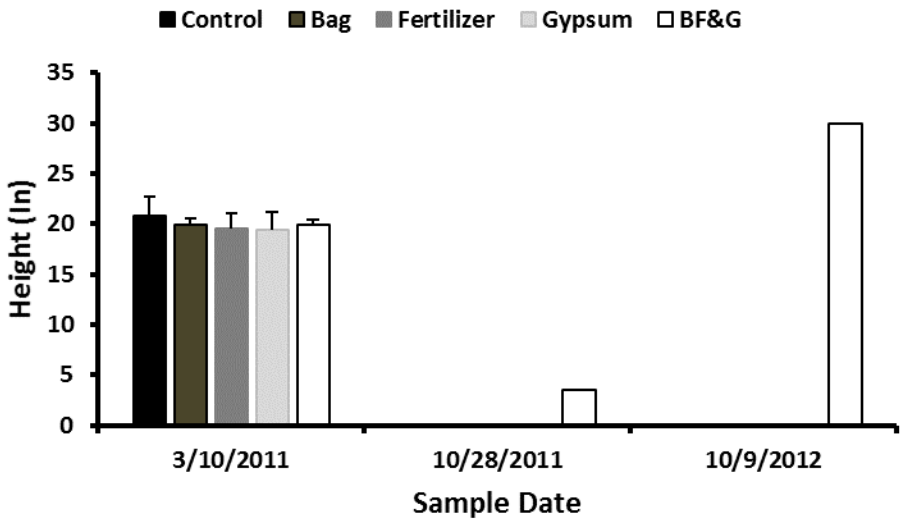

Figure 18. Mean (±SE) height of Beautyberry planted on 10 March 2011 exposed to five soil treatments. Only the BF&G treatment had survivors post planting.

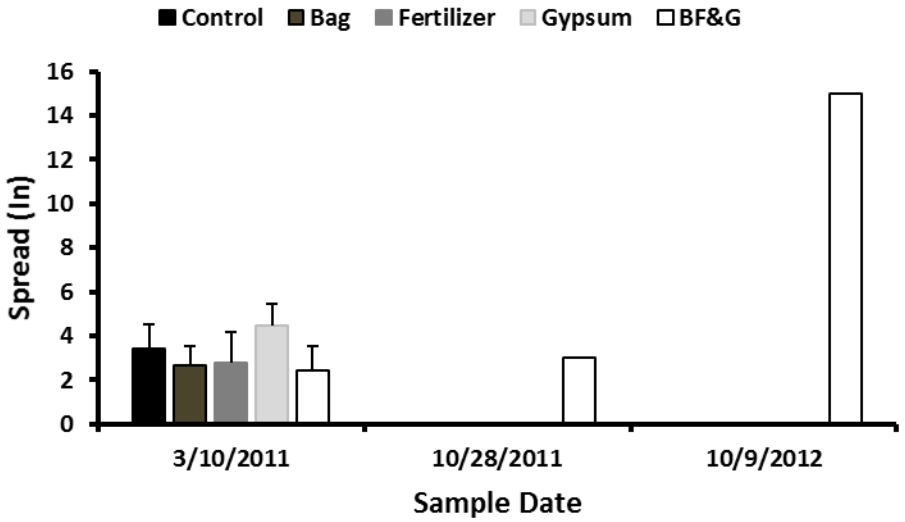

Figure 19. Mean (±SE) spread of Beautyberry planted on 10 March 2011 exposed to five soil treatments. Only the BF&G treatment had survivors post planting.

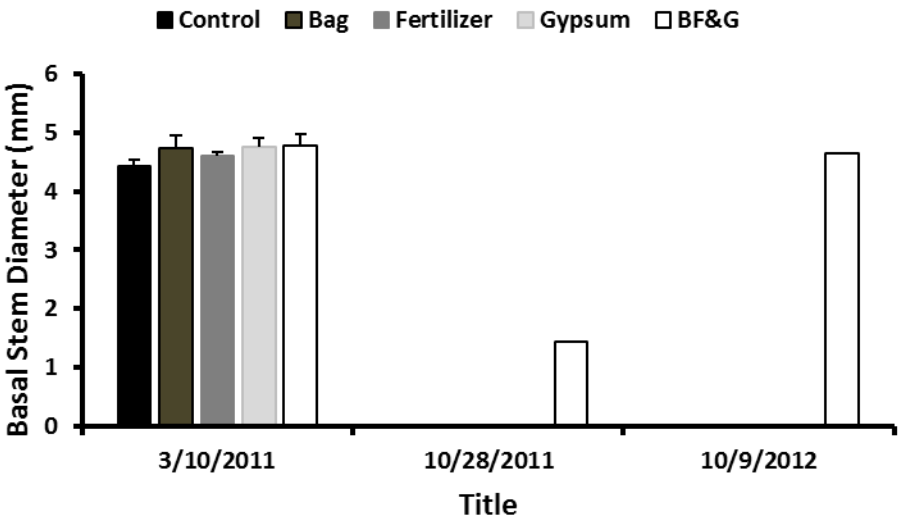

Figure 20. Mean (±SE) basal stem diameter of Beautyberry planted on 10 March 2011 exposed to five soil treatments. Only the BF&G treatment had survivors post planting.

Hackberry – 2011 Planting

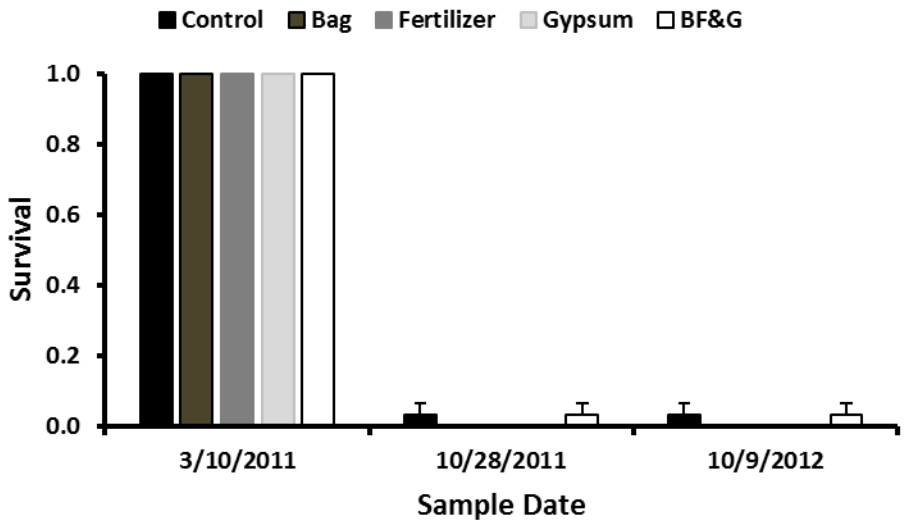

Figure 21. Mean (±SE) Survival of Hackberry planted on 10 March 2011 exposed to five soil treatments. Only the Control and BF&G treatment had survivors post planting.

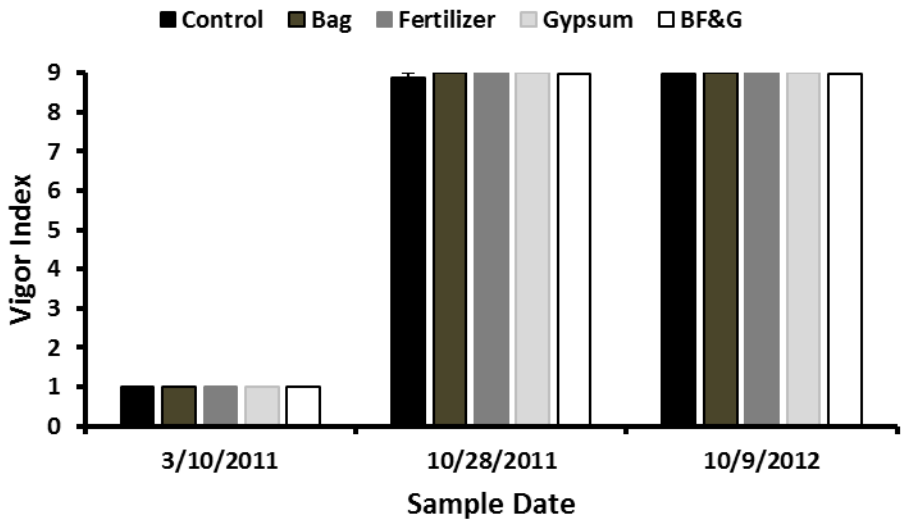

Figure 22. Mean (±SE) Vigor of Hackberry planted on 10 March 2011 exposed to five soil treatments. Only the Control and BF&G treatment had survivors post planting and vigor was similar among all treatments for all dates.

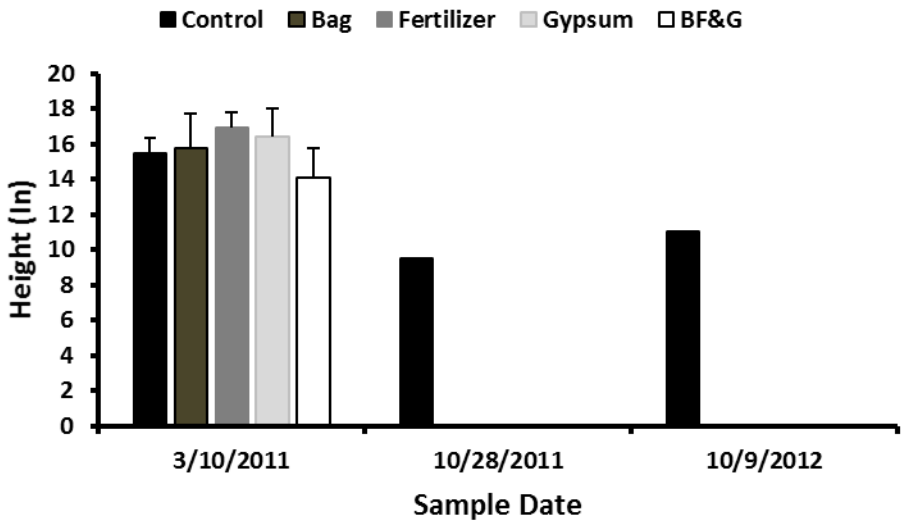

Figure 23. Mean (±SE) Height of Hackberry planted on 10 March 2011 exposed to five soil treatments. Height was similar among all treatments for all dates.

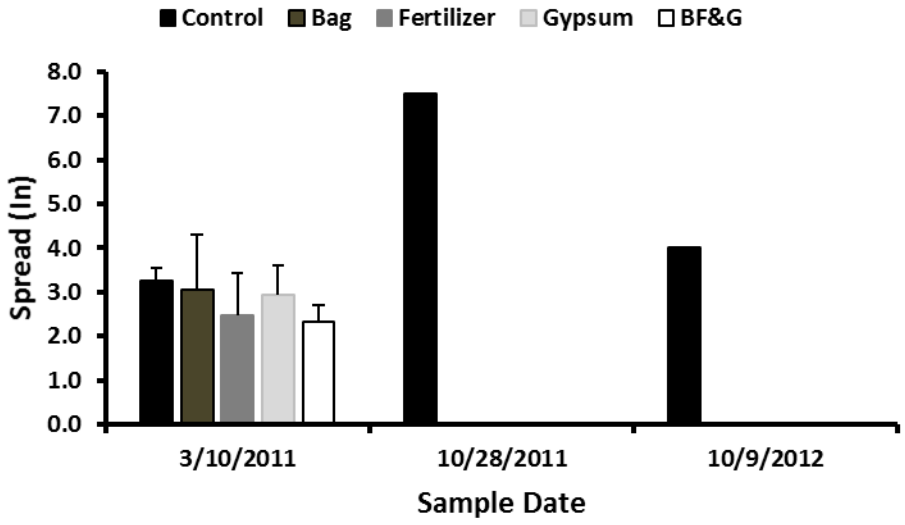

Figure 24. Mean (±SE) Spread of Hackberry planted on 10 March 2011 exposed to five soil treatments. Spread was similar among all treatments for all dates.

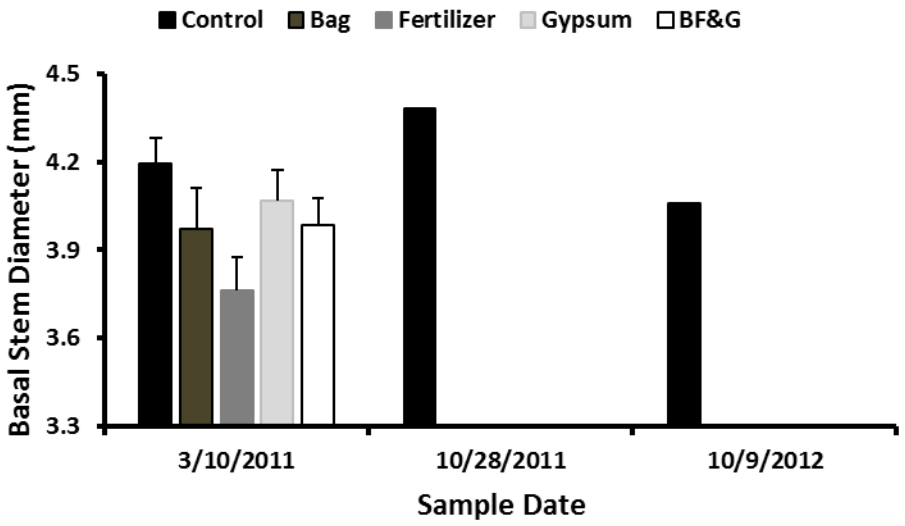

Figure 25. Mean (±SE) Basal Stem Diameter of Hackberry planted on 10 March 2011 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

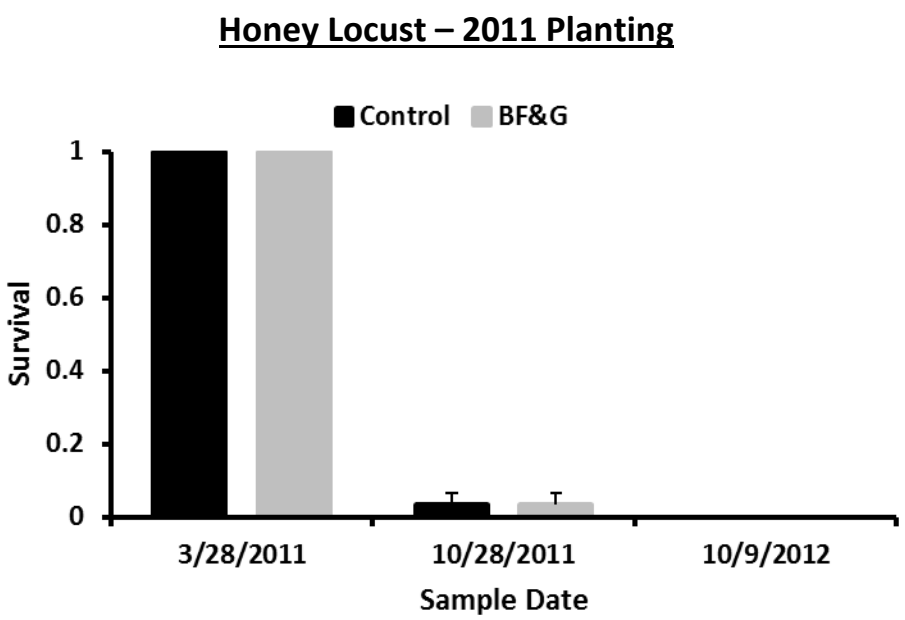

Figure 26. Mean (±SE) Survival of Honey Locust planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals on 9 October 2012.

