Quantifying Variable Rainfall Intensity Events on Seasonal Runoff and Sediment Losses from Strip and Conventionally Tilled Peanuts

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ABSTRACT

The majority of peanut production in Georgia is in the Coastal Plain region where sandy soils and relatively high rainfall (~1250 mm/yr) provide a favorable environment for the crop. Coastal Plain soils have traditionally been cropped under conventional tillage practices; and are susceptible to runoff, sediment, and chemical losses from short duration-high intensity, runoff producing storms. We quantified infiltration, runoff, and sediment losses from a Tifton loamy sand managed under conventional- (CT) and strip- (ST) tillage systems and planted to peanut at three times during a growing season with simulated rainfall that utilized variable rainfall intensities representative of each time period (spring, summer, fall). In 2008, a field study was established with CT and ST systems each planted to single-row peanut. Simulated rainfall was applied at planting, 30 days after planting, and after peanut harvest with rainfall events comprised of variable intensity (I_v) patterns representative of each time or season (spring=I_{vSPR}, summer=I_{vSUM}, fall=I_{vFALL}). Simulated rainfall was applied to 6-m^2 plots (n=3) for each treatment with runoff (R) and sediment (E) yields measured from each plot. Overall, runoff and infiltration from CT and ST plots was 9–22% and 78–91% of the total rainfall applied, respectively. The most runoff occurred from CT-I_{vFALL} plots; the least from ST-I_{vSUM} plots. Sediment yields from CT and ST plots ranged from 105–1419 kg/ha. The most sediment occurred from CT-I_{vSPR} plots; the least from ST-I_{vSUM} plots. The most runoff and sediment per unit of rainfall applied occurred from CT-I_{vFALL} plots. Rainfall intensity and runoff from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were correlated (r=0.73–0.95). Runoff and sediment yield from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were also correlated (r=0.66–0.99). Values of R_{max} for CT and ST plots were 7–20% of the maximum intensity for their respective I_v events. Values of R_{max} and E_{max} for CT and ST plots occurred 3–8 min after the maximum intensity for their respective events. The CT plots averaged 60% more runoff, 86% higher R_{max} values, 3.3-fold more sediment, and 3.7-fold higher E_{max} values than ST plots. Maximum difference between CT and ST plots for runoff (2.4-fold), R_{max} (2.7-fold), and sediment (3.8-fold) was for I_{vFALL} events; maximum difference between CT and ST plots for E_{max} (5.6-fold) was for I_{vSUM} events. Results show the pronounced effect of three rainfall intensity patterns and tillage on runoff and sediment losses from critical times (planting, first fungicide application ~30 days after planting, after harvest) during a peanut growing season. Understanding the magnitude of runoff and sediment losses help define "windows of risk" and how conservation tillage can reduce those losses and help producers manage natural resources and agrichemical losses from peanut cropping systems.

Peanut production is vital to the Georgia agricultural industry, both economically and as a rotational crop for traditional row-crop producers. Georgia accounts for 49% of the peanut production in the U.S., with planted acreages averaging 231,000+ ha annually (2000–2009) (Georgia Peanut Commission, 2010). The majority (>90%) of peanut production in Georgia occurs in the Coastal Plain region. The highly-weathered, sandy soils and relatively high rainfall in this region are generally favorable for the crop. However, these soils, traditionally cropped under conventional tillage (CT) practices, tend to be drought-prone, and are susceptible to runoff, sediment, and chemical losses. Rainfall in the Coastal Plain (~1250 mm/yr) tends to have short duration-high intensity, runoff producing storms especially at critical times during the growing season when antecedent water content is high and/or soil cover (residue, canopy) is none to minimal. Also, climatic conditions can yield extended drought periods during the crop growing season, thus, peanut production generally includes supplemental irrigation to minimize yield limiting water stress.

