Rainfall Simulation on Erosion Abatement Measures for Louisiana Roadsides

Noura Bakr, H. M. Selim, David Weindorf, Yuanda Zhu, Allen Arceneaux, Wentai Zhang, and Tamer Elbana

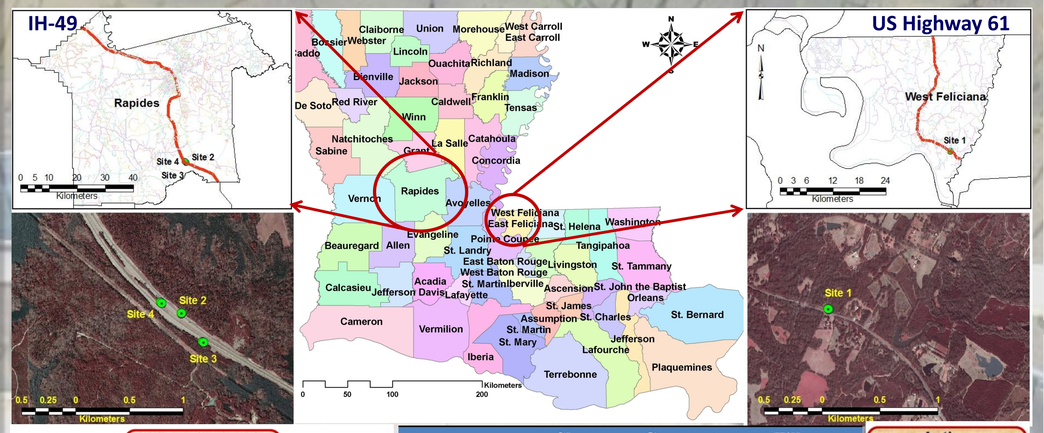
LSU AgCenter, Baton Rouge, LA, USA

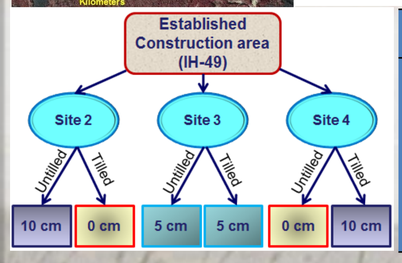
Abstract

In this study we evaluated the impact of compost/mulch thickness (0 as control, 5-, and 10-cm) and tillage practices on runoff flow rate, total suspended solids (TSS) losses and phosphorous (P) using in-situ rainfall simulation. Four sites with eight plots (side-by-side) were studied in West Feliciana and Rapides Parishes, LA. The former location was in an active highway construction area while the latter location was in an established area plagued by continual rill and sheet erosion. A Tlaloc 3000 rainfall simulator at an intensity of 70-80 mm/h was used. The rainfall simulations experiments were conducted in the Spring of 2011 and 2012. Two pulses of 30 min durations were consecutively applied to each plot. The second pulse was applied as soon as runoff from the first pulse ceased. Runoff was observed after 5 and 10 min for the 5 cm and 10 cm compost/mulch plots, respectively and after 2 min for the control plots. Furthermore, the compost/mulch resulted in reduction of the flow rate from 1.3 mm/min to 0.4 – 1.0 mm/min. Tillage incorporation of the compost/mulch reduced its effectiveness and increased the flow rate for the 5 and 10 cm compost/mulch plots. One way analysis of variance (ANOVA) indicated significant differences between the first and second pulses. The cumulative flow as a percentage of that applied using the rainfall simulator was high for the control plots (90%) and was reduced to 28% for the 10 cm compost/mulch plots. The TSS results revealed that compost/mulch significantly decreased sediment concentration in the runoff. Total P in the runoff was <1 ppm for all treatments. The presence of compost/mulch on the soil surface decreased runoff, flow rate, and TSS and is recommended for erosion control on Louisiana roadsides.