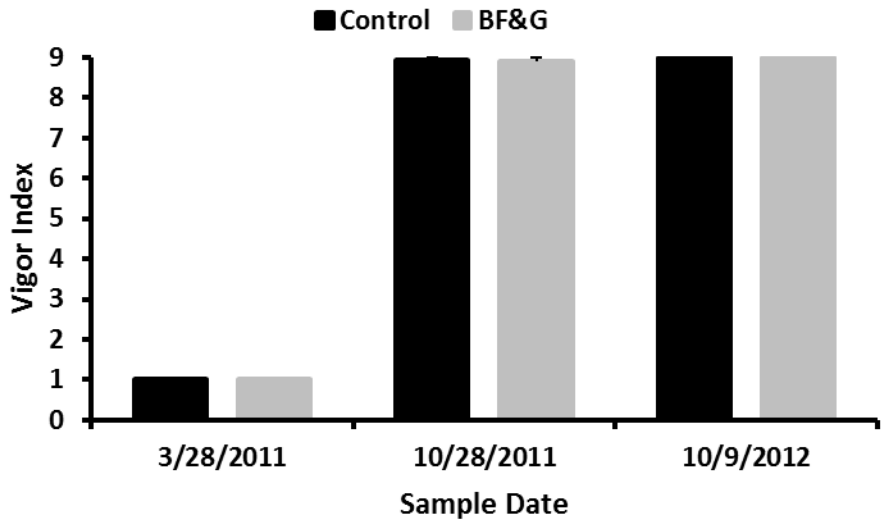

Figure 27. Mean (±SE) Vigor of Honey Locust planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals on 9 October 2012.

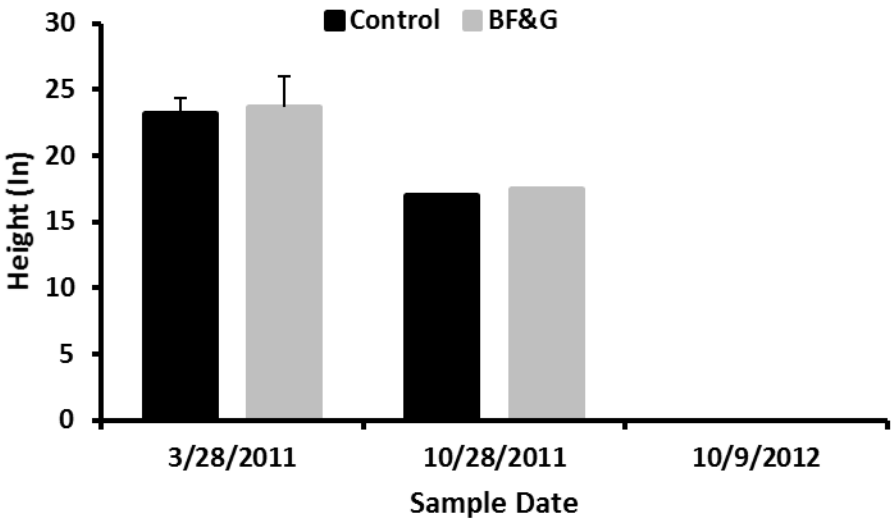

Figure 28. Mean (±SE) Height of Honey Locust planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals on 9 October 2012.

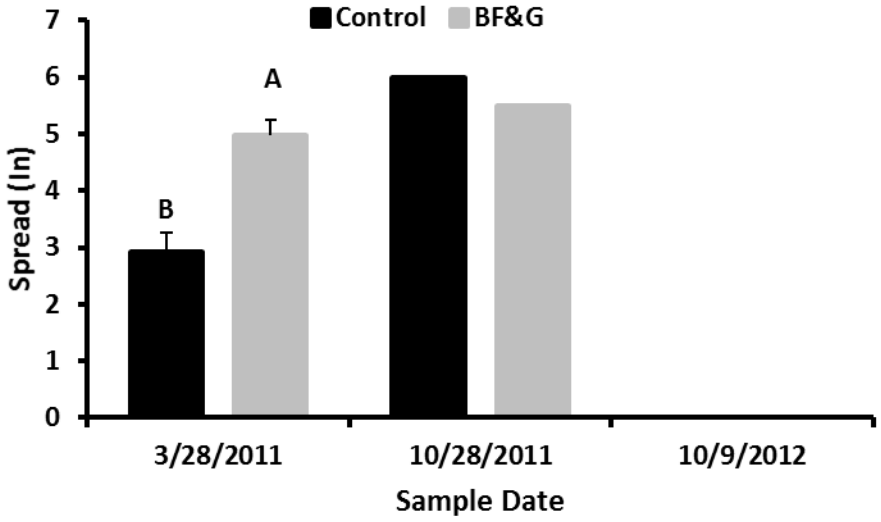

Figure 29. Mean (±SE) Spread of Honey Locust planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals on 9 October 2012.

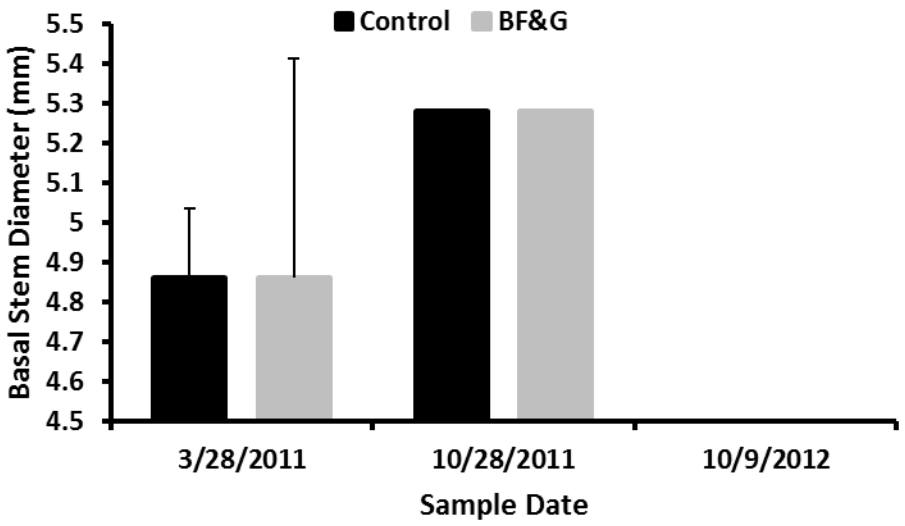

Figure 30. Mean (±SE) Basal Stem Diameter of Honey Locust planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals on 9 October 2012.

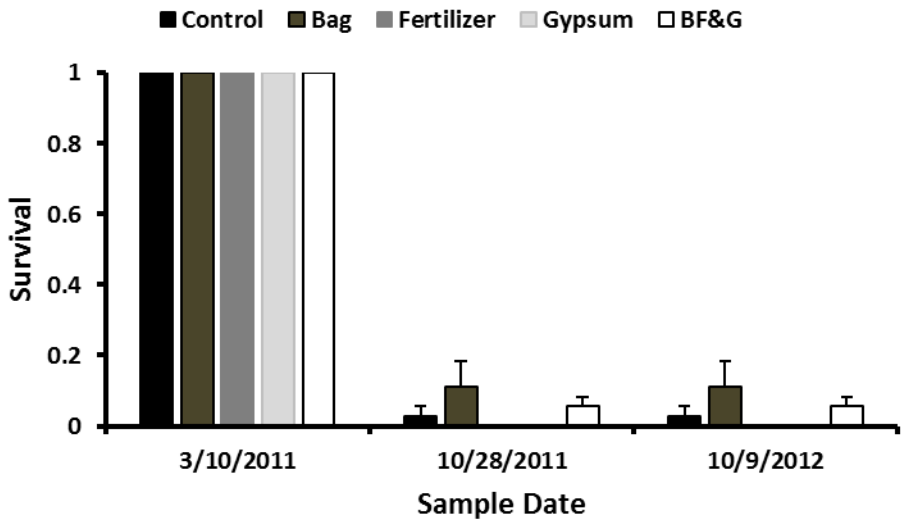

Figure 31. Mean (±SE) Survival of Live Oak planted on 10 March 2011 exposed to five soil treatments. Only the Control, Bag, and BF&G treatment had survivors post planting. Survival was similar among all treatments for all dates.

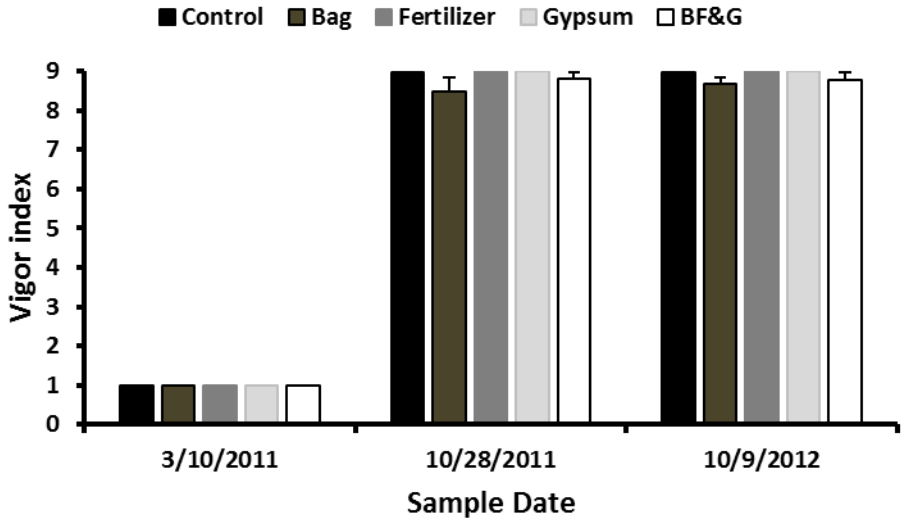

Figure 32. Mean (±SE) Vigor of Live Oak planted on 10 March 2011 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

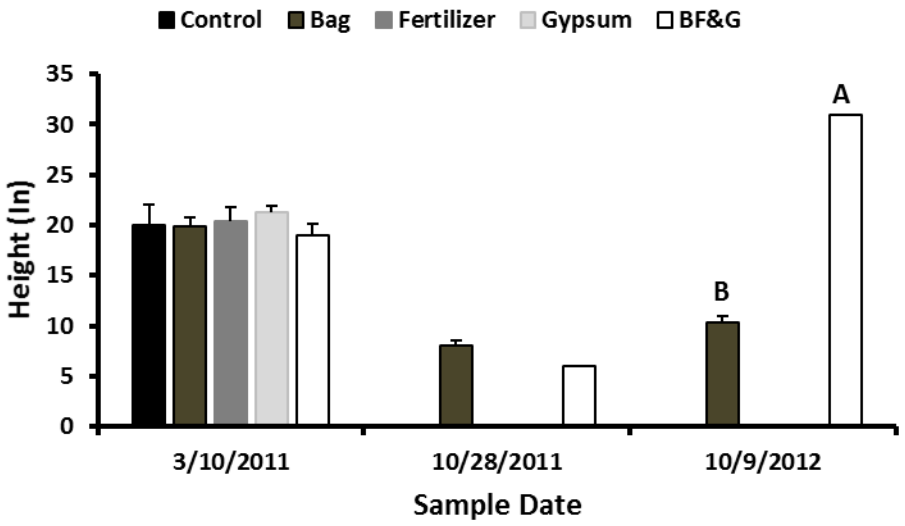

Figure 33. Mean (±SE) Height of Live Oak planted on 10 March 2011 exposed to five soil treatments. Height was similar between the two survivng treatments on 28 October 2011, but the tree in the BF&G treatment was taller than the trees in the Bag treatment on 9 October 2012.

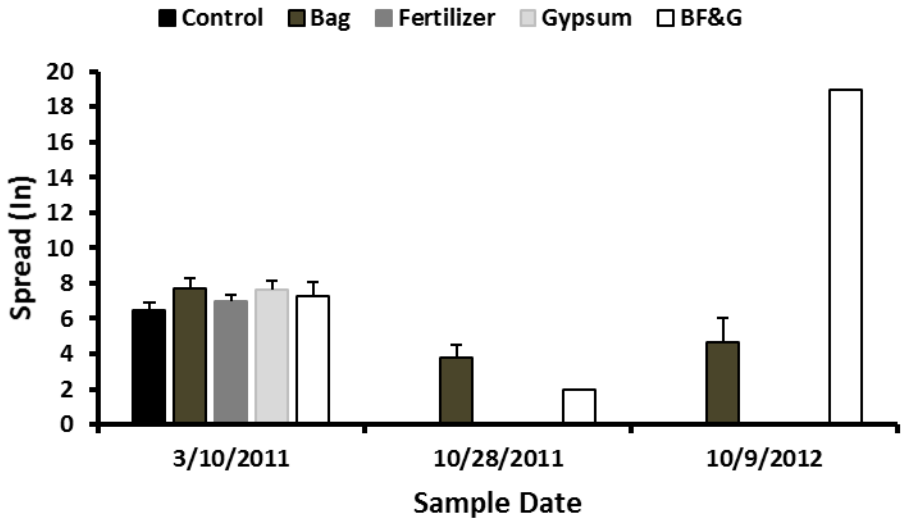

Figure 34. Mean (±SE) Spread of Live Oak planted on 10 March 2011 exposed to five soil treatments. Spread was similar among all treatments for all dates.

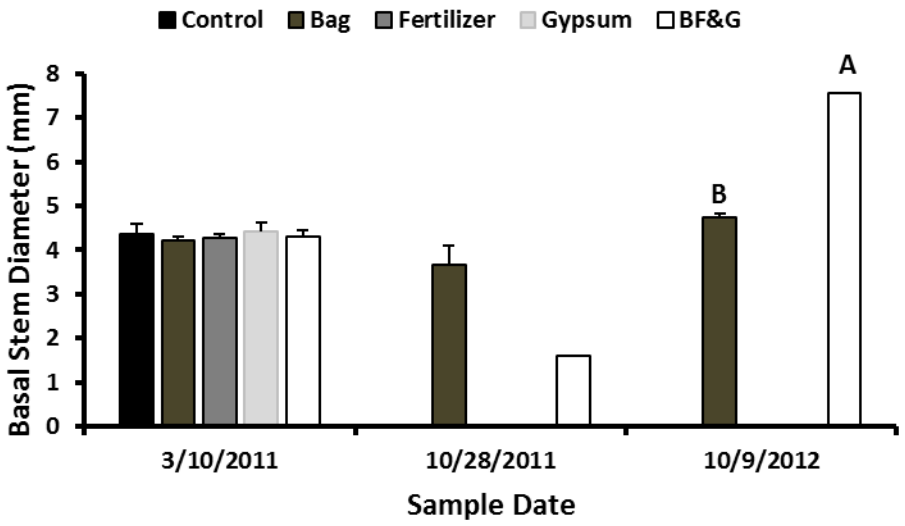

Figure 35. Mean (±SE) Basal Stem Diameter of Live Oak planted on 10 March 2011 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

Persimmon – 2011 Planting

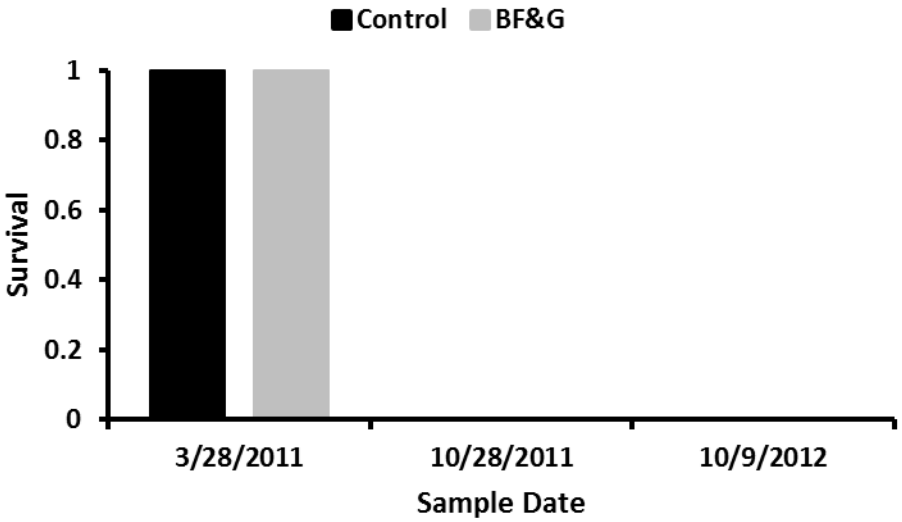

Figure 36. Mean (±SE) Survival of Persimmon planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals beyond the initital planting.