Conservation tillage (strip tillage, ST) adoption in the Coastal Plain region of Georgia has

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increased because ST systems accumulate residue and organic carbon at the soil surface, which dissipates raindrop impact energy and increases soil resistance; thus maintaining infiltration and reducing runoff, soil detachment, and sediment transport (Reeves, 1997; Truman *et al.*, 2005; Truman *et al.*, 2007; Truman and Nuti, 2010; Truman *et al.*, 2011). However, studies have reported less runoff from CT systems than ST systems, especially 1–3 yrs after ST adoption due to increased consolidation (NeSmith *et al.*, 1987; Radcliffe *et al.*, 1988; Soileau *et al.*, 1994; Cassel and Wagger, 1996). Consequently, paratilling, a non-inversion, deep tillage technique, is often used in ST systems to disrupt dense, water-restrictive subsurface layers. After fall paratilling in 2007, bulk densities for ST were as much as 31% less than those for ST prior to paratilling at the study site described herein. Disrupting these layers with paratilling reduces bulk density, increases infiltration, and reduces runoff (Truman *et al.*, 2005; Truman *et al.*, 2007). In the Coastal Plain region of Georgia, it is generally recommended that land managed in ST and planted to peanut be paratilled in the fall prior to planting peanut the following spring.

Frequency of severe rainfall events has increased throughout the U.S., including the Southeast, mainly in the form of increased intensity of extreme rainfall events (Nearing *et al.*, 2005; Todd *et al.*, 2006). Changes in rainfall intensity within a storm affect how rainfall is partitioned (infiltration, runoff) and sediment and chemical transport (Potter *et al.*, 2010; Truman *et al.*, 2007; Truman *et al.*, 2011).

In the Coastal Plain region of Georgia, data are limited on effects of peanut cropping systems on runoff and sediment yields. Truman & Williams (2001) used simulated rainfall (I=63.5 mm/h) to evaluate runoff and soil loss from single- and twin-row peanut systems as a function of canopy cover conditions. They found that single-row planted peanut had as much as 3-times more runoff and soil loss than twin-row planted peanut. Twin-row planted peanut maximized peanut canopy development and percent soil cover early in the growing season and minimized the time in which bare soil is vulnerable to a runoff producing rainstorm. However, they did not evaluate peanut production under strip-tillage nor with variable rainfall intensity patterns that commonly occur throughout the growing season. Our objective was to quantify runoff and sediment losses from a Tifton loamy sand managed under conventional- (CT) and strip- (ST) tillage systems and planted to peanut at planting, 30 days after planting, and after harvest.

Materials and Methods

The 1-ha field site was located near Tifton, GA (N 31° 26′, W 83° 35′) on a Tifton loamy sand (Typic Kandiudult; 82% sand, 7% clay; 2% slope), which represents over 762,000 farmable ha in the Coastal Plain region of Georgia. The site has been managed under CT and ST systems in a cotton (*Gossypium hirsutum*)-peanut (*Arachis hypogea*) rotation since 1998 (Potter *et al.*, 2010; Truman *et al.*, 2011). The CT consisted of fall disking, drilling a winter rye (*Secale cerale*) cover crop, followed by spring disking, turning with a moldboard plow, field cultivator levelling/conditioning, and bedding. Rye surface cover was incorporated 10–15 cm. The ST consisted of planting a winter rye cover just after crop harvest in the fall and killing the rye chemically 30 days before planting the next year's row crop. All ST plots were paratilled (depth=~30 cm) in the fall (11 October, 2007) prior to the 2008 peanut growing season. With ST, a 10-cm wide strip was tilled and used to plant the crop into. In 2008, this site was cropped to single-row peanut (planted 12 May, 0.9 m row spacing). Surface residue cover for CT and ST were <1 and 50%, respectively.

Rainfall simulation plots (2-m wide, 3-m long) were established on each treatment combination at three critical times during the 2008 peanut growing season: 13–20 May (freshly tilled seedbed condition at planting); 23–26 June (first fungicide application with minimal canopy cover); and 21–31 October (tilled/disturbed soil surface immediately after harvest with peanut hay distributed back over bed). Each 6-m^2 plot consisted of a wheel track and two half beds on either side of the wheel track. Antecedent water content (w) was determined gravimetrically (Gardner, 1986) from samples taken in three locations around each 6-m^2 plot just prior to simulating rainfall (0–2 and 2–15 cm depths).

Simulated rainfall was applied with an oscillating nozzle rainfall simulator (Truman *et al.*, 2011) that used 80150 Veejet nozzles (2.3-mm median drop size). The simulator was placed 3 m above each 6-m^2 plot. Simulated rainfall was applied at three variable rainfall intensity (I_v) patterns: a spring time variable intensity pattern used at planting (I_{vSPR}); a summer time variable intensity pattern used at the first fungicide application (I_{vSUM}); and a fall time variable intensity pattern used just after peanut harvest (I_{vFALL}) (Fig. 1). Data from the I_{vSPR} pattern have been reported previously (Potter *et al.*, 2010).

