NPB 199

Annual Update Proj. Carries Fwd to 2007

PID 199
Bud ID 447
SID FL-40

Influence of Bahiagrass Kill Time and Tillage on Peanut Yield and Quality after Bahiagrass in Florida

(A Report of the Peanut Tillage Study in 2006)

David Wright, Jim Marois, and Duli Zhao

IFAS-North Florida Research and Education Center
University of Florida, Quincy, FL 32351

Introduction

Studies have shown that sod-based rotation of peanut (*Arachis hypogea* L.) and cotton (*Gossypium hirsutum* L.) in the Southeast US can significantly reduce disease pressure (Marois and Wright, 2003; Tsigbey et al., 2005; Wright et al., 2006), improve crop growth and development, and increase crop yield and profitability (Katsvairo et al., 2006) compared with conventional cropping systems. The value of bahiagrass (*Paspalum notatum*) in rotation with peanuts is clear in many field experiments. However, most growers have not see the system as being out of crop production for a year or more and the cost of breaking up the land to get it back to peanut production. With rising fuel prices as well as input cost, it has become more important to find ways of reducing costs and increasing profitability while increasing peanut yields. Studies suggest that there are considerable differences among tillage methods in input cost, soil impact or crop yields (Jordan et al., 2002). In order to make the sod-based crop rotation system more profitable by reducing energy input and tillage requirements, we conducted this research at three states of Florida, Alabama, and Georgia. The specific objectives of this study were to investigate effects of bahiagrass kill time and tillage practices on peanut yield, market grade, and net return and to test if fungicide application has different effects on peanut yield. In this report, we summarize the results of peanut yield responses to bahiagrass kill time, tillage, and fungicide application in 2006 at two locations (Marianna and Quincy) of the North Florida Research and Education Center.

Materials and Methods

Marianna location

The experiment included two levels of bahiagrass kill time (fall kill and spring kill) and six tillage treatments within each kill time. The dates of bahiagrass fall kill and spring kill were 26 October 2005 and 20 March 2006, respectively with 3 qts. of Rundup Weather Max per acre. The six tillage treatments were: (1) Strip till, (2) Disk+turned, (3) Dick+chisel, (4) Paratill+strip till at planting, (5) Disk+strip till, and (6) Strip till+40 lbs N acre^{-1}. A rate of 40 lbs N fertilizer of Ammonium N per ace was forecasted on April 15 for the strip tii+40 lbs N treated plots.

Peanut (cv. AP 3) was seeded on 15 May 2006 with a row space of 3 feet and six seeds per foot row. During the growing season, insects and diseases were controlled and irrigation was scheduled based on peanut production practices in the region. When crop reached maturity stage on 4 October 2006, the two middle rows in each plot were mechanically dogged and reversed and harvested on 9 October. Pod samples were placed a forced-air dryer at 45°C for 72 hours to ensure for a constant weight. Pod yield and market pod grade characteristics (i.e. percent extra large kernels, percent total sound mature kernels and percent fancy pods) were determined.

Quincy location

The experiment included two levels of bahiagrass kill time (fall kill and spring kill), six tillage treatments and two levels of fungicide applications (Fungicide or No fungicide). The fall kill date was 26 October 2005 with 3 qts. of Rundup Weather Max per acre and the spring kill was two times of applying Glyphomax Plus on 29 March and 10 April 2006 with the rate of 3 qts. acre^{-1} each time. The six tillage treatments were same as that in Marianna and they were: (1) Strip till, (2) Disk+turned, (3) Dick+chisel, (4) Paratill+strip till at planting, (5) Disk+strip till, and (6) Strip till+40 lbs N acre^{-1}. Seeds of peanut cultivar AP 3 were planted on 16 May 2006. Measurements of Soil mechanical resistance were taken in all plots using a CP20 Cone Penetrometer on 18 May, 5 June, 25 July, and 15 August. In contrast to the no any fungicide application treatment, the fungicide treated plots received three fungicides of Bravo Ultrex (1.0 lb/acre), Folicur 3.6 F (7.2 oz/acre), and Headline (12 oz/acre) with a 14-d interval starting from July 13 and ending on September 21. Except for the tillage and fungicide treatments, other field management practices, such as irrigation and herbicide and insecticide application, were scheduled based on peanut production practices in the region during the growing season. At maturity, the two middle rows in each plot were mechanically harvested. Pod samples were dried to determine yield and market pod grade characteristics using the similar methods described above.