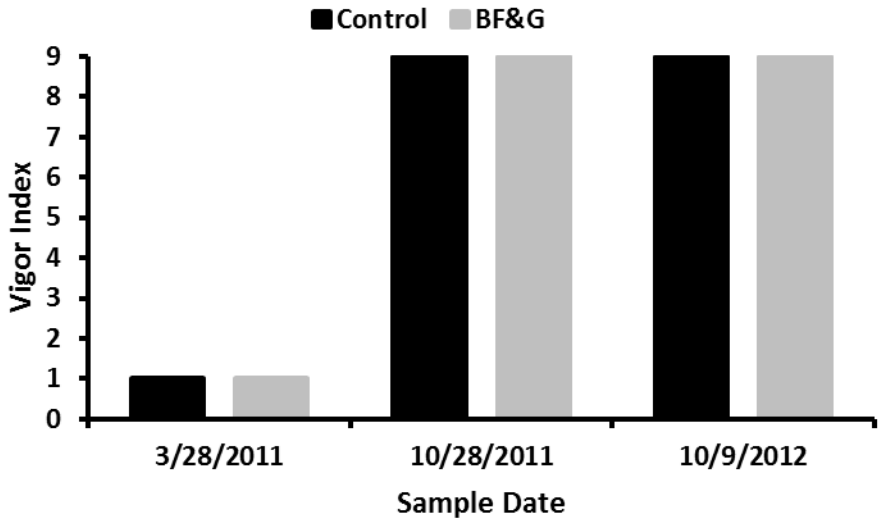

Figure 37. Mean (±SE) Vigor of Persimmon planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals beyond the initital planting.

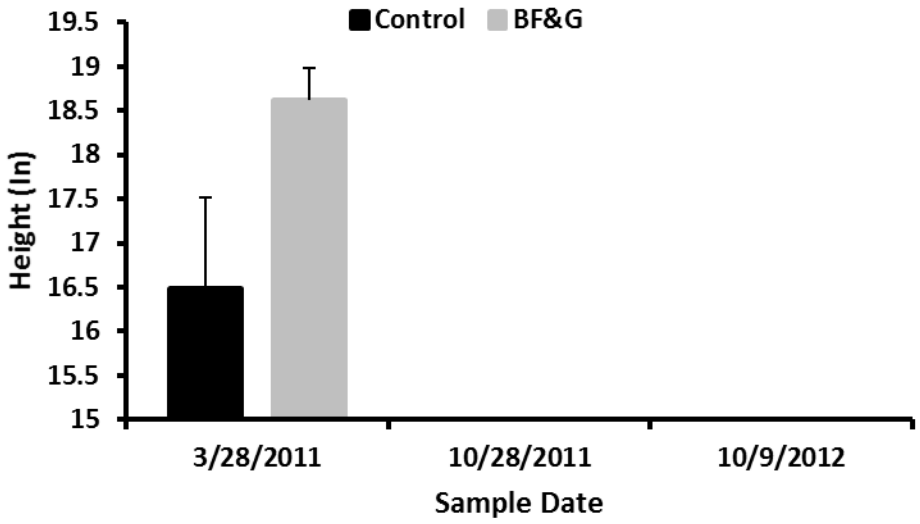

Figure 38. Mean (±SE) Height of Persimmon planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals beyond the initital planting.

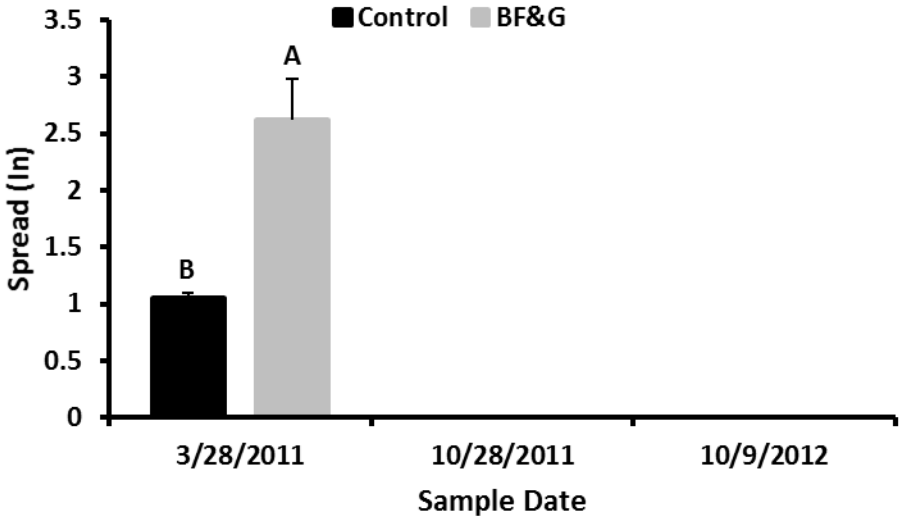

Figure 39. Mean (±SE) Height of Persimmon planted on 28 March 2011 exposed to two soil treatments. The trees planted in the BF&G had a greater spread than the trees planted in the Control treatment. There were no surviving individuals beyond the initial planting.

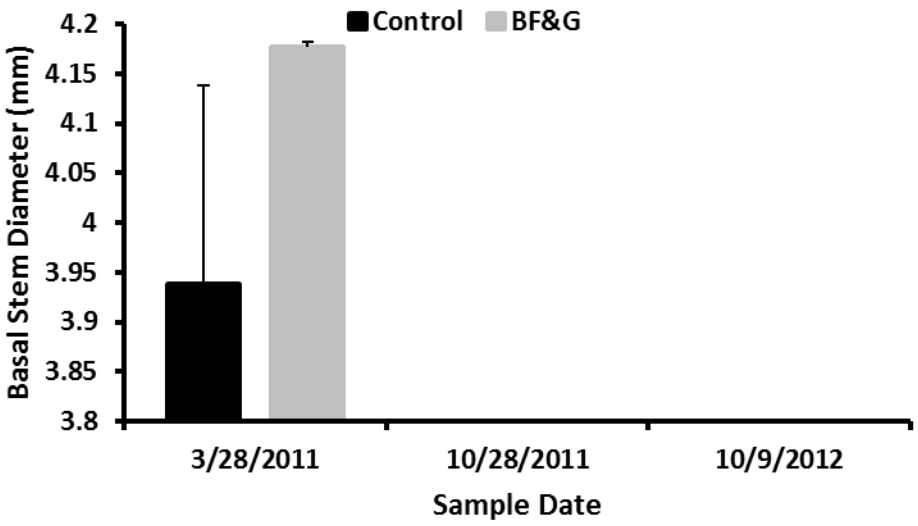

Figure 40. Mean (±SE) Basal Stem Diameter of Persimmon planted on 28 March 2011 exposed to two soil treatments. There were no surviving individuals beyond the initital planting.

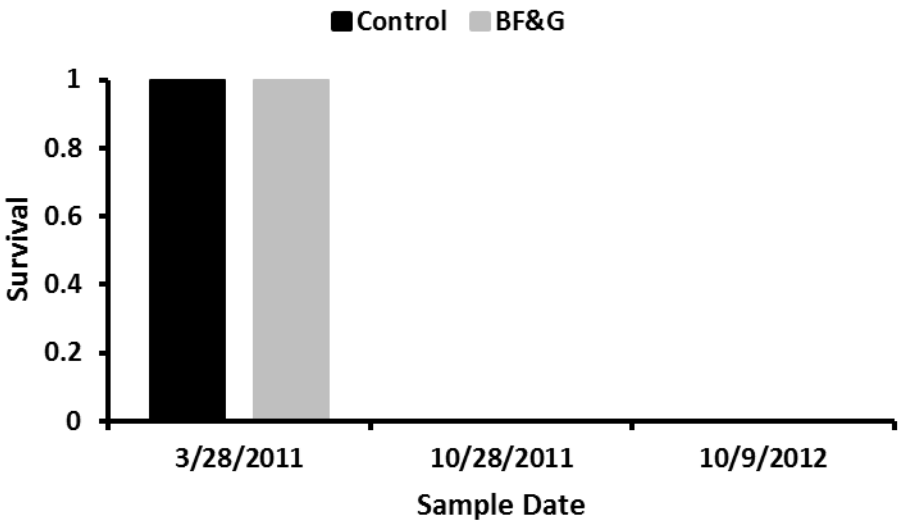

Figure 41. Mean (±SE) Survival of Toothache tree planted on 28 March 2011 exposed to two soil treatments. There were no survivors post planting.

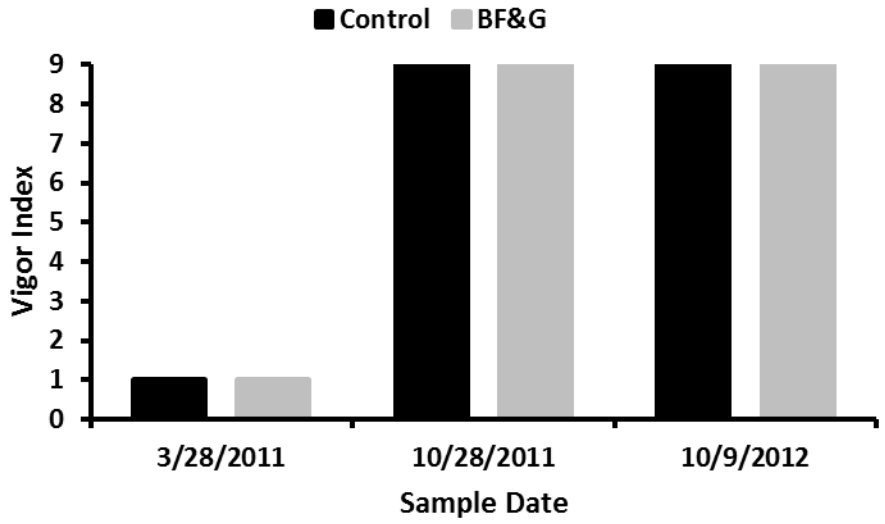

Figure 42. Mean (±SE) Vigor of Toothache tree planted on 28 March 2011 exposed to two soil treatments. There were no survivors post planting.

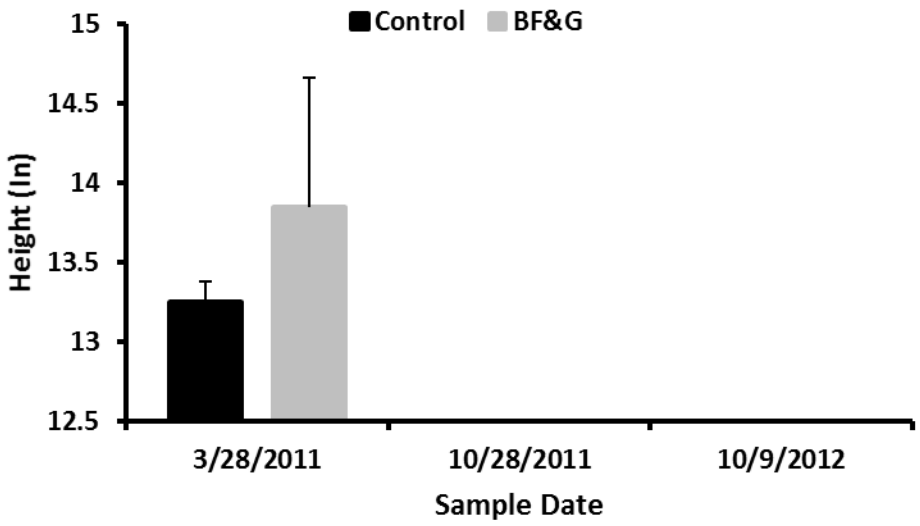

Figure 43. Mean (±SE) Height of Toothache tree planted on 28 March 2011 exposed to two soil treatments. There were no survivors post planting.

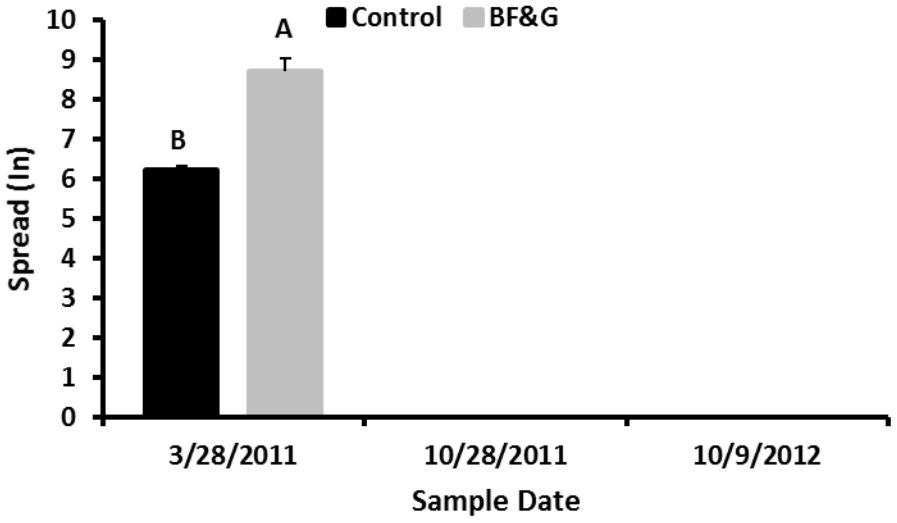

Figure 44. Mean (±SE) Spread of Toothache tree planted on 28 March 2011 exposed to two soil treatments. The plants exposed to the BF&G treatments had a greater spread than those exposed to the control. There were no survivors post planting.

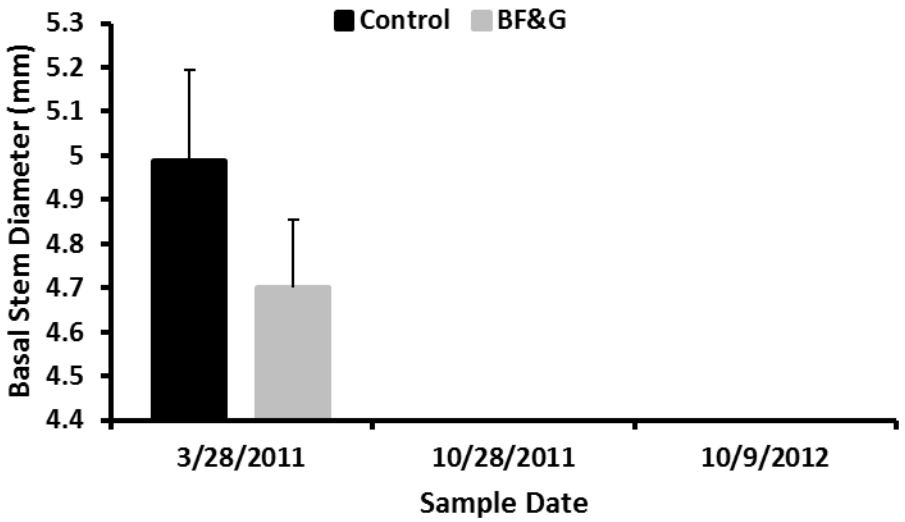

Figure 45. Mean (±SE) Basal Stem Diameter of Toothache tree planted on 28 March 2011 exposed to two soil treatments. There were no survivors post planting.