Variable rainfall intensity patterns were developed from measured 5- and 1-min natural rainfall data (30 yrs) collected at Tifton, GA. Natural rainfall during the spring (March, April, May),
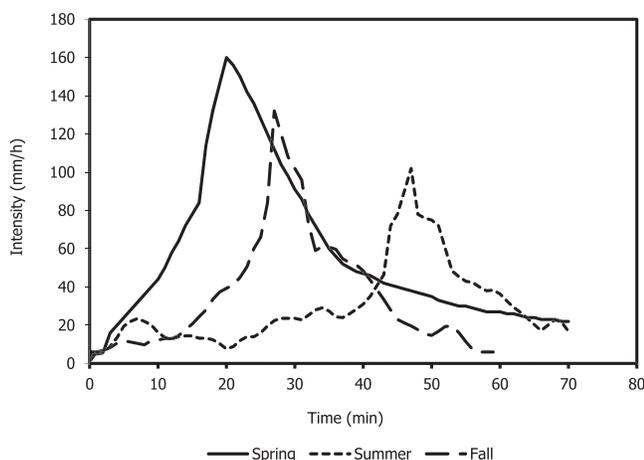
Fig. 1. Simulated variable rainfall intensity patterns evaluated.

summer (June, July, August), and fall (September, October, November) were analyzed to determine respective patterns that occurred most frequently during each 3-month season. Parameters (I_{max}, time to I_{max}, $Precip_{max}$, duration) were averaged for the group of natural storms occurring most often during each 3-month season. For each season, the individual storm with the most parameters similar to the average of the entire group of storms was selected and its pattern programmed into the simulator on a 1-min basis as the representative I_v pattern for that 3-month season (I_{vSPR} for spring; I_{vSUM} for summer; I_{vFALL} for fall).

Rainfall duration for the I_{vSPR}, I_{vSUM}, and I_{vFALL} patterns was 70, 70, and 60 min, respectively. Average rainfall I during the I_{vSPR}, I_{vSUM}, and I_{vFALL} patterns was 56, 30, and 36 mm/h, respectively. Maximum rainfall I during the I_{vSPR}, I_{vSUM}, and I_{vFALL} patterns was 160, 102, and 132 mm/h, respectively. Total rainfall volume applied to each 6-m^2 plot was repeatable (avg. I_{vSPR}=61 mm, CV=3%; avg. I_{vSUM}=30 mm, CV=3%; avg. I_{vFALL}=36 mm, CV=2%). Irrigation well water was used in all simulations. Runoff (R) and sediment (E) were measured from the down slope end of each 6-m^2 plot at 5-min intervals throughout each simulation, and determined gravimetrically. Infiltration (INF) was calculated by difference (rainfall-runoff). The parameter dINF was calculated by difference (maximum INF– minimum INF). Estimates of days of water for crop use for I_{vsum} events were calculated from INF values for each tillage treatment and an assumed evapotranspiration value (6 mm/day).

Treatments consisted of two tillage systems (CT, ST) and three rainfall intensity patterns (I_{vSPR}, I_{vSUM}, I_{vFALL}). Means, coefficients of variation (CV, %), and standard error bars are given for measured data (n=3). Unpaired t-tests (two-tailed

distribution) were used to determine significance among treatment means using SigmaStat 3.1 (Systat, 2004). All test statistics were evaluated at P=0.05, unless otherwise noted. All other data analysis was conducted with Microsoft Office Excel 2007.

Results and Discussion

Spring (I_{vSPR}) event. Runoff and infiltration from CT and ST plots was 11–13% and 87–89% of the total rainfall applied, respectively (Table 1); no significant differences were found for runoff or infiltration parameters for CT and ST treatments. In previous studies, runoff from CT plots (avg.=36% of rainfall applied) was 2.3- to 5.1-fold greater than that from ST plots (avg.=10% of rainfall applied) (Truman *et al.*, 2007; Truman and Nuti, 2010; Truman *et al.*, 2011). Relatively low and similar water contents of the top 15 cm soil depth for CT and ST plots, especially the 0–2 cm layer (w=~1.0%), contributed to similar runoff yields from CT and ST plots. The sandy Ap horizon (82% sand, 0–30 cm) of the Tifton loamy sand allows water to infiltrate quickly to less permeable subsurface horizons. Porosities for the Ap horizon were 10% greater than those for the argillic (Bt) horizon (30–51 cm); hydraulic conductivities for Ap and Bt horizons were 5–15 cm/h and 2.5–5 cm/h, respectively (C. Truman, D. Bosch, unpublished data). Infiltrating water is "backed up" during a rainfall event as it reaches the Bt horizon, effectively decreasing infiltration and generating runoff. Amount of water in the Ap horizon when rainfall starts affects how much additional water it can hold before infiltration is decreased and runoff starts. Relatively low water contents at the beginning of I_{vSPR} events yields less water in the Ap horizon, thus more infiltration and less runoff occurs.