The experiments were split (in Marianna) or split-split plot (in Quincy) design with four replications. The bahiagrass kill times were main plots, tillage treatments were sub-plots, and fungicide treatments (in Quincy) were sub-sub plots. The sub-plot or sub-sub-plot size was 50 feet long and 18 feet wide in Marianna and 25 feet long and 18 feet wide in Quincy. Analysis of variance (ANOVA) was carried out to determine the main and interactive effects of bahiagrass kill time and tillage. The least significant difference (LSD) tests were used to distinguish the treatment difference at $P = 0.05$ level.

Results and Discussion

Soil mechanical resistance

Studies have confirmed that soil compaction directly affects crop root growth and limits use of deep soil water and nutrients, resulting in low yields (Atwell, 1990; Alakukku and Elonen, 1995). Measurements of soil mechanical resistance, using a CP 20 Cone Penetrometer in Quincy, indicated that the fall kill treatment had less soil resistance from 20 to 30 cm of soil depth than the spring kill treatment (Figure 1A). Less resistance in soil compaction layer for the fall killed than the spring killed bahiagrass is not surprised because fall kill treatment had more time to decompose bahiagrass, especially roots. When roots decay, they leave root channels which may improve soil penetration. However, this soil penetration advantage did not result in yield benefit of the following peanut in the present study (Tables 1 and 2). Types of tillage greatly affected soil mechanical resistance. Averaged across measurement dates and the bahiagrass killed times, the Disk+strip till treatment had the greatest and the Paratill+strip till had lowest soil resistance (Figure 1B).

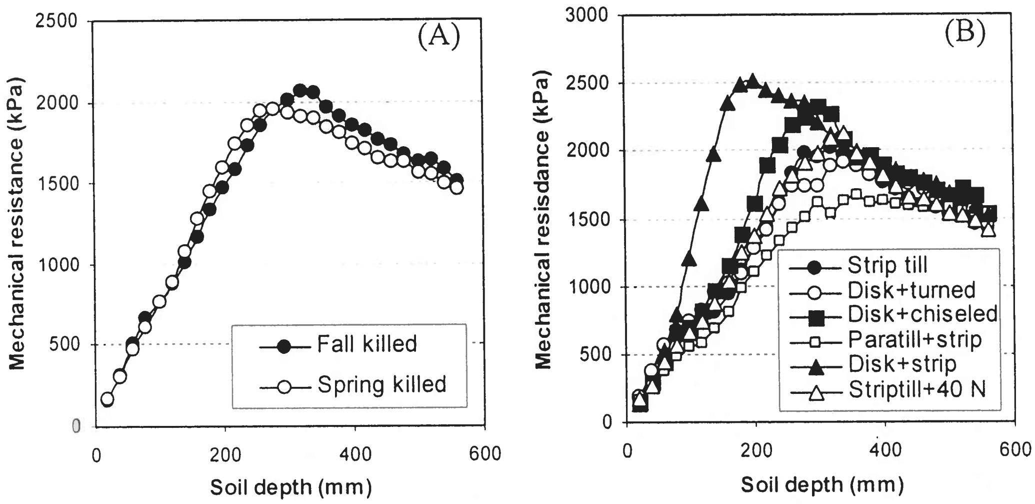

Figure 1. Soil mechanical resistance for (A) plots of fall kill vs. spring kill bahiagrass and (B) the six tillage types. Data are means of four times of measurements in Quincy, Florida.

Peanut yield response to bahiagrass kill time and tillage

Peanut yields in Marianna and Quincy with the fungicide application were 4273 and 3978 lbs acre^{-1}, respectively, averaged across the bahia kill time and tillage treatments. The good yields are attributable to being after 2 years of bahiagrass. Statistical analysis indicated that there was significant difference ($P < 0.05$) in peanut yield between the two experimental locations. Therefore, yield data were analyzed independently for each location. In Marianna, neither the kill time nor tillage statistically affected pod yield. The interaction between replication and the kill time was significant ($P < 0.05$, Table 1). In Quincy, the kill time did not, but the tillage did affect peanut yield ($P < 0.10$). There was no any interaction of the kill time and tillage in yield in Quincy (Table 1).

