UF IFAS Extension UNIVERSITY of FLORIDA

SS-AGR-125

Use of Perennial Grasses in Peanut/Cotton Rotations: Effect on Pests[1]

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While there is no such thing as a silver bullet that solves all the problems in cropping systems, the sod-based peanut/cotton cropping system does solve several farming-related problems. In several articles on adopting the sod-based peanut/cotton cropping systems, we showed beneficial effects on soil health and economics. In this publication we discuss the effect of perennial grasses on peanut and cotton nematode, disease, and weed problems.

Nematodes

Nematodes cause plant damage estimated at about $8 billion every year across the United States. Although not always visible to farmers and subsequently often overlooked, crop losses due to nematodes can exceed 80% on some fields. Nematode damage is more pronounced in Florida because of the sandy soils. Nematode damage also varies with crop, nematode species, and environmental conditions. Most farmers use nematicides or fumigants to control nematodes where high levels are expected. This practice is expensive, and there are options that are better for the environment. Many nematicides and fumigants such as 1,2-dibromo-3-chloropropane (DBCP) and ethylene bromide are now banned, and fenamiphos and methyl bromide are no longer available to farmers. A new nematicide has come on the market the past few years, Velum Total, which is effective as a nematicide, fungicide, and insecticide as it contains active ingredients for control of multiple pests. In studies comparing rotation with nematicides with and without irrigation, rotation gave highest yield increases of about 1000 lbs/ac on peanut while irrigation resulted in 400 lbs/ac increase with a 200 lb/ac increase from use of Velum Total. Rotation is still one of the big factors in maintaining high yields.

Over 40% of fields in Florida were affected by nematodes of the *Meloidogyne* genus (root knot) in 2012. Likewise, Temik has been removed from the market but the same active ingredient is back on the market, which was the main nematicide used for cotton/peanut. With few commercial peanut and cotton varieties resistant to root-knot and the limited availability of nematicides, coupled with the high costs, perennial grasses, including bahiagrass and bermudagrass in rotations, are an alternative control for nematodes. For over half a century, farmers in the southeastern United States have obtained good crop yields immediately following perennial grasses and less nematode damage on a number of crops. This is because the perennial grasses, including bahiagrass, are non-hosts to most nematodes that impact row crops. Bahiagrass and bermudagrass reduces infestations from nematodes of the *Meloidogyne* genus. In

1. This document is SS-AGR-125, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date July 2006. Revised September 2013, November 2015, and November 2018. Visit the EDIS website at http://edis.ifas.ufl.edu.

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addition, both bahiagrass and coastal bermudagrass can reduce southern blight caused by the fungus *Sclerotium rolfsii* in both peanut and cotton. The most damaging pathogen, *Sclerotium rolfsii*, also augments infestation from *M. arenaria*.

The two major nematodes affecting cotton in Florida are *M. incognita* (root knot) and *Rotylenchulus reniformis* (reniform). Over 50% of cotton fields in some regions of Florida are infested by nematodes. Nematodes of the *Meloidogyne* genus that affect cotton also interact with other pathogens and augment yield losses. Bahiagrass is a non-host to both the *Meloidogyne* genus and the *Rotylenchulus* genus.

When included in the peanut/cotton rotation, bahiagrass reduces nematode infestation by spacing out the time before the susceptible crops are grown. This allows nematode levels to decline to levels that will not cause economic damage when the host crop is planted. Use of crop rotations as a nematode control method is more practical in field crops than in high-value horticultural crops because field crops are of lower value and less money can be spent on control measures.