Sediment yields for I_{vSPR} events ranged from 636–1419 kg/ha (Table 1). The CT plots had 2.2-fold more sediment than ST plots. Runoff (Fig. 2A) and sediment (Fig. 2B) curves for CT and ST plots had similar shapes as the I_{vSPR} pattern. After 15 min of rainfall, runoff and sediment rates increased sharply until each reached its peak. Maximum 5-min runoff (R_{max}) values for CT and ST plots were similar (Table 1), and were 14–18% of the maximum intensity (160 mm/h) for the I_{vSPR} event. Maximum 5-min sediment (E_{max}) values and R_{max} values occurred 5–8 min after the maximum intensity for the I_{vSPR} event (20 min). Values of E_{max} for CT plots were 78% higher than those for ST plots. After reaching respective R_{max}

Table 1. Hydrology and erosion parameters for each treatment studied.

Treatment[a]	Rainfall[b] mL	w, 2 cm %	w, 15 cm %	INF %	R_{tot} mm/h	R_{max} mm/h	E g	E_{max} kg/m^2/h
CT-I$_{vSPR}$[c]	60 (02)[d]	0.9 (27)	7.1 (08)	88.5 (02)	6.4 (13)	23.2 (20)	852 (06)	0.57 (08)
ST-I$_{vSPR}$[c]	61 (02)	1.0 (61)	6.4 (30)	86.9 (01)	7.3 (08)	28.7 (10)	382 (29)	0.32 (27)
Diff, %	2	11	11	2	14	24	123	78
P[e]	NS	NS	NS	NS	NS	NS	**	**
CT-I$_{vSUM}$	30 (03)	3.9 (22)	9.7 (06)	85.4 (01)	4.3 (07)	20.0 (11)	235 (20)	0.28 (22)
ST-I$_{vSUM}$	29 (03)	3.4 (32)	7.8 (06)	90.7 (01)	2.8 (11)	12.2 (07)	63 (16)	0.05 (34)
Diff, %	1	15	24	6	54	64	273	460
P	NS	NS	*	**	**	**	**	**
CT-I$_{vFALL}$	37 (01)	9.6 (12)	10.1 (10)	78.2 (04)	7.7 (10)	25.3 (04)	463 (05)	0.71 (16)
ST-I$_{vFALL}$	36 (01)	5.8 (26)	7.9 (10)	89.8 (01)	3.2 (07)	9.3 (13)	121 (11)	0.18 (17)
Diff, %	3	66	28	15	140	172	281	295
P	NS	NS	*	**	***	***	***	**

[a]CT=conventional tillage; ST=strip tillage.

[b]Rainfall volume; w=gravimetric water content; INF=infiltration as a percent of rainfall; R_{tot}=total runoff; R_{max}=maximum 5-min runoff rate; E=sediment yield; E_{max}=maximum 5-min sediment rate.

[c]Data from Potter *et al.* (2010).

[d]Mean (Coefficient of Variation).

[e]*, **, *** indicated statistical significance at the 0.05, 0.01, and 0.001 levels, respectively; NS=Not Signficant.

and E_{max} values, runoff curves declined at similar rates and sediment curves declined at different rates until 40 min. From 40 min until the end of the I$_{vSPR}$ event, runoff and sediment curves decreased at a much lower rate.