Table 1. Analysis of variance (ANOVA) for peanut yield responses to the kill time of bahiagrass and tillage at Marianna and Quincy, Florida in 2006.

Source	DF	*P* value	
		Marianna	Quincy[†]
Replication	3	0.1458	0.5663
Kill time	1	0.9122	0.3616
Rep × Kill time	3	0.0274	0.6685
Tillage	5	0.4843	0.0910
Rep × tillage	15	0.2323	0.4061
Kill time × tillage	5	0.7473	0.2334

[†] In order to compare two locations, yield of the fungicide treated plots in Quincy was reported in this Table.

Peanut yields from bahiagrass kill date and tillage treatments at two locations are given in Table 2. Averaged across the tillage treatments, peanut yields of the fall kill and spring kill of bahiagrass were 4264 and 4280 lbs acre^{-1}, respectively in Marianna and 3890 and 4066 lbs acre^{-1}, respectively in Quincy. In Marianna, tillage did not affect peanut yield in the fall kill, but the strip till had higher yield than the disk+chiseled treatment in the spring kill of bahiagrass ($P < 0.05$). Although yield did not differ between the fall kill and spring kill when averaging yield across tillage treatments at Quincy, yield of the strip+40 lb N treatment was significantly lower than that of the disk+turned treatment in the fall kill and that of the disk+chiseled treatment in the spring kill. The yield of the paratill+strip till at planting time was also lower than that of the disk+chiseled (Table 2).

Table 2. Effects of bahiagrass kill time and tillage on peanut yield (lbs acre^{-1}) at Marianna and Quincy, Florida in 2006.

Tillage	Marianna			Quincy†		
	Fall kill	Spring kill	Mean	Fall kill	Spring kill	Mean
Strip till	4078 a‡	4499 a	4289 a	3776 ab	4441 ab	4109 ab
Disk+turned	4115 a	3806 b	3960 a	4516 a	4369 ab	4442 a
Disk+chiseled	4331 a	4364 ab	4348 a	3731 ab	4697 a	4214 ab
Paratill+strip till	4353 a	4442 ab	4398 a	3983 ab	3508 b	3746 bc
Disk	4521 a	4316 ab	4420 a	4049 ab	3759 ab	3904 abc
Strip till+40 lb N	4187 a	4253 ab	4220 a	3285 b	3634 b	3465 c
$LSD_{0.05}$	1114	648	622	875	1023	650

† Yield of the fungicide treated plots in Quincy was reported in this Table to compare two experimental locations.
‡ Means within a column followed by the same letter are not significantly different at the level of $P = 0.05$.

Peanut yield response to fungicide application

Analyses of variance for data collected from Quincy indicated that the interaction of bahiagrass kill time × tillage × fungicide application was not significant (data not shown). Yield data were pooled over tillage treatments within a kill time to determine the main effect of fungicide application. Overall, application of fungicide significantly improved peanut yield. Fungicide application in the fall kill and spring kill treatments increased by 20 and 23%, respectively (Figure 2). Therefore, controlling diseases by applying appropriate fungicides is still one of important management practices in sod-based peanut rotation systems.