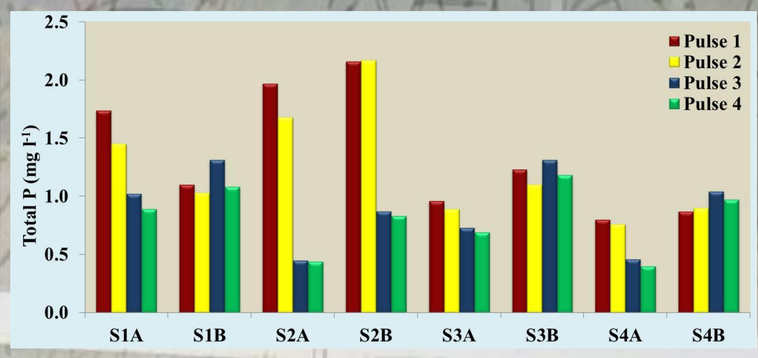
Materials and Methods

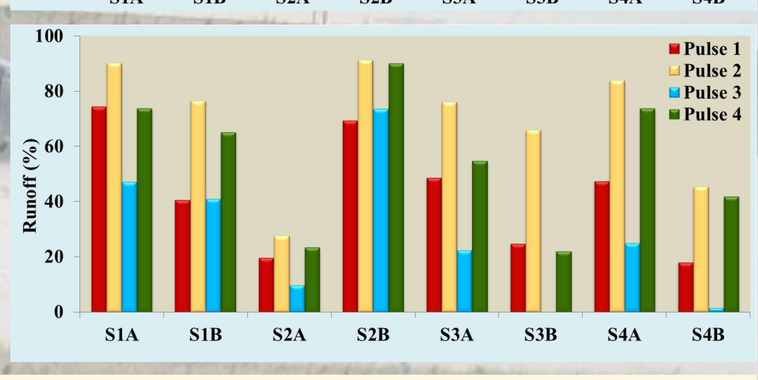
A Tlaloc 3000 rainfall simulator covers 2.8X2.3m^2 area with a central nozzle at 3 m. Water pressure was adjusted to 3.5 psi, with 75 mm/h intensity for a 30 min duration. Polyethylene tarps were used as windscreen sides. Framework was leveled for direct spraying on the release plot. A 250-gal tank was used to pump water. Rainfall simulation experiments were carried out in the Spring of 2011 and 2012.