Summer (I$_{vSUM}$) event. Runoff and infiltration from CT and ST plots was 9–14% and 86–91% of the total rainfall applied, respectively (Table 1). Sediment yields from CT and ST plots ranged from 105–392 kg/ha. The CT plots had 54% more runoff and 3.7-fold more sediment than ST plots. Runoff (Fig. 3A) and sediment (Fig. 3B) curves for CT and ST plots had similar shapes as the I$_{vSUM}$ pattern. After 45 min of rainfall, runoff and sediment rates increased sharply until each reached its peak. Values of R_{max} for CT and ST plots were 12–20% of maximum intensity (102 mm/h) for the I$_{vSUM}$ event; R_{max} and E_{max} values for CT and ST plots occurred 3–4 min after the maximum intensity for the I$_{vSUM}$ event (47 min). Values of R_{max} and E_{max} for CT plots were 64% and 5.6-fold higher than those for ST plots. After reaching respective R_{max} and E_{max} values, runoff curves declined at similar rates and sediment curves declined at different rates until 60 min. Peanut canopy cover during the I$_{vSUM}$ event averaged 10% (~30 days after planting), and influenced runoff and sediment losses, especially combined with surface residue cover on ST plots.

Fall (I$_{vFALL}$) event. Runoff and infiltration from CT and ST plots were 9–22% and 78–91% of the total rainfall applied, respectively (Table 1). Sediment yields from CT and ST plots ranged from 202–771 kg/ha. The CT plots had 2.4-fold more runoff and 3.8-fold more sediment than ST plots.
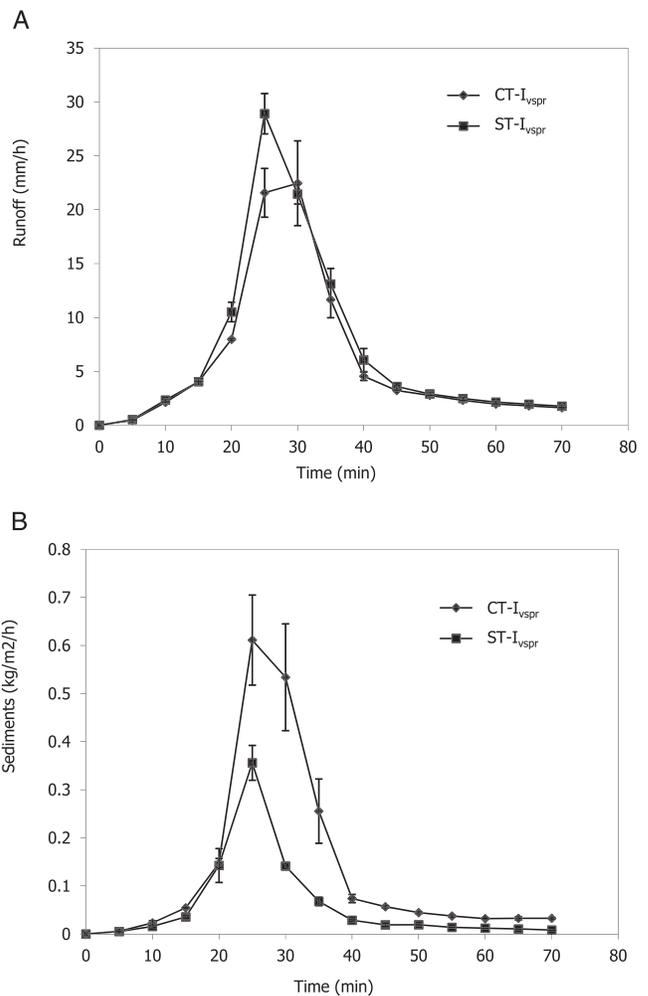
Fig. 2. Runoff (A) and sediment yield (B) rates for the CT and ST treatments during the 70 min I$_{vspr}$ simulated rainfall events (bars=standard error, S.E.).
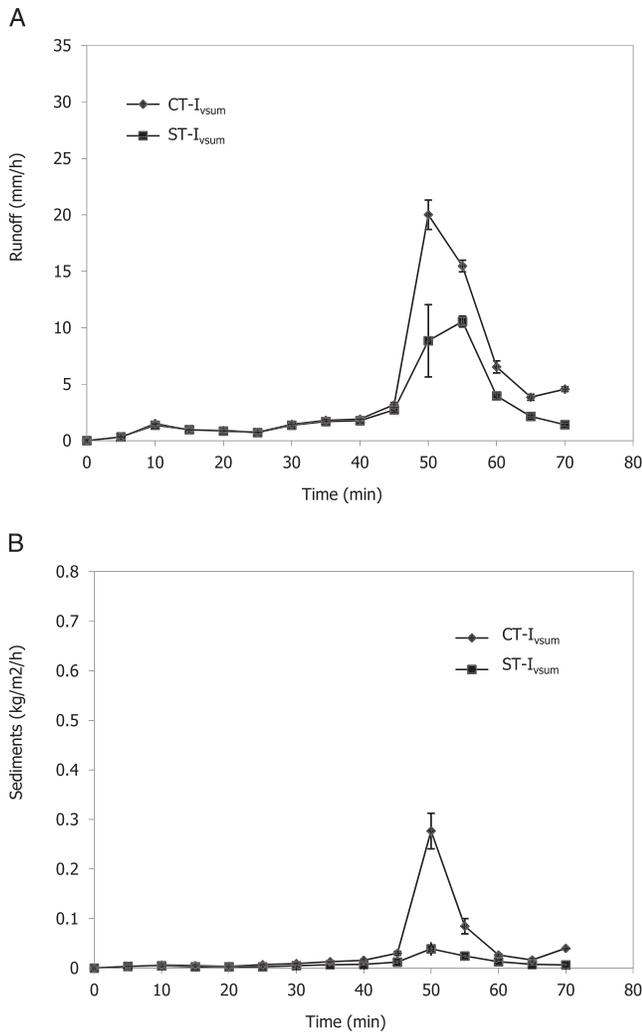
A