Hackberry – 2012 Planting

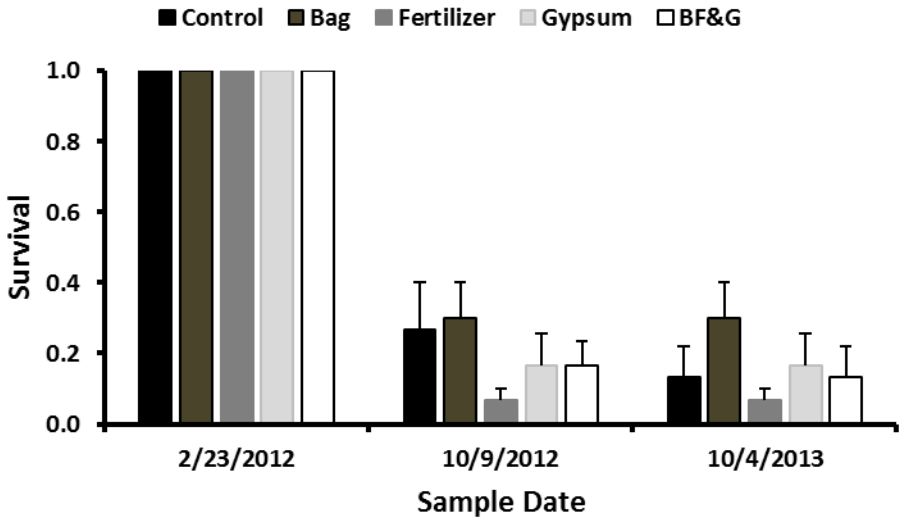

Figure 46. Mean (±SE) Survival of Hackberry planted on 23 February 2012 exposed to five soil treatments. Survival was similar among all treatments for all dates.

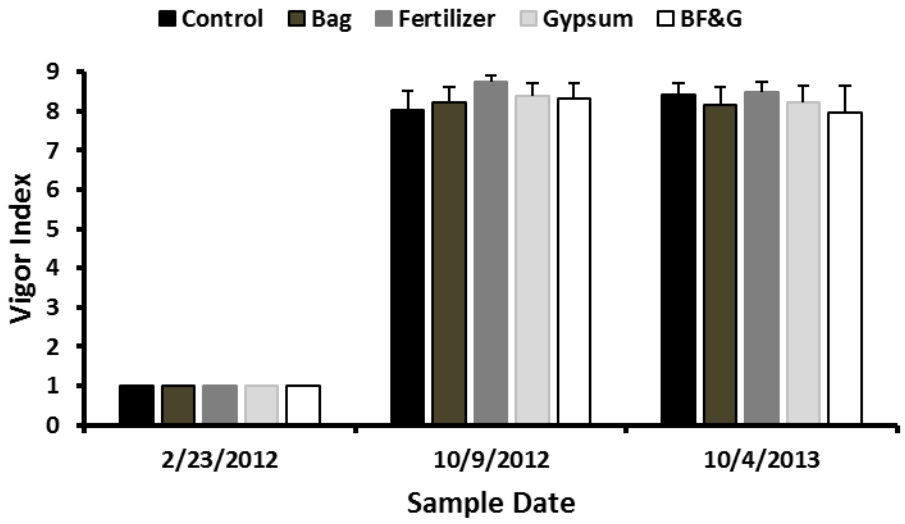

Figure 47. Mean (±SE) Vigor of Hackberry planted on 23 February 2012 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

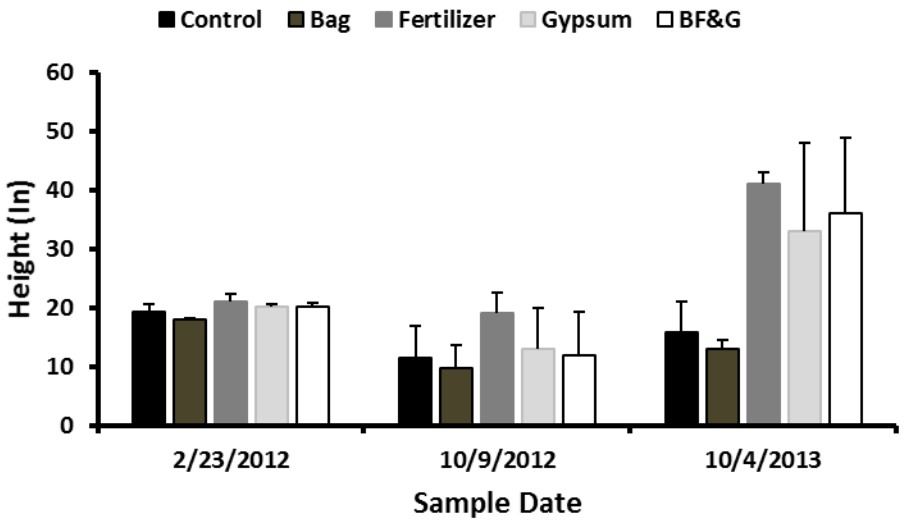

Figure 48. Mean (±SE) Height of Hackberry planted on 23 February 2012 exposed to five soil treatments. Height was similar among all treatments for all dates.

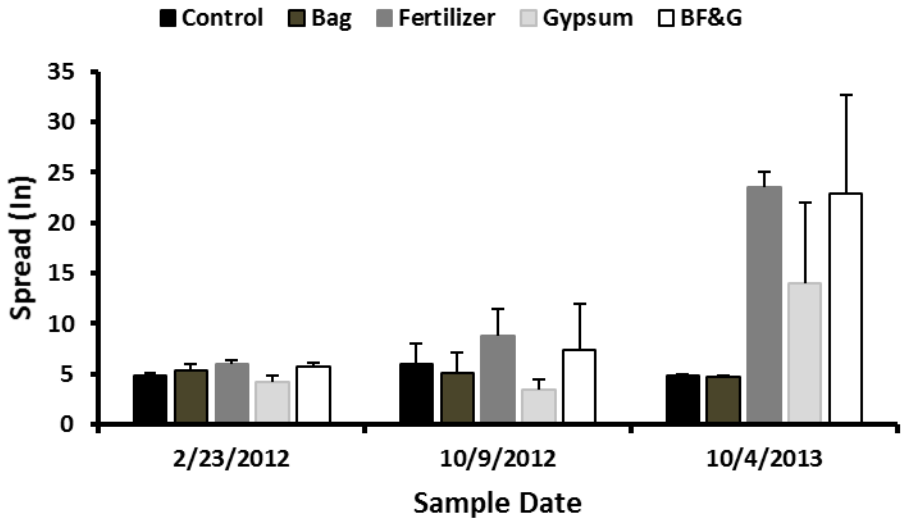

Figure 49. Mean (±SE) Spread of Hackberry planted on 23 February 2012 exposed to five soil treatments. Spread was similar among all treatments for all dates.

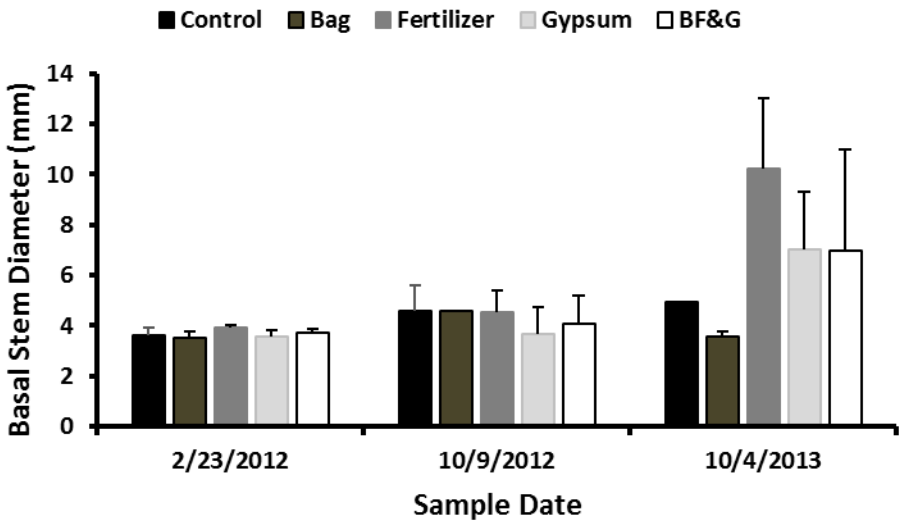

Figure 50. Mean (±SE) Basal Stem Diameter of Hackberry planted on 23 February 2012 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

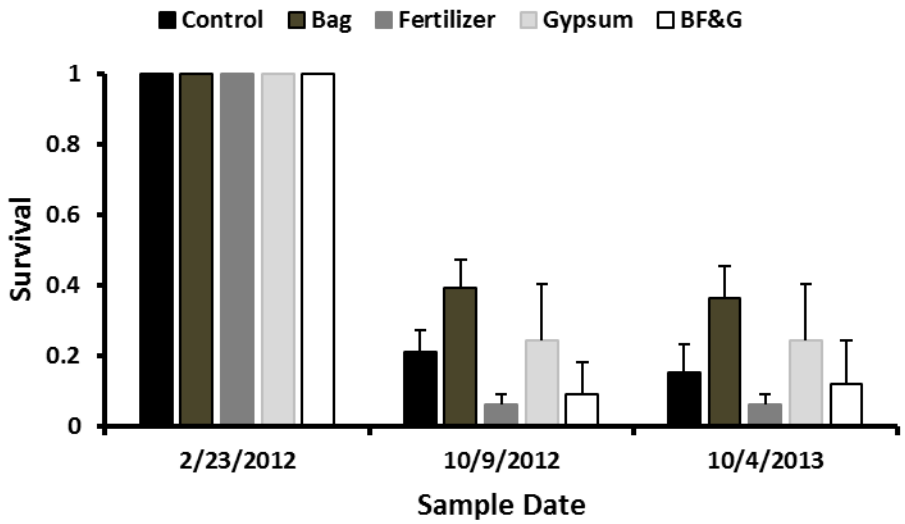

Figure 51. Mean (±SE) Survival of Live Oak planted on 23 February 2012 exposed to five soil treatments. Survival was similar among all treatments for all dates.

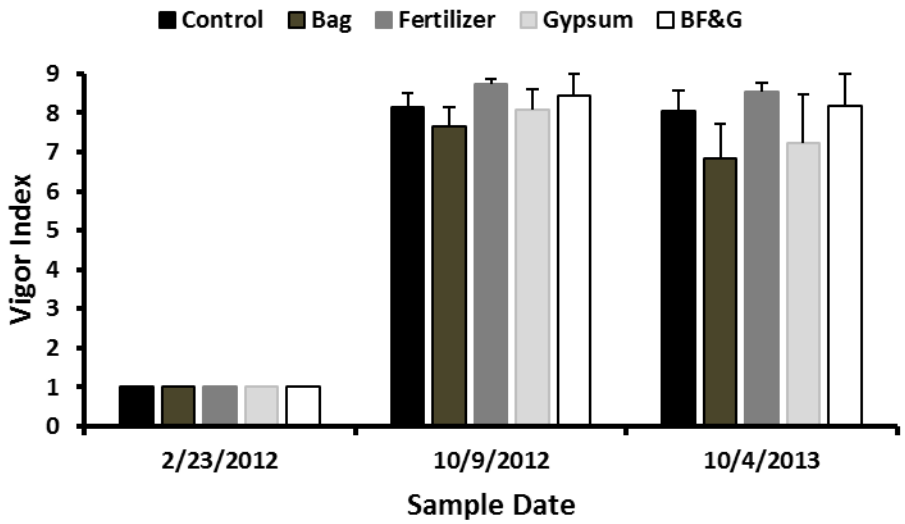

Figure 52. Mean (±SE) Vigor of Live Oak planted on 23 February 2012 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

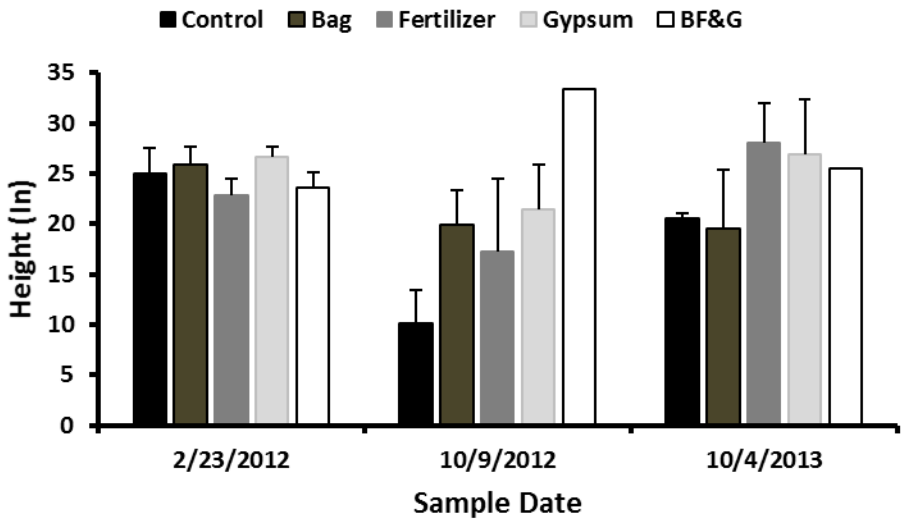

Figure 53. Mean (±SE) Height of Live Oak planted on 23 February 2012 exposed to five soil treatments. Height was similar among all treatments for all dates.

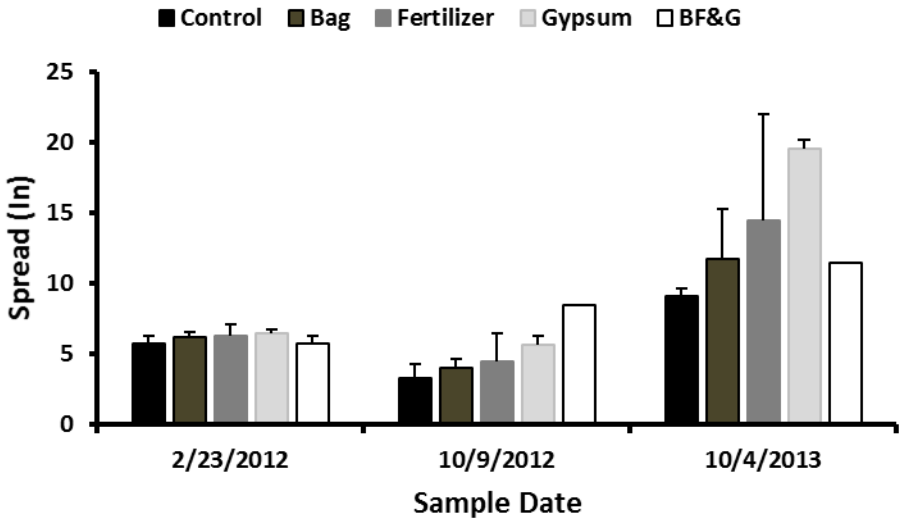

Figure 54. Mean (±SE) Spread of Live Oak planted on 23 February 2012 exposed to five soil treatments. Spread was similar among all treatments for all dates.