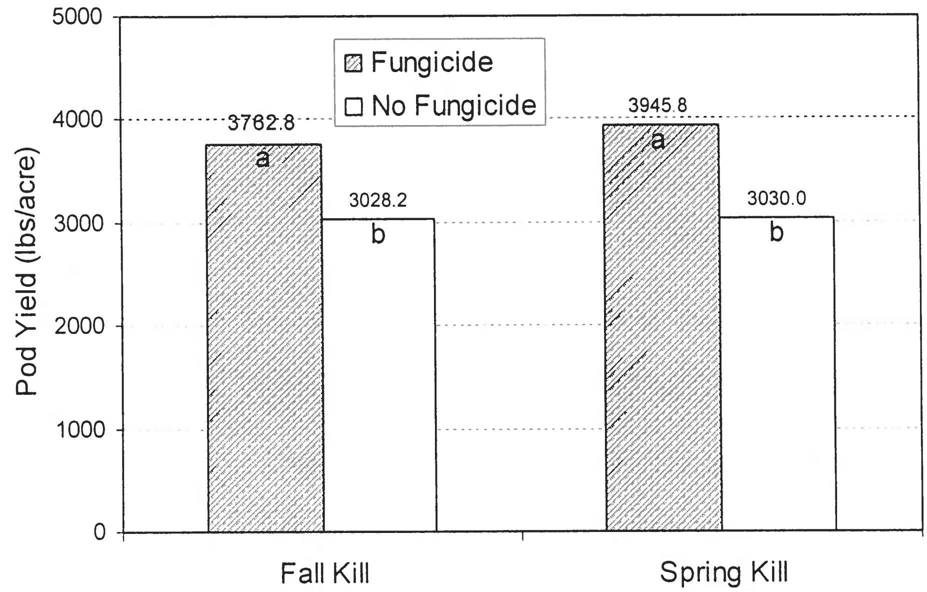

Figure 2. Influence of fungicide application on yield of peanut following bahiagrass tillage study in Quincy, FL

<u>Market grade characteristics</u>

Peanut quality and kernel grade characteristics are in process. Results will be reported as they are available.

Summary

Preliminary results of this study at the two locations (Marianna and Quincy) of the North Florida Research and Education Center in 2006 indicated that:

1. Peanut yield did not differ between the bahiagrass fall kill and spring kill treatments at both locations although soil penetration was improved by the fall killed compared to the spring killed bahiagrass. Therefore, in the sod-based rotation systems in Florida, farmers may have a wide window to kill bahiagrass and to prepare seedbed for following peanut crop.

2. Peanut yield response to tillage treatments depends upon the experimental location. At Marianna, the six tillage treatments did not affect peanut yield in fall kill, but in spring kill, yield of the strip till was significantly higher than the disk+turned treatment. At Quincy, the disk+turned treatment had significant higher yield than the strip till+40 lb N treatment in fall kill. In the spring kill, the treatment of disk+chiseled had the highest, but the disk+strip till at planting and the strip till+40 lb N treatments had the lowest yield. More studies are required for further investigating tillage effect on peanut yield.

3. Application of N fertilizer did not improve peanut yield, when peanut followed bahiagrass in strip till system at both locations in this study. Therefore, N nutrient

may not be a factor of limiting peanut yield or make a difference in cover crop decomposition in the strip till system of peanut following bahiagrass in Florida.

4. Fungicide application significantly increased peanut yield, although peanut leaf diseases severity could be reduced if bahiagrass is involved in the cropping systems (Tsigbey et al., 2005). Therefore, application of fungicides in sod-based rotation systems is still important for high-yielding peanut production.

5. High yields of peanuts may be expected when planting peanuts after bahiagrass.

References

Alakukku, L., Elonen, P. 1995. Long-term effects of a single compaction by heavy field traffic on yield and nitrogen uptake of annual crops. Soil Tillage Res, 36: 141-152.

Atwell, B.J. 1990. The effect of soil compact on wheat during early tillering. I: Growth, development and root structure. New Phytol., 115: 29-35.

Jordan, D.L., Bailey, J.E., Barnes, J.S., Bogle, C.R., Bullen, S.G., Brown, A.B., Edmisten, K.L., Dnphy, E.J., Johnson, P.D. 2002. Yield and economic return of ten peanut-based cropping systems. Agron. J., 94: 1289-1294.

Katsvairo, T.W., Wright, D.L., Marois, J.J., Hartzog, D.L., Rich, J.R., Wiatrak, P.J. 2006. Sod–livestock integration into the peanut–cotton rotation: A systems farming approach. Agron. J. 98: 1156-1171.

Marois, J.J., Wright, D.L. 2003. Effect of tillage system, phorate, and cltivar on tomato spotted wilt of peanut. Agron. J. 95: 386-389.

Wright, D.L., Katsvairo, T.W., Marois, J.J., Wiatrak, P.J. 2004. Introducing bahiagrass in peanut/cotton cropping systems-effects on soil physical characteristics. In Annual Meeting Abstracts of ASA, CSSA, and SSSA. Madison, WI.

Wright, D.L., Tillman, B.L., Marois, J.J., Rich, J.R., Sprenkel, R.K., Ferrell, J.A. 2006. Conservation Tillage Peanut Production. S-AGR-185, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. http://edis.ifas.ufl.edu.

Tsigbey, F.K., Marois, J.J., Wright, D.L., Katsviro, T.W. 2005. Incorporating bahiagrass rotation into peanut cropping systems in North Florida to manage peanut diseases. 2005 Proc. Am. Peanut Res. Ed. Society. P. 100