B

Fig. 3. Runoff (A) and sediment yield (B) rates for the CT and ST treatments during the 70 min I$_{vsum}$ simulated rainfall events (bars=standard error, S.E.).
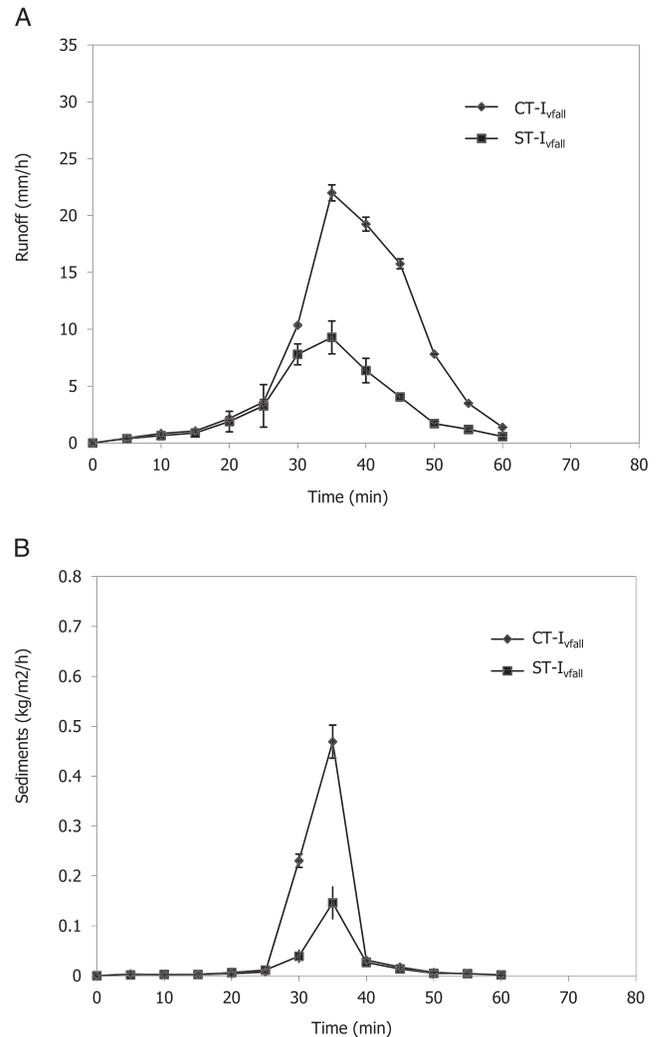
A

B

Fig. 4. Runoff (A) and sediment yield (B) rates for the CT and ST treatments during the 60 min I$_{vfall}$ simulated rainfall events (bars=standard error, S.E.).

Runoff (Fig. 4A) and sediment (Fig. 4B) curves had similar shapes as the I$_{vFALL}$ pattern. After 25 min of rainfall, runoff and sediment rates increased sharply until each reached its peak. Values of R$_{max}$ for CT and ST plots were 7–19% of maximum intensity (132 mm/h); R$_{max}$ and E$_{max}$ values for CT and ST plots occurred 6–8 min after the I$_{vFALL}$ peak (27 min). Values of R$_{max}$ and E$_{max}$ for CT plots were 2.7-fold and 3.9-fold higher than those for ST plots. After reaching respective R$_{max}$ and E$_{max}$ values, runoff and sediment curves declined at different rates for the remaining I$_{vFALL}$ event duration (60 min). Runoff rates gradually declined never reaching a steady-state rate; Sediment rates from 40 to 60 min were low, like those for this 0–25 min time period.