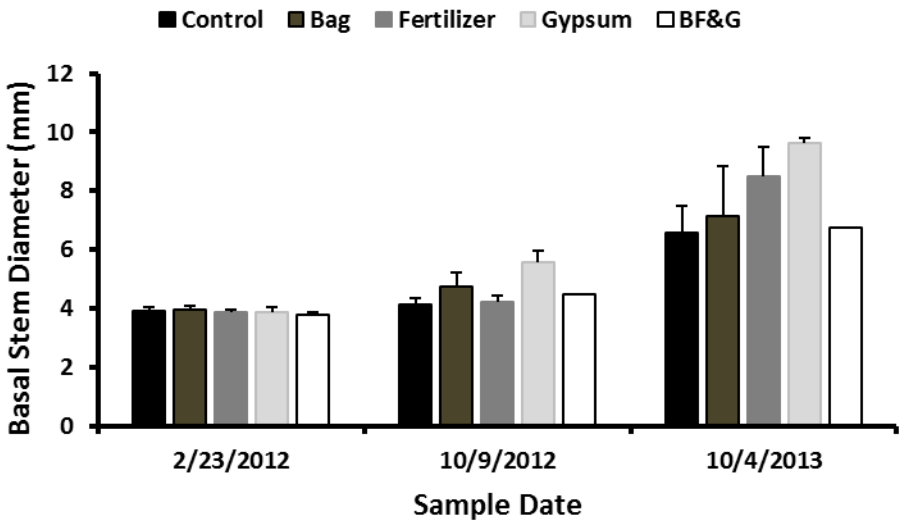

Figure 55. Mean (±SE) Basal Stem Diameter of Live Oak planted on 23 February 2012 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

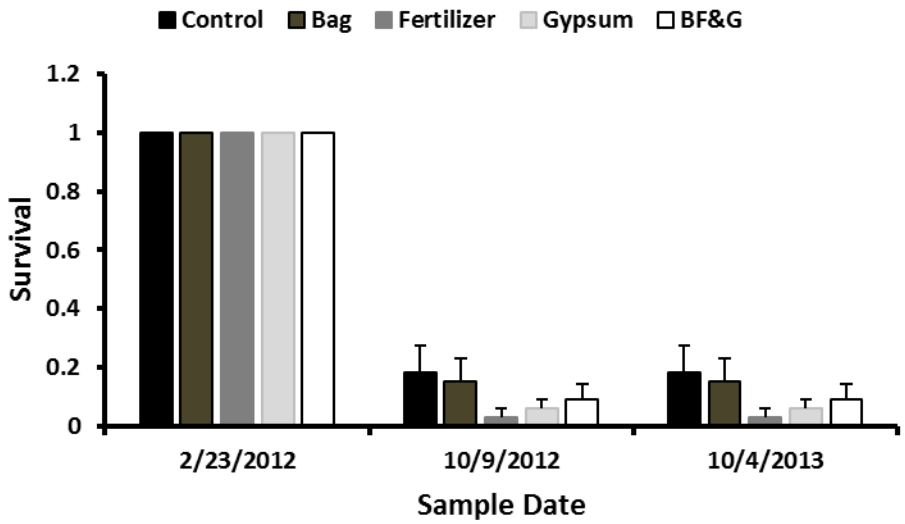

Figure 56. Mean (±SE) Survival of Sand Oak planted on 23 February 2012 exposed to five soil treatments. Survival was similar among all treatments for all dates.

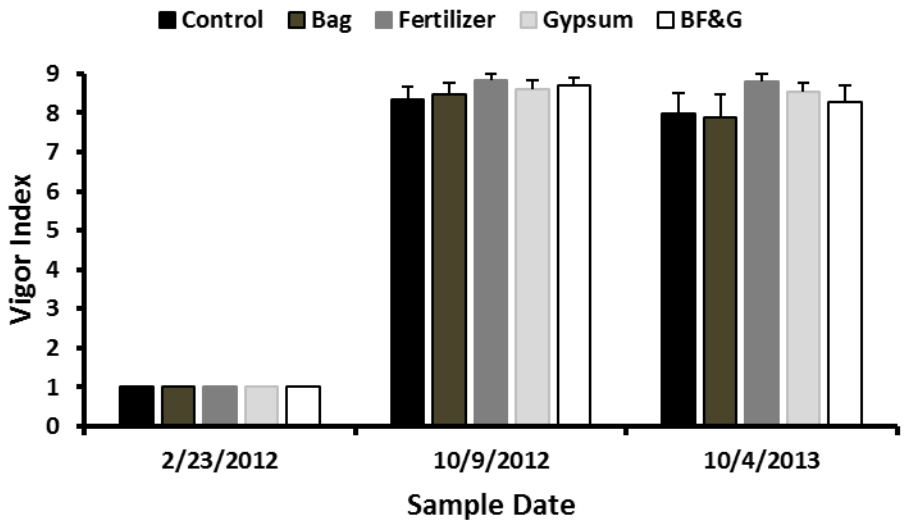

Figure 57. Mean (±SE) Vigor of Sand Oak planted on 23 February 2012 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

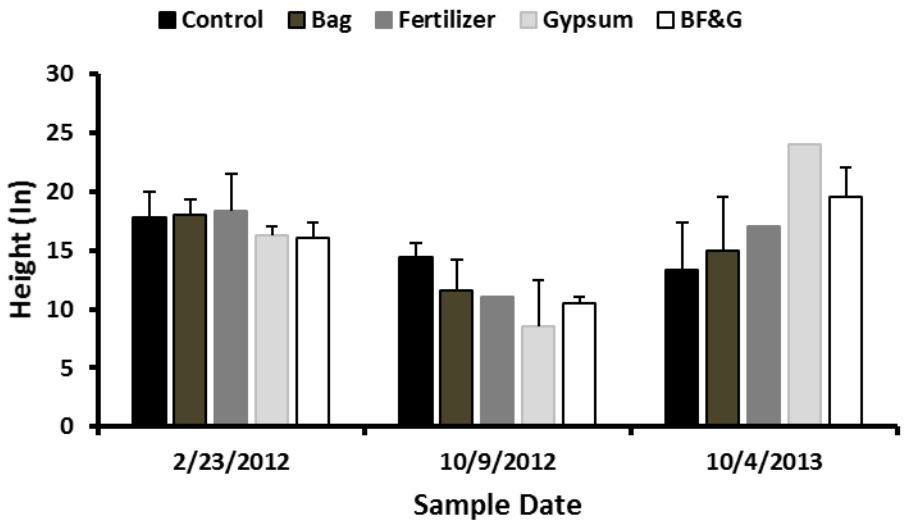

Figure 58. Mean (±SE) Height of Sand Oak planted on 23 February 2012 exposed to five soil treatments. Height was similar among all treatments for all dates.

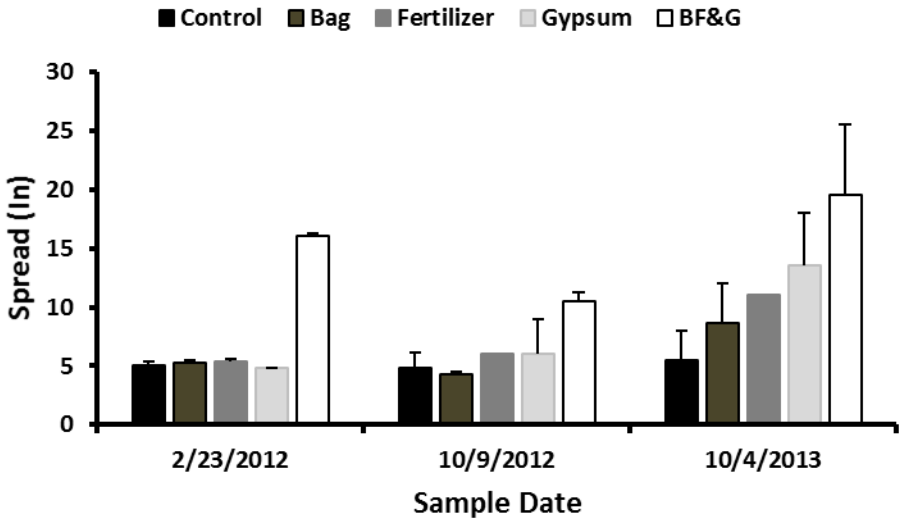

Figure 59. Mean (±SE) Spread of Sand Oak planted on 23 February 2012 exposed to five soil treatments. Spread was similar among all treatments for all dates.

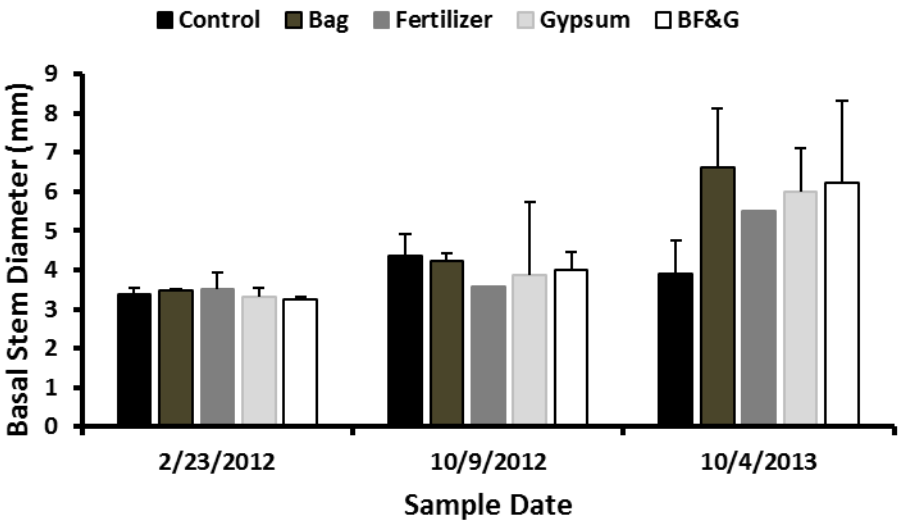

Figure 60. Mean (±SE) Basal Stem Diameter of Sand Oak planted on 23 February 2012 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

Hackberry – 2013 Planting

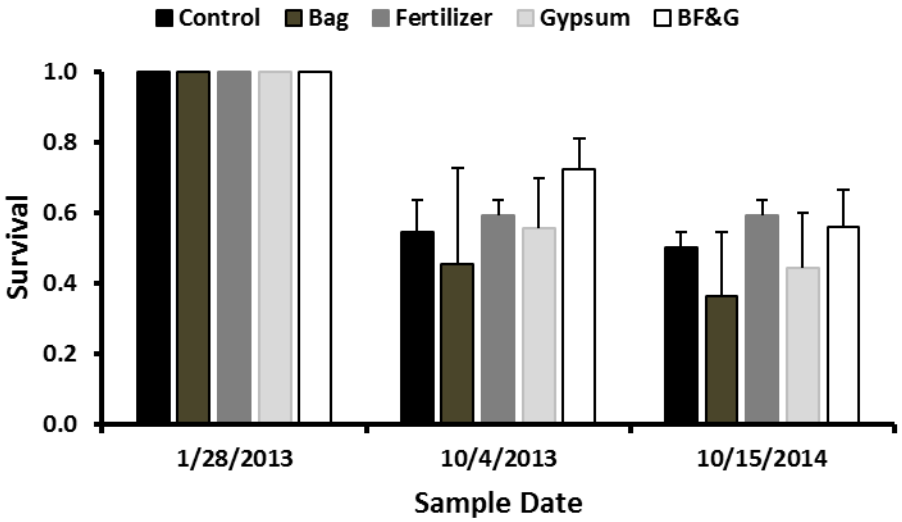

Figure 61. Mean (±SE) Survival of Hackberry planted on 28 January 2013 exposed to five soil treatments. Survival was similar among all treatments for all dates.

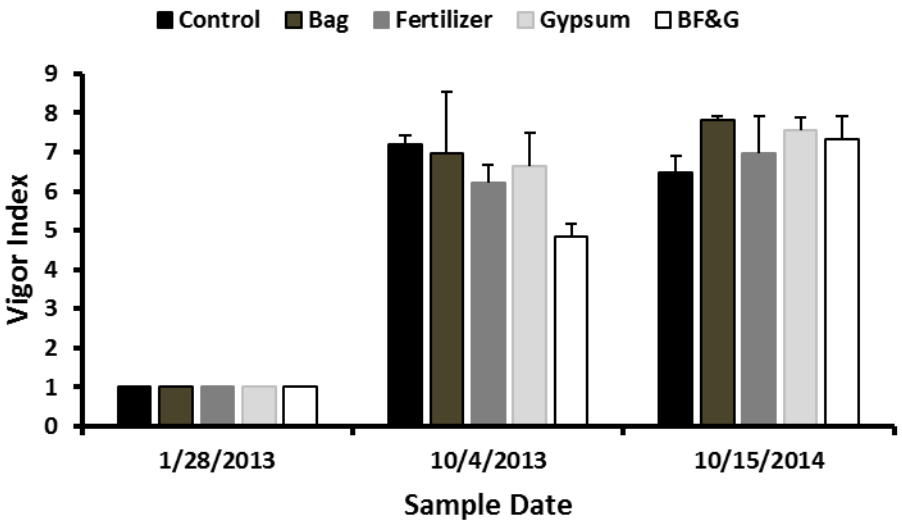

Figure 62. Mean (±SE) Vigor of Hackberry planted on 28 January 2013 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

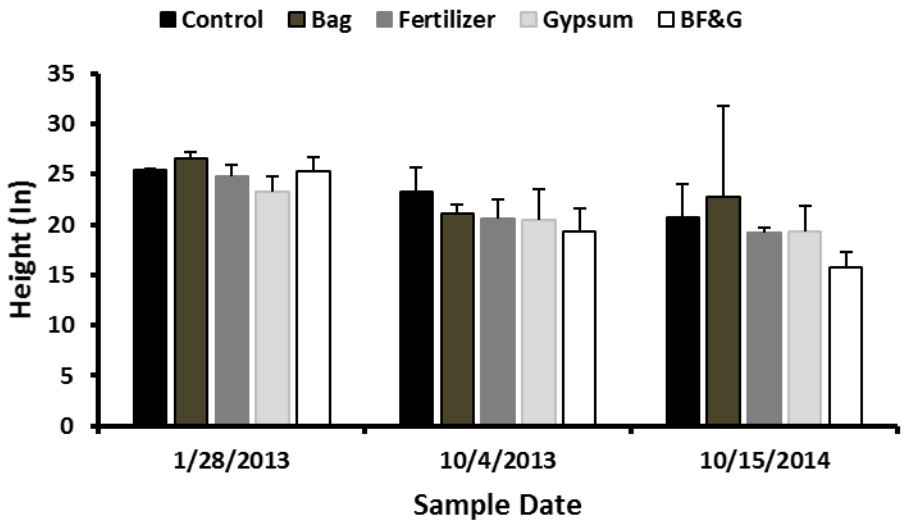

Figure 63. Mean (±SE) Height of Hackberry planted on 28 January 2013 exposed to five soil treatments. Height was similar among all treatments for all dates.

