SURFACE RUNOFF WATER QUALITY FROM MULTIPLE BEST MANAGEMENT PRACTICES IN NORTH TEXAS

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INTRODUCTION (1)

Agricultural runoff is a significant water quality problem for reservoirs serving North Texas. Preventing or reducing nutrient and sediment loading in these reservoirs involves developing and implementing best management practices (BMPs). However data on the effectiveness of BMPs on improving the quality of water running off the calcareous soils in this area is lacking and therefore needs research attention.

OVERALL GOAL (2)

Evaluate and quantify the effectiveness of best management practices (BMPs) for reducing nutrient and sediment runoff from agricultural lands.

MATERIALS & METHODS (3)

Experimental set-up and monitoring

Experimental site	TAMU-USC†, Dallas
Experimental design	RCBD with 3 replications‡
BMPs§	• Residue management (RM)
	• No-Till (NT)
	• 2.74-m buffer strips (BS)
	• Control (C) was CT¶
Size of plots	19.8 x 15.2 m (12 plots total)
Runoff monitoring	
Flow and volume	• 1.0 H-type flume
	• In-Situ level troll®
Time paced sampling	• 1640 LLA#
	• ISCO 3700

†Texas A&M University-Urban Solutions Center

‡Two of the three replications for each BMP treatment were equipped with Isco autosamplers.

§At the beginning of the study, plots were planted in winter wheat. BMPs were implemented after harvesting the wheat. In summer, RM treatments were left fallow and wheat stubble left in place; no-till plots were planted with pigeon pea and wheat stubble in BS treatments were tilled. All treatments received weed control as needed.

¶CT = conventional tillage

#LLA = Liquid level actuator

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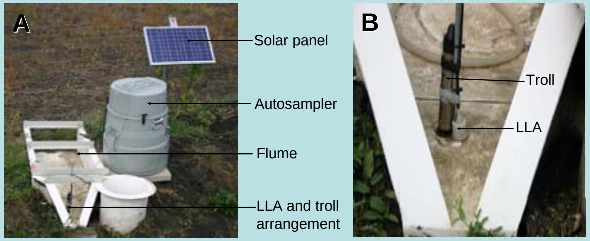

Figure 1. Field set up of runoff monitoring and sampling equipment (A) and close up on LLA and troll arrangement (B)

Measurement of water quality parameters (5)

Parameter	Method
• pH	electrometric
• EC	platinum conductivity cell
• Sediment	sedimentation + oven drying at 60ºC

Data Analyses

- Data from seven representative natural rainfall events ranging from 21 - 138 mm were used.
- Treatment means and standard deviations for pH, electrical conductivity (EC) and sediment were determined using data from the two treatment replicates with automatic samplers.
- However statistical analysis for runoff volume involved data from all three replicates.
- Sediment load (mg) in runoff from each plot was calculated as the product of the concentration (mg/L) and the total runoff volume (L) for each time interval and summed up.

RESULTS (6)

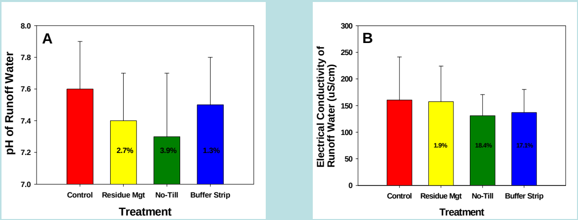

Figure 2. Average pH (A) and EC (B) measured for runoff water collected from the various treatments over seven rainfall events ranging from 21 to 138 mm. Numbers in bars represent percent reductions for each BMP treatment.

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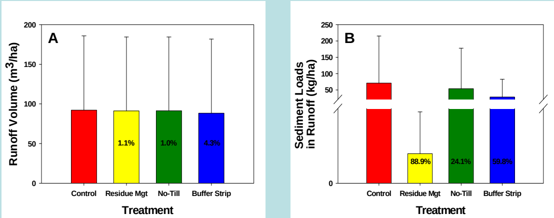

Figure 3. Average runoff volume (A) and sediment amounts (B) in runoff measured from the various treatments over seven natural rainfall events ranging from 2.1 to 138 mm. Numbers in bars represent percent reductions for each BMP treatment.

DISCUSSION (8)

In general, these preliminary results show that the BMPs implemented are reducing runoff volume, pH and EC levels and sediment amounts in runoff water. Most reductions were observed for sediment (24 - 89%) (Fig. 3B) while modest reductions were observed for EC (2 - 18%) (Fig. 2B). Reductions observed for pH (Fig. 2A) and runoff volume (Fig. 3A) were low (1 - 4%).

From these results, RM appears to be the most effective BMP for reducing sediment in runoff while NT is most effective for pH and EC reductions and BS the best for reducing runoff volume.

Though not shown, peak values measured for pH, EC, sediment, dissolved P and NO_3-N in runoff samples collected from the various treatments over 14 rainfall events ranging from 11- 138 mm were not significantly different at the 5% significance level. Load reductions for dissolved P and NO_3-N are not discussed because they are in the process of being determined.

CONCLUSION (9)

Runoff results for the seven rainfall events discussed show that RM, NT and BS are more effective at reducing sediment amounts and EC of runoff than volume and pH.

SPONSOR (10)

Texas State Soil and Water Conservation Board