Peanut Diseases

Huge increases in yield have been reported when peanut and cotton are planted after perennial grass as compared to the conventional peanut/cotton rotations. Our studies have shown peanut yields to be consistently higher in the sod rotation (1000 lbs/acre) compared to the conventional rotations (Table 1). Previously, in many southern states, including Florida, Georgia, Alabama, the Carolinas, and Mississippi, peanut yield increases in sod rotations were the result of reduced nematodes and diseases following the non-host perennial crop. However, we now consider improvements in soil conditions and a doubling of root mass a contributing factor for the high yields. Averaged over two years, our results showed lower tomato spotted wilt virus (TSWV) (10.2%) incidence for the bahiagrass-rotated peanuts compared to the conventional peanut/cotton (21.7%) rotation using conservation tillage (Figure 1). Similarly, bahiagrass reduced Cercospora leaf spot severity. We have also observed lower incidences of the fungus *Sclerotium rolfsii* for peanuts in the sod-based rotation compared to the peanut/cotton rotation. Fungicide applications can be started 10-14 days later saving one or more fungicide applications. Likewise, we had 8000 lb/ac peanut yields in 2014 and in 2017 strip-tilled into killed-bahiagrass, which is more than double state average yields.

Table 1. Peanut yield in strip-tilled peanuts for two crop rotations in Florida during 2017.

Rotation	2017
	lbs/acre
Bahiagrass-Bahiagrass-Peanut-Cotton	6186
Peanut-Cotton-Cotton	5160

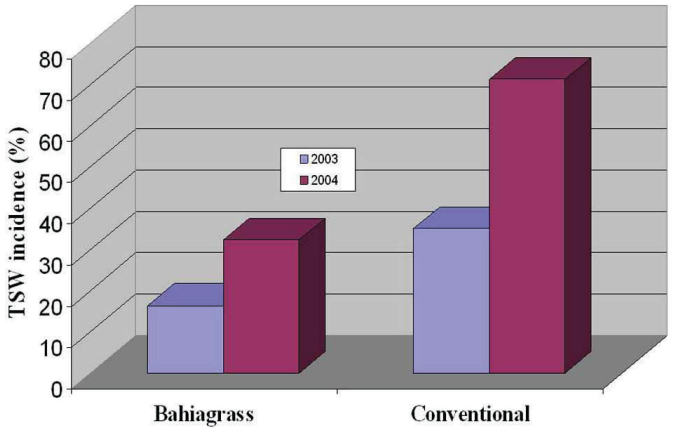

Figure 1. Incidence of TSWV on peanut under bahiagrass and conventional rotations in Quincy, FL, during 2003 and 2004.

Weeds reduce plant growth and yield by competing with crops for essential resources such as moisture, nutrients, and light. Weeds also make harvesting more difficult and can stain the cotton lint during harvest, thus reducing both yield and quality. Complex multi-crop rotations are considered superior over simple rotations from a weed control perspective. Better weed control can be achieved with diverse rotations because a broader spectrum of herbicides can be used compared to simpler rotations. Including perennial grasses in rotations provides for longer periods between crops, which can effectively break the lifecycles of weeds that are adapted to certain crops or even weeds that are adapted to certain rotations. Also, by spacing out crops, diverse rotations enable growers to rotate herbicides with different modes of action. This can delay and may prevent the development of herbicide-resistant weeds. Diverse rotations improve soil health and result in healthier plants that can outcompete weeds. Our studies from a long term study have shown fewer weeds and weed biomass for the sod-based peanut/cotton cropping system. We also observed rapid canopy development and early season weed suppression in cotton and peanuts after bahiagrass. Figure 2 contrasts weed densities for cotton in the traditional peanut/cotton rotation and cotton in the sod-based peanut/cotton rotation. Cotton in the sod rotation grew taller and had better weed suppression compared to cotton in the conventional rotation.

Figure 2. In the forefront are weed problems in the conventional cotton, and in the background are fewer weeds in the sod-rotated cotton.

Conclusion

A reduction in the number and amount of pesticides used in crop production is good from an environmental standpoint and can also help farmers realize more profit. The profit margin from both cotton and peanuts necessitates that all management practices that cause yield losses, including pest management, be controlled within economic constraints. Growing cotton in rotation with bahiagrass would be a cost-effective way to control pests. Complete details on the sod rotation, including the effect on soil health and economics, are available on our website http://nfrec.ifas.ufl.edu/programs/sod_rotation.shtml and in other publications on this website.

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