Comparing events, the most runoff occurred from CT-I$_{vFALL}$ plots; the least from ST-I$_{vSUM}$ plots. Since each seasonal event had different rainfall volumes and/or durations, we compared

runoff and sediment losses per unit of rainfall applied across all events. For runoff, maximum and minimum amounts occurring from CT-I$_{vFALL}$ and ST-I$_{vSUM}$ plots were the same whether comparing runoff with units of mm/h or expressed as a percentage of rainfall applied. The most sediment occurred from CT-I$_{vSPR}$ plots; the least from ST-I$_{vSUM}$ plots. When data were expressed as sediment loss per unit of rainfall applied, the greatest loss occurred from CT-I$_{vFALL}$ plots, despite having 1.8-fold less sediment than CT-I$_{vSPR}$ plots. Thus, CT-I$_{vFALL}$ plots yield the most runoff and sediment per unit of rainfall applied among treatment combinations evaluated.

Runoff and sediment yields for this study are compared to those of Truman and Williams (2001) to see if differences in runoff and sediment losses exist between constant and seasonal, variable intensity patterns during similar times during the peanut growing season (Table 2). Note all comparisons are

for CT and single-row peanut treatments on a Tifton loamy sand; Truman and Williams used constant intensity (I=63.5 mm/h) simulated rainfall, whereas the current study used variable intensity simulated rainfall representative of each season (spring, summer, fall). Runoff (% of rainfall applied) from Truman and Williams was 2.5–3.0 fold greater than the current study, except for fall in which runoff from both studies were similar. The highest runoff from the Truman and Williams study was from the summer season (26–30 days after planting); highest runoff for the current study was from the fall season (after harvest). For sediments, similar sediment yields are reported from both studies for the spring season. However, sediment yield from the Truman and Williams study was 11-fold greater for summer than the current study; yet the current study reports sediment yields that are 2.4-fold greater than those from Truman and Williams for the fall season. Data indicate that differences in runoff and sediment yield comparisons between the two studies were due to the respective rainfall intensity patterns used in each study. Truman *et al.* (2007) also found differences in runoff, sediment, and carbon transport between constant and variable intensity simulated rainfall, and reported the implications of their results on model predictions of runoff, sediment, and agrichemicals.

For the Tifton loamy sand, transport relationships mostly determine measured sediment yields. Runoff curves had similar shapes as rainfall intensity patterns for all I_v patterns studied. Correlation values (r) for intensity vs. runoff from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were 0.91, 0.94, 0.93, 0.91, 0.73, and 0.95, respectively. Sediment from the Tifton loamy sand is susceptible to deposition due to transport-limiting conditions (large sediment sizes and/or low runoff transport capacity) during a rainfall event, which influences measured sediment. Correlation values (r) for runoff vs. sediment yield from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were 0.99, 0.94, 0.91, 0.92, 0.66, and 0.82, respectively. These r values decreased as w increased.

Tillage impacted runoff and sediment amounts and rates for I_{vSPR}, I_{vSUM}, and I_{vFALL} events. Strip-tillage reduced runoff for I_{vSUM}, and I_{vFALL} events, and sediment losses for all three events. Over all events, CT plots (<1% residue cover) averaged 60% more runoff, 86% higher R_{max} values, 3.3-fold more sediment, and 3.7-fold higher E_{max} values than ST plots (50% residue cover). Residue cover associated with ST effectively reduced surface sealing (Baumhardt *et al.*, 1993; Alberts and Neibling, 1994; Potter *et al.*, 1995; Baumhardt and Lascano, 1996). Values for dINF (INF$_{max}$-INF$_{min}$) relate to the degree of surface sealing (15, 18) with larger dINF values

Table 2. Runoff (R, % of rainfall applied) and sediment yield (E) comparisons.