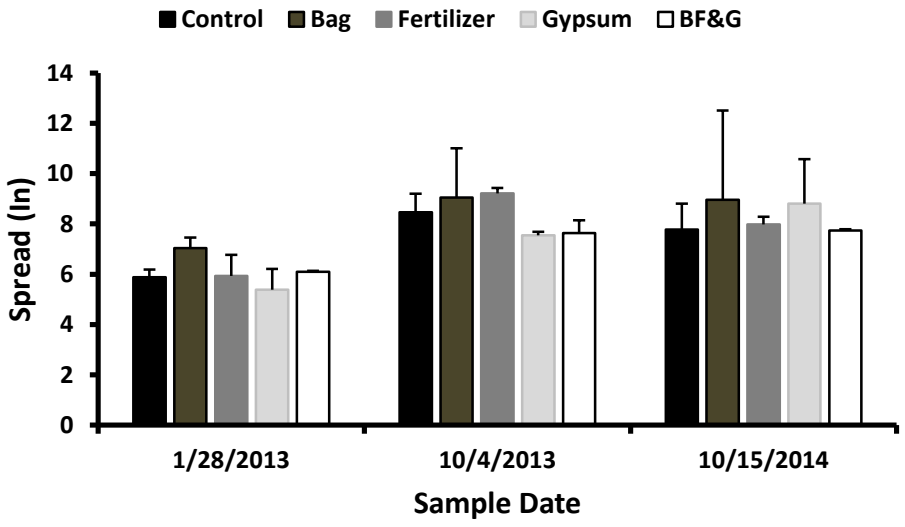

Figure 64. Mean (±SE) Spread of Hackberry planted on 28 January 2013 exposed to five soil treatments. Spread was similar among all treatments for all dates.

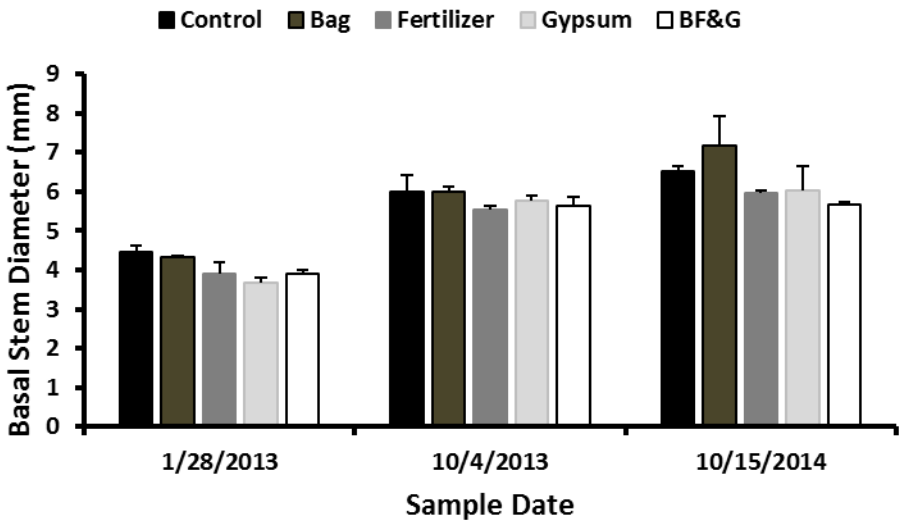

Figure 65. Mean (±SE) Basal Stem Diameter of Hackberry planted on 28 January 2013 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

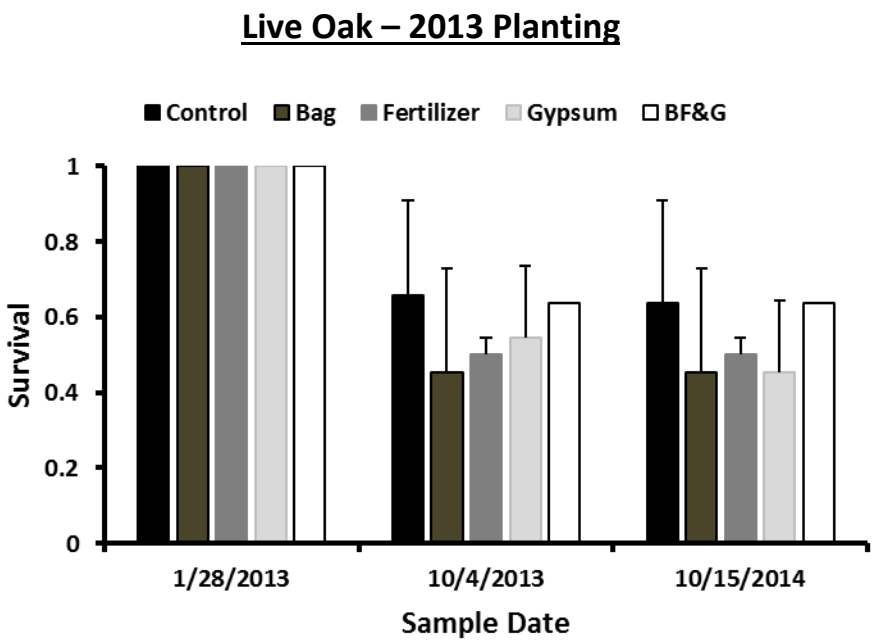

Figure 66. Mean (±SE) Survival of Live Oak planted on 28 January 2013 exposed to five soil treatments. Survival was similar among all treatments for all dates.

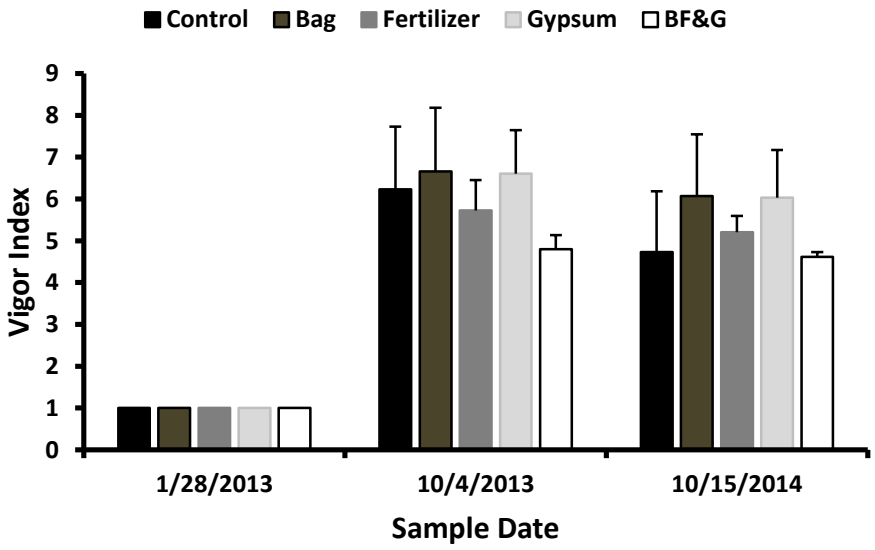

Figure 67. Mean (±SE) Vigor of Live Oak planted on 28 January 2013 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

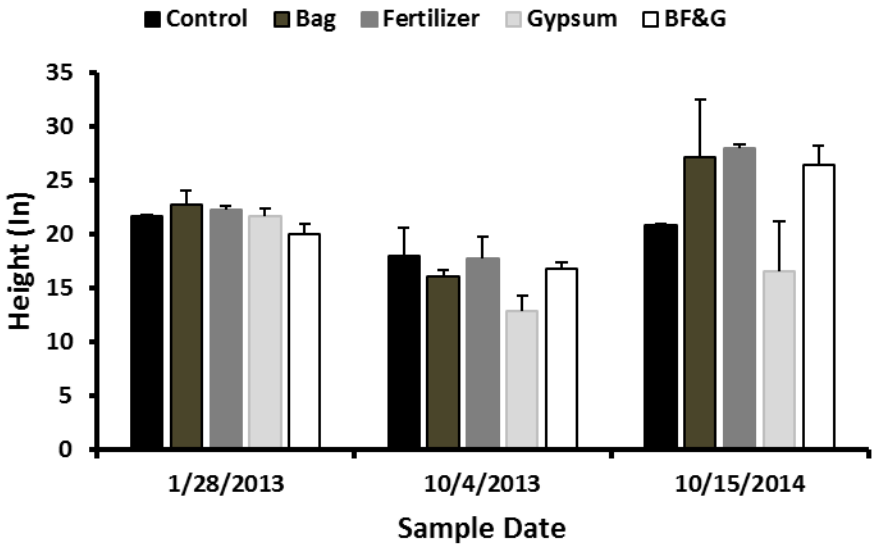

Figure 68. Mean (±SE) Height of Live Oak planted on 28 January 2013 exposed to five soil treatments. Height was similar among all treatments for all dates.

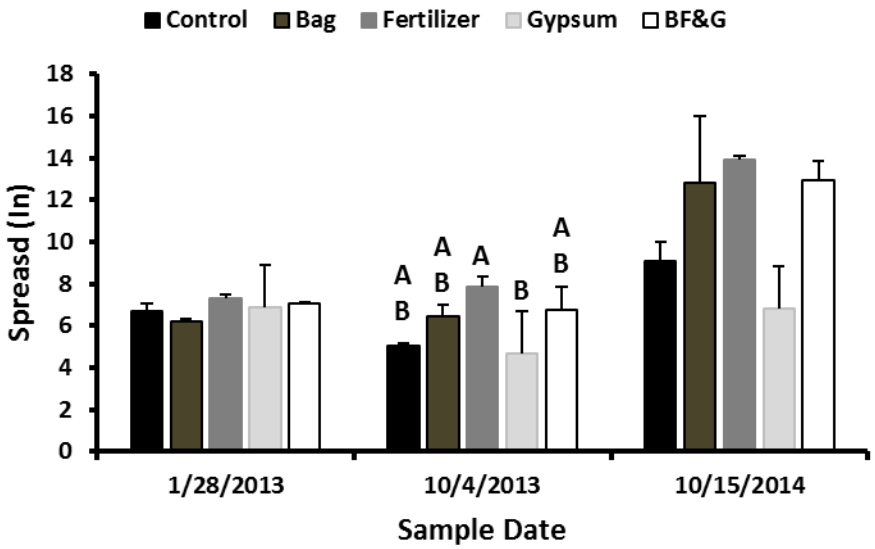

Figure 69. Mean (±SE) Spread of Live Oak planted on 28 January 2013 exposed to five soil treatments. Spread varied among treatments on 4 October 2013 but was similar among all treatments on 15 October 2014.

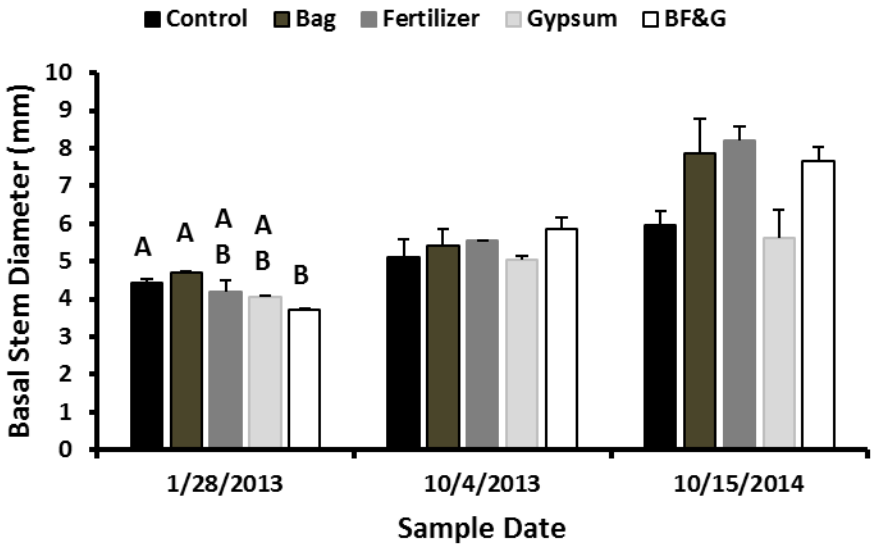

Figure 70. Mean (±SE) Basal Stem Diameter of Live Oak planted on 28 January 2013 exposed to five soil treatments. Although Basal Stem diameter varied among treatments when planted, Basal Stem Diameter was similar among all treatments on both subsequent sample dates. Means with a similar letter are not different.

Sand Oak – 2013 Planting

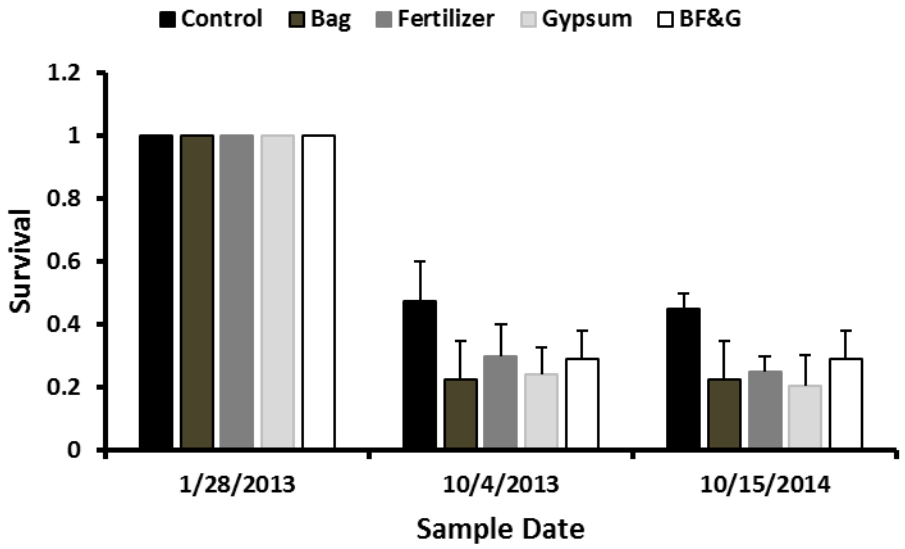

Figure 71. Mean (±SE) Survival of Sand Oak planted on 28 January 2013 exposed to five soil treatments. Survival was similar among all treatments for all dates.

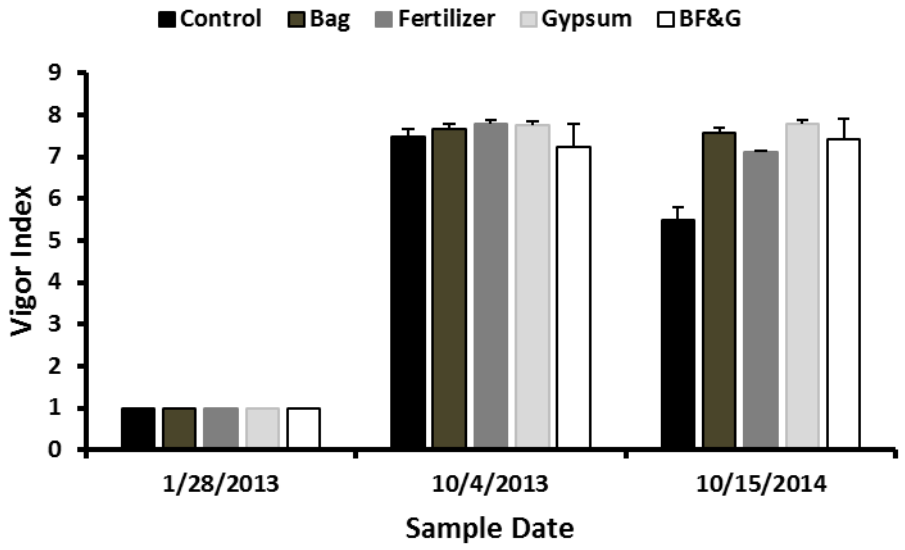

Figure 72. Mean (±SE) Vigor of Sand Oak planted on 28 January 2013 exposed to five soil treatments. Vigor was similar among all treatments for all dates.