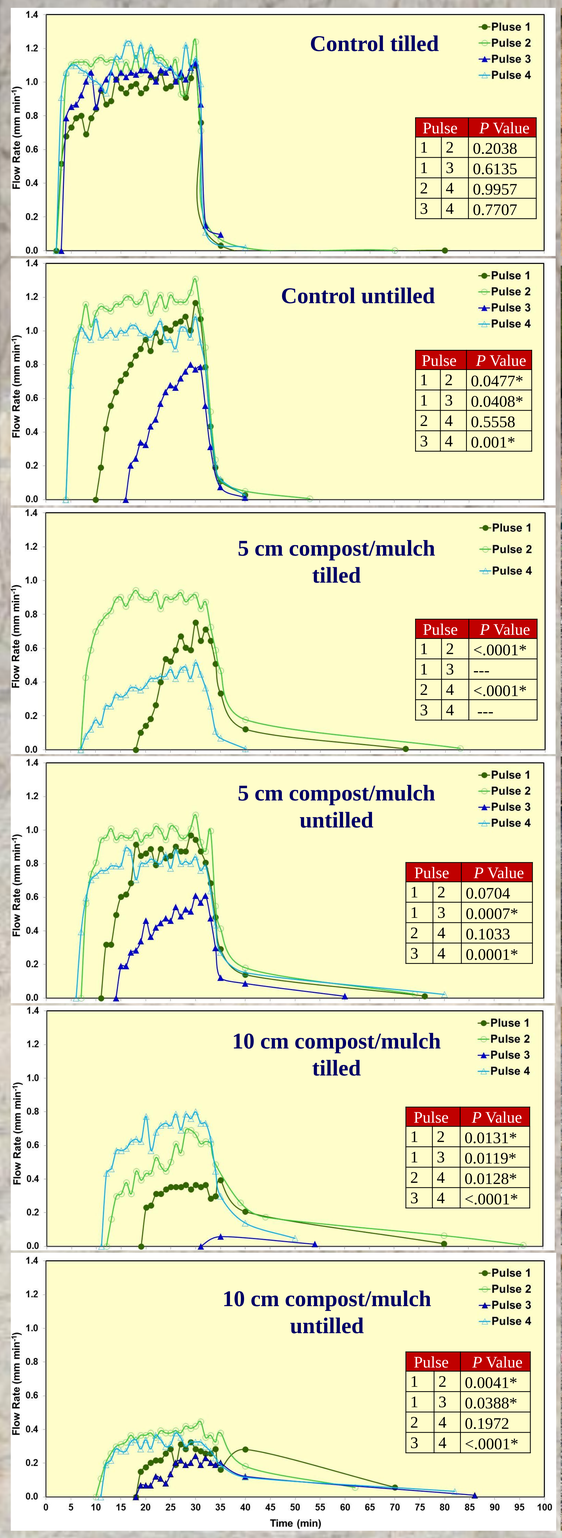


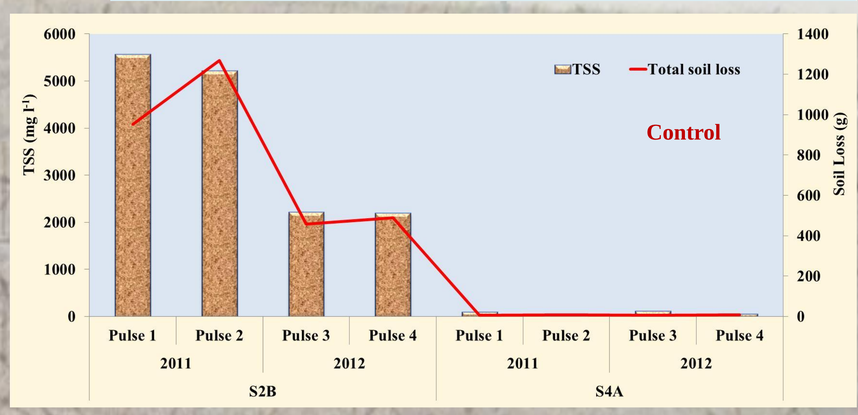
Site	ID	Slope (%)	Compost cover (cm)	Tillage practices
1	S1A	34	10	no-tillage
	S1B		5	light-tillage
2	S2A	25	10	no-tillage
	S2B		Control	light-tillage
3	S3A	15	5	no-tillage
	S3B		5	light-tillage
4	S4A	10	Control	no-tillage
	S4B		10	light-tillage

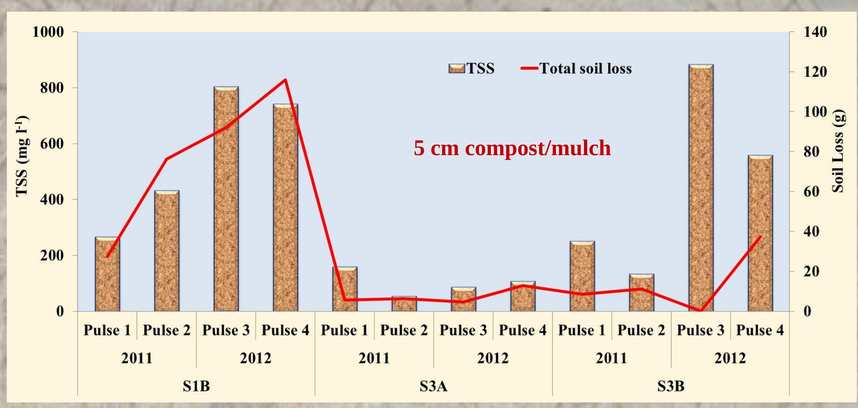


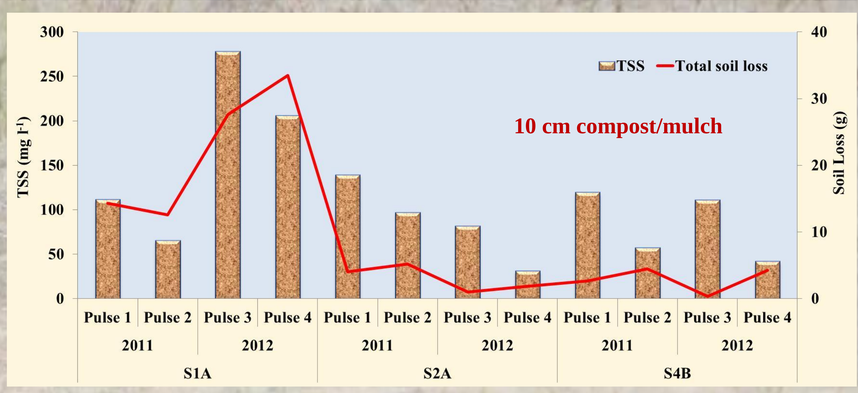


Results









Conclusions

Tillage, slope, and construction activities reduced the effectiveness of compost/mulch as a soil erosion retardant by increasing flow rate, runoff and TSS. Although 10 cm compost/mulch produced the best results, 5 cm compost/mulch may provide the most effective cost/benefit ratio; ideal fodder for future study. This study confirmed the successful use of compost/mulch as a BMP to reduce erosion hazard on roadsides.