Season[a]	DSP[b]	R[c] %	R[d] %	E[c] kg/ha	E[d] kg/ha
SPR	0–8	29.6[e]	11.5	1460	1420
SUM	26–30	45.0	14.6	4624	392
FALL	127–155	22.5	21.8	320	772

[a]SPR=spring; SUM=summer; FALL=fall.
[b]Days since planting. DSP=127–155 are after peanut harvest.
[c]Truman and Williams (2001).
[d]Current study.
[e]All data are from CT and single-row peanut treatments.

indicative of more surface sealing. For the I_{vSPR} event, CT plots had dINF values (117.8) that were 6% greater than those for ST plots (110.9) (P=0.026). Thus, CT plots experienced more surface sealing than ST plots, yet surface sealing did not significantly change rainfall partitioning characteristics. Values of dINF were not calculated for I_{vSUM} events because of peanut canopy cover present (~10%); they were calculated for I_{vFALL} events, but no significant differences were found between CT and ST plots (86.0 vs. 87.8). Infiltration differences among CT and ST for I_{vSUM} events (~30 days after planting) are important to the peanut crop in terms of water availability during the summer months of the growing season when daily air temperatures routinely exceed 32°C (90°F) and rainfall can be sporadic. If one assumes that all infiltration from the I_{vSUM} event for CT and ST plots is available for crop use and an evapotranspiration value of 6 mm/d, days of water for crop use can be calculated for CT and ST treatments. For the I_{vSUM} event, CT and ST plots had 3.6 and 3.9 days of water for crop use (0.3 d or 8% difference; P=0.008). The 1.4 mm of water or 0.3 days of water for crop use difference is for just this one event, and could make a difference in water stress levels and/or irrigation timing, and/or costs, especially given the porous surface horizon and low water holding capacity of the Tifton loamy sand.

Summary and Conclusions

We quantified runoff and sediment losses from a Tifton loamy sand managed under CT and ST systems and planted to peanut at three times during the peanut growing season (at planting, 30 days after planting, after harvest). Rainfall simulation events with variable rainfall intensities (I_v) representative of each time period (spring, I_{vSPR}; summer, I_{vSUM}; fall, I_{vFALL}) were used. We found that over the three seasonal events, runoff and infiltration from CT and ST plots was 9–22% and 78–91% of the total rainfall

applied, respectively. The most runoff occurred from CT-I_{vFALL} plots; the least from ST-I_{vSUM} plots. Sediment yields from CT and ST plots ranged from 105–1419 kg/ha. The most sediment occurred from CT-I_{vSPR} plots; the least from ST-I_{vSUM} plots. On a per unit rainfall applied basis, the most sediment occurred from CT-I_{vFALL} plots. Thus, CT-I_{vFALL} plots yield the most runoff and sediment per unit of rainfall applied among treatment combinations evaluated. Runoff and sediment curves for CT and ST plots had similar shapes as corresponding simulated rainfall patterns. Rainfall intensity and runoff from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were correlated (r=0.73–0.95). Runoff and sediment yield from CT and ST plots for I_{vSPR}, I_{vSUM}, and I_{vFALL} events were also correlated (r=0.66–0.99). Values of R_{max} for CT and ST plots were 14–18% of the maximum intensity (160 mm/h) for I_{vSPR} events, 12–20% of the maximum intensity (102 mm/h) for I_{vSUM} events, and 7–19% of maximum intensity (132 mm/h) for I_{vFALL} events. Values of R_{max} and E_{max} for CT and ST plots occurred 5–8 min after the maximum intensity for I_{vSPR} events (20 min); 3–4 min after the maximum intensity for I_{vSUM} events (47 min); and 6–8 min after I_{vFALL} events (27 min).

Strip-tillage reduced runoff for I_{vSUM}, and I_{vFALL} events, and sediment losses for all three events. Over all events, CT plots averaged 60% more runoff, 86% higher R_{max} values, 3.3-fold more sediment, and 3.7-fold higher E_{max} values than ST plots. Maximum difference between CT and ST plots for runoff (2.4-fold), R_{max} (2.7-fold), and sediment (3.8-fold) was for fall events; maximum difference between CT and ST plots for E_{max} (5.6-fold) was for summer events.

Frequently occurring rainfall intensity patterns that occur during critical times (planting, first fungicide application ~30 days after planting, immediately after harvest) during the peanut growing season influences infiltration, runoff, and sediment yields. Our results show the pronounced effect of the three rainfall intensity patterns and tillage on runoff and sediment losses from those periods during the peanut growing season. Understanding the magnitude of runoff and sediment losses help define ''windows of risk'' and how conservation tillage can reduce those losses and help producers manage natural resources and agrichemical losses from peanut cropping systems.

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