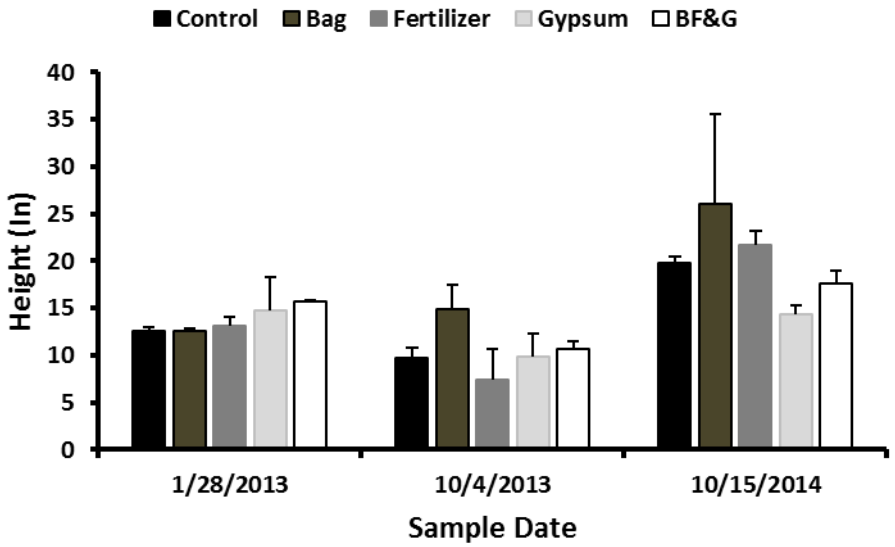

Figure 73. Mean (±SE) Height of Sand Oak planted on 28 January 2013 exposed to five soil treatments. Height was similar among all treatments for all dates.

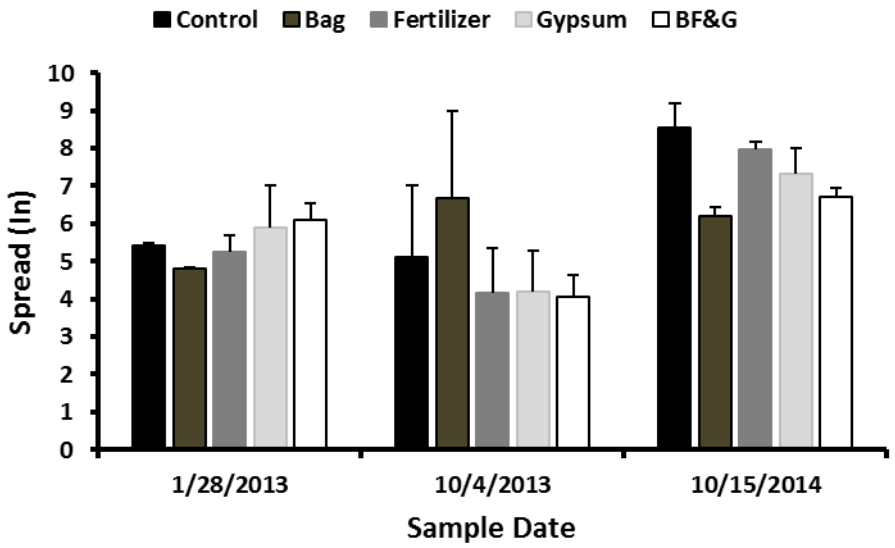

Figure 74. Mean (±SE) Spread of Sand Oak planted on 28 January 2013 exposed to five soil treatments. Height was similar among all treatments for all dates.

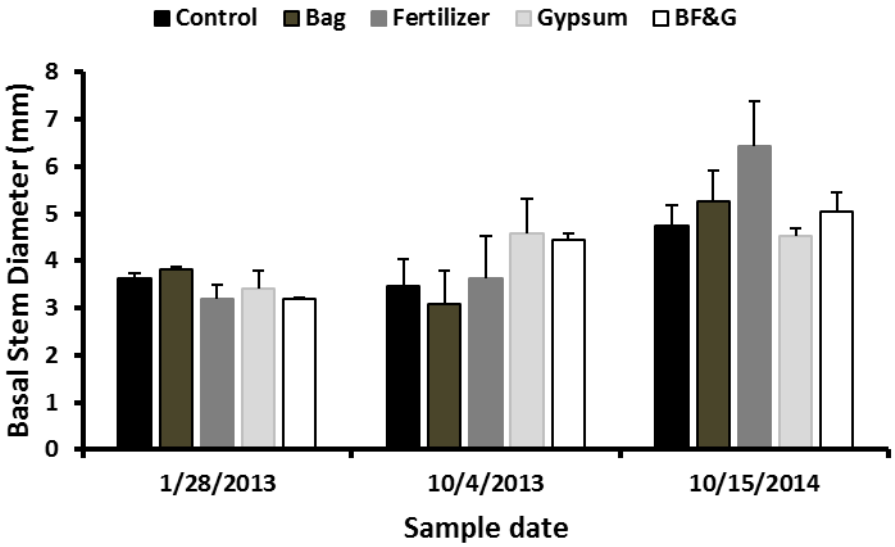

Figure 75. Mean (±SE) Basal Stem Diameter of Sand Oak planted on 28 January 2013 exposed to five soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

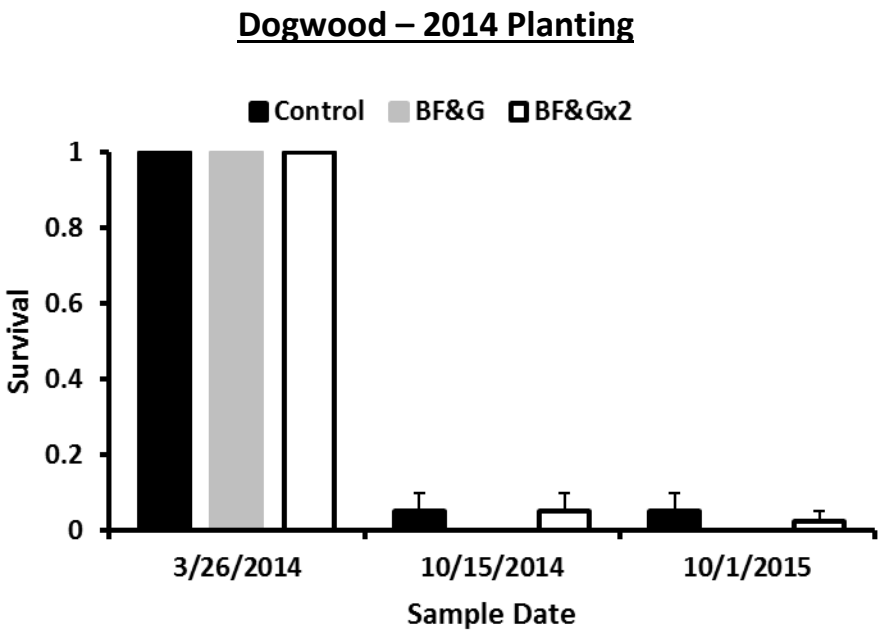

Figure 76. Mean (±SE) Survival of Dogwood planted on 26 March 2014 exposed to three soil treatments. There were no survivors in the BF&G treatment and the number of survivors did not differ between the Control and the BF&Gx2 treatments after planting.

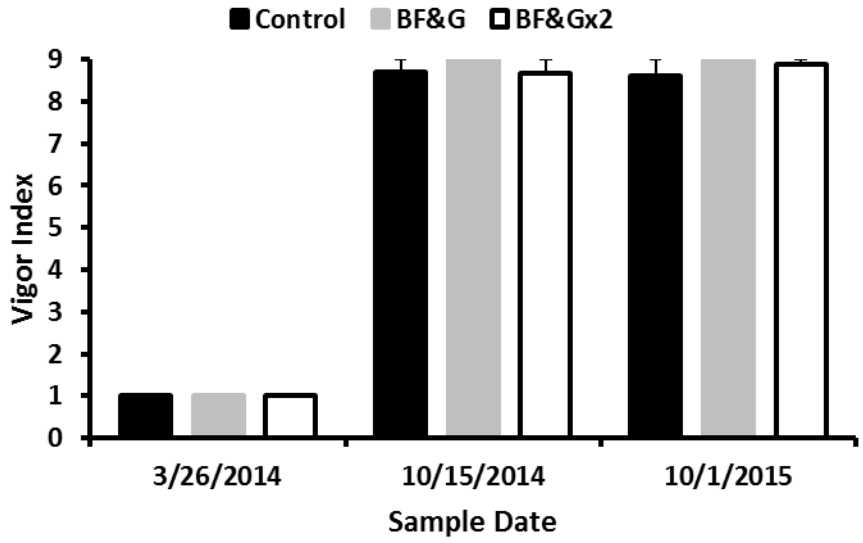

Figure 77. Mean (±SE) Vigor of Dogwood planted on 26 March 2014 exposed to three soil treatments. There were no survivors in the BF&G treatment and vigor did not differ between the Control and the BF&Gx2 treatments after planting.

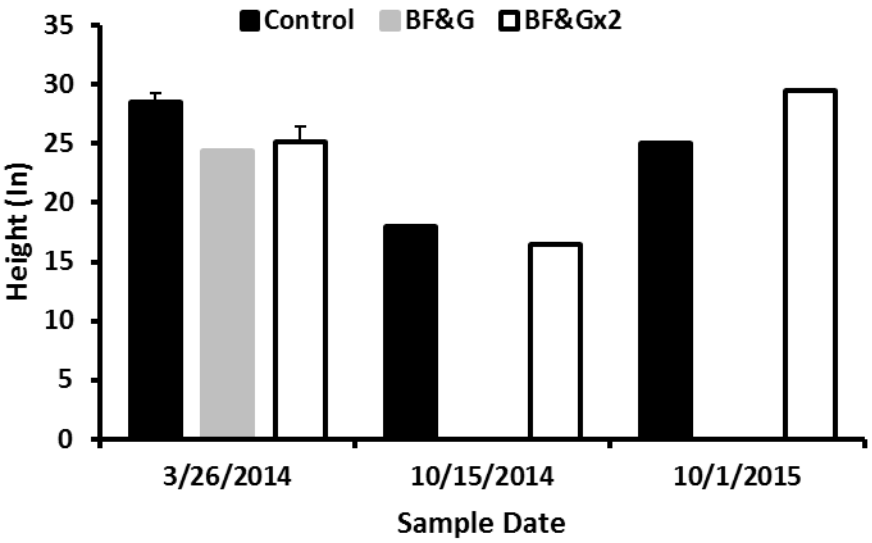

Figure 78. Mean (±SE) Height of Dogwood planted on 26 March 2014 exposed to three soil treatments. Height did not differ among treatments.

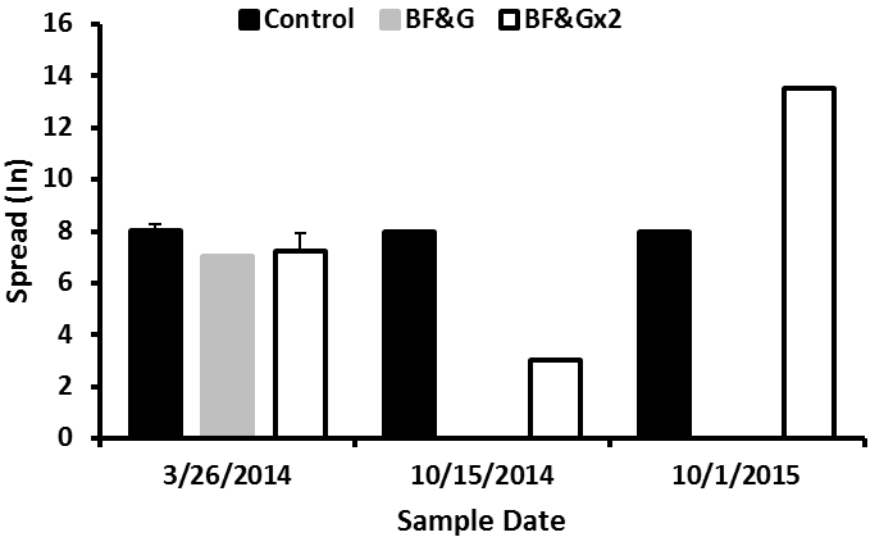

Figure 79. Mean (±SE) Spread of Dogwood planted on 26 March 2014 exposed to three soil treatments. Height did not differ among treatments.

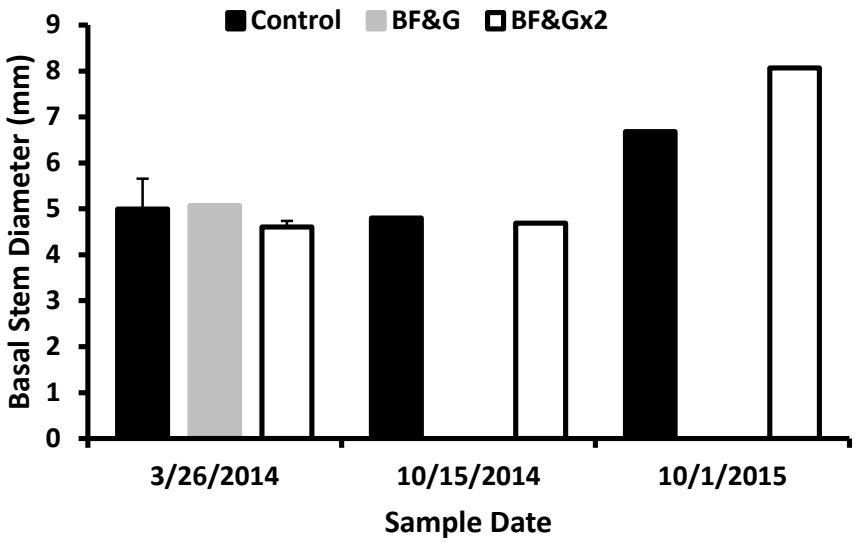

Figure 80. Mean (±SE) Basal Stem Diameter of Dogwood planted on 26 March 2014 exposed to three soil treatments. Basal Stem Diameter did not differ among treatments.

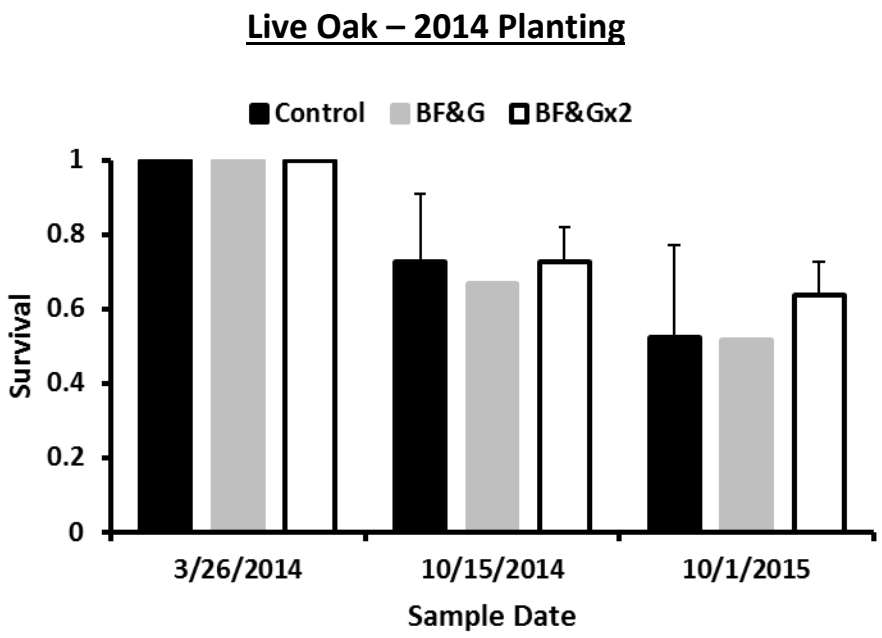

Figure 81. Mean (±SE) Survival of Live Oak planted on 26 March 2014 exposed to three soil treatments. Survival was similar among all treatments for all dates.

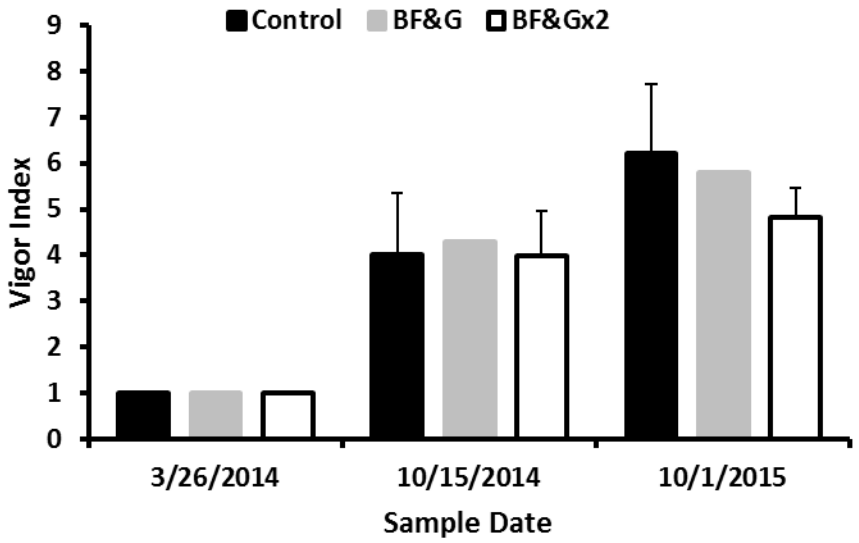

Figure 82. Mean (±SE) Vigor of Live Oak planted on 26 March 2014 exposed to three soil treatments. Vigor was similar among all treatments for all dates.

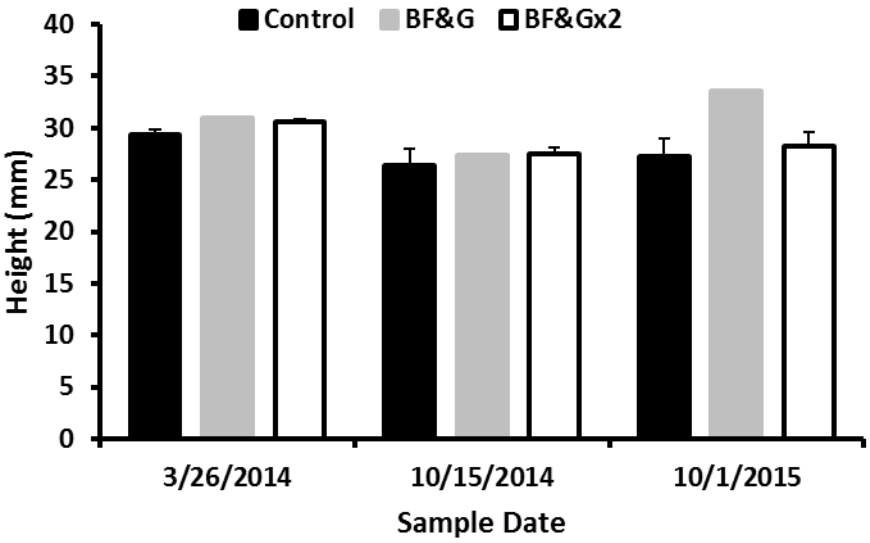

Figure 83. Mean (±SE) Height of Live Oak planted on 26 March 2014 exposed to three soil treatments. Height was similar among all treatments for all dates.

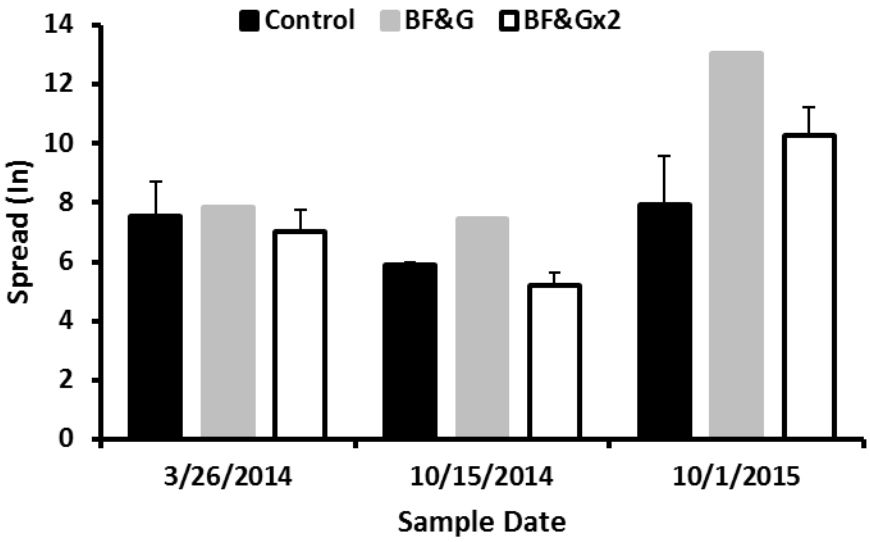

Figure 84. Mean (±SE) Spread of Live Oak planted on 26 March 2014 exposed to three soil treatments. Spread was similar among all treatments for all dates.

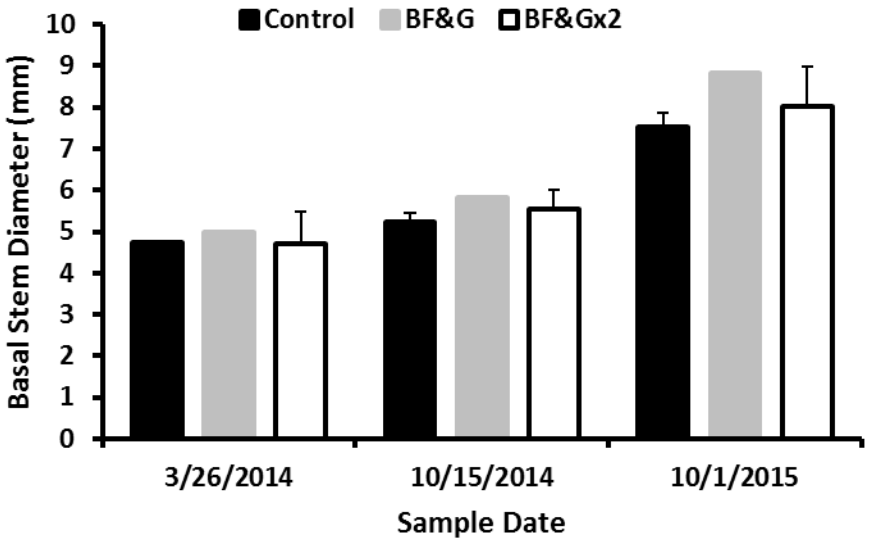

Figure 85. Mean (±SE) Basal Stem Diameter of Live Oak planted on 26 March 2014 exposed to three soil treatments. Basal Stem Diameter was similar among all treatments for all dates.

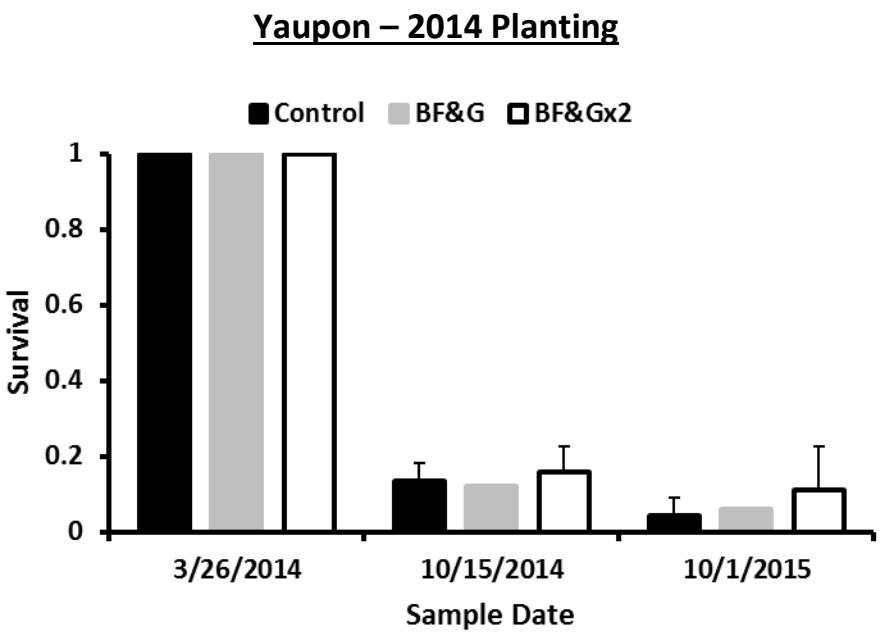

Figure 86. Mean (±SE) Survival of Yaupon planted on 26 March 2014 exposed to three soil treatments. Survival was similar among all treatments for all dates.

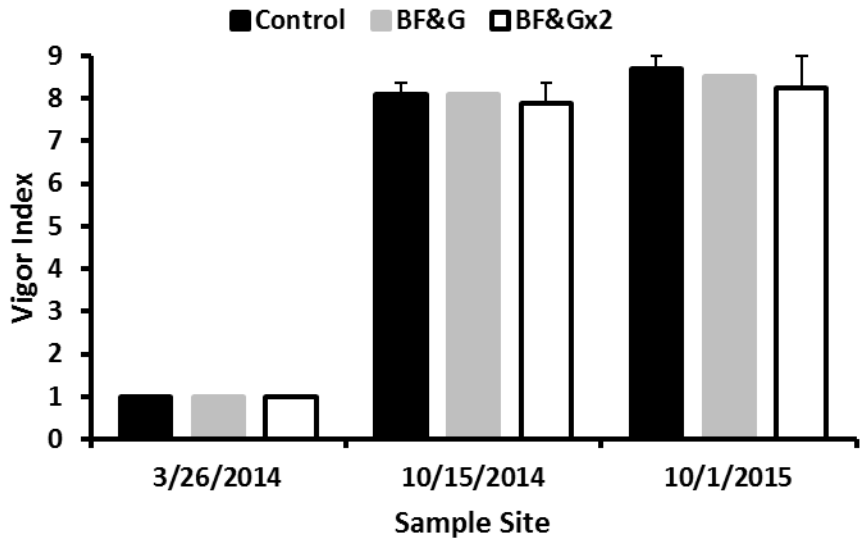

Figure 87. Mean (±SE) Vigor of Yaupon planted on 26 March 2014 exposed to three soil treatments. Vigor was similar among all treatments for all dates.

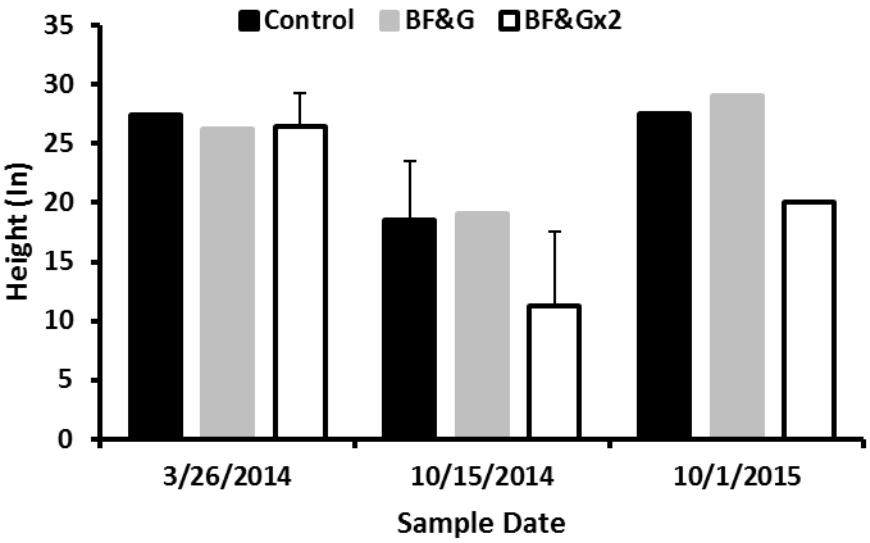

Figure 88. Mean (±SE) Height of Yaupon planted on 26 March 2014 exposed to three soil treatments. Height was similar among all treatments for all dates.

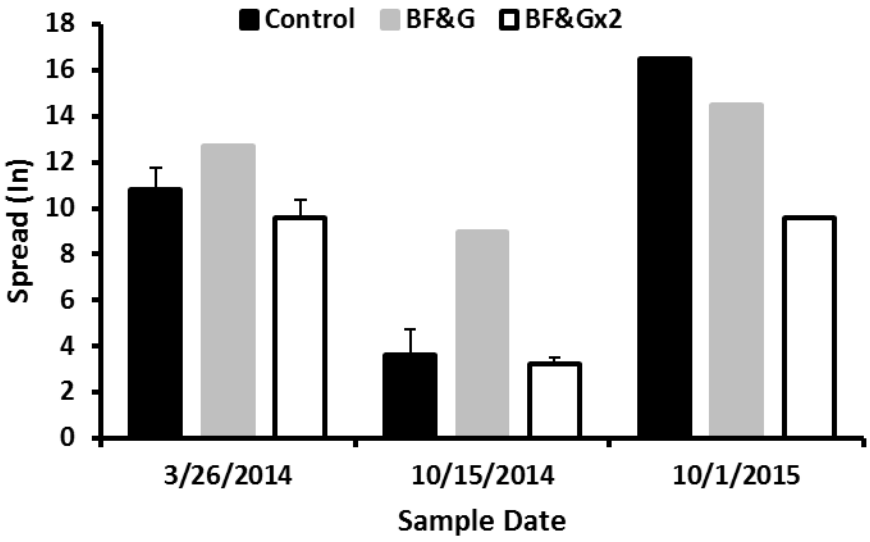

Figure 89. Mean (±SE) Spread of Yaupon planted on 26 March 2014 exposed to three soil treatments. Spread was similar among all treatments for all dates.

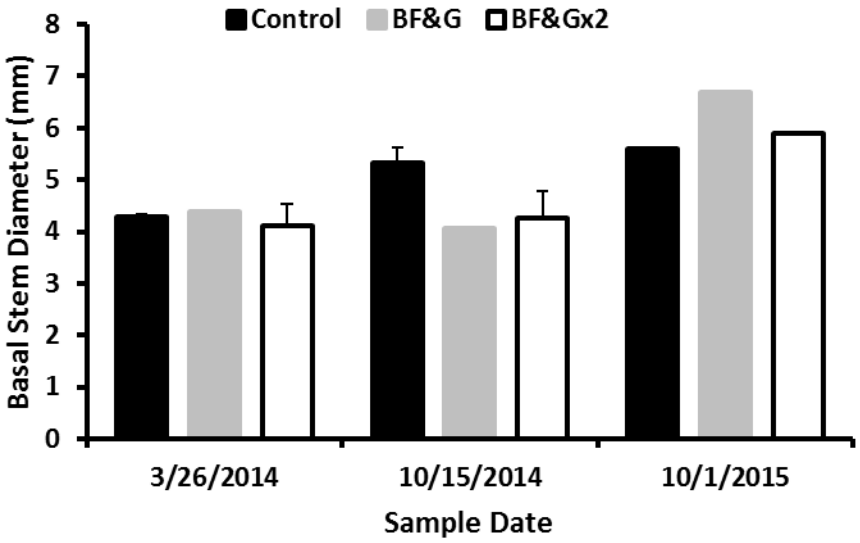

Figure 90. Mean (±SE) Basal Stem Diameter of Yaupon planted on 26 March 2014 exposed to three soil treatments. Basal Stem Diametert was similar among all treatments for all dates.