Task 6. Soil Amendments Evaluation

Overview of Previous Reports

Al-WTR from Manatee County was evaluated as an amendment applied to a manure-impacted soil from the Lake Okeechobee Basin in a rainfall simulation study. The Al-WTR was applied to the soil via surface application and incorporation into the soil at a rate of 2.5% of dry soil weight as shown in Table 1. The following is a brief summary of what has been reported previously. Surface application (T1) of Al-WTR reduced soluble phosphorus (SP) concentrations in runoff by 77% but did not reduce the P concentrations in the subsurface flow or the leachate. Incorporation of Al-WTR (T2 and T3) reduced surface runoff P concentration by approximately 45%. Phosphorus concentrations for subsurface flow were reduced by 37% by mixing the Al-WTR in the top 10 cm of soil (T2) and by 90% by mixing the Al-WTR with the whole soil layer (T3). Phosphorus concentrations for leachate were reduced by 11% by mixing the Al-WTR in the top 10 cm of soil (T2) and by 94% by mixing the Al-WTR with the whole soil layer (T3). Although shoot biomass (forage yield) varied considerably, there was no trend that suggested an adverse effect of Al-WTR on either shoot or root yield (Table 2).

Results Obtained Since the Previous Report

Data that has not been reported previously relates primarily to the elemental analysis of the biomass material (shoots and roots). Trends in biomass P and N concentrations for the six simulation events are shown in Figures 1 and 2, respectively. Values are averaged over all treatments since there were no significant differences between treatments. Pre-treatment plant material contained approximately 3,200 µg P g^{-1} and approximately 500 µg N g^{-1}. Biomass P concentration remained relatively stable during the six simulation events because of the high P concentrations existing in the soil. However, biomass N concentrations decreased over the study period because no additional N was added to the soil. When averaged over all simulation events, P and N concentrations in both shoot and root biomass were not affect by any of the Al-WTR treatments (Figures 3 and 4).

Aluminum concentration in the shoots did not significantly increase between simulation events although there was high variability for simulation 6 which resulted in a slightly higher average concentration for that time period (Figure 5). The variability observed in simulation 6 can attributed to shoot contamination when cutting shoots to the soil surface. This is supported by a large standard deviation observed for simulation 6. Since this was the last harvest, shoots were cut down to the soil surface in order to get a measure of total above-ground biomass. This apparently resulted in inclusion of some soil particles in the biomass sample. When averaged over all simulation events, there were no effects of Al-WTR treatments on biomass Al concentrations. Biomass Al concentrations were in the low range of concentrations reported in the literature for forages. Aluminum concentrations in the roots were highly variable. As with the shoots, Al contamination is believed to be a factor because of the high level of variability in the results even though roots were washed multiple times to remove soil and WTR particles. The standard deviation was so high that there was no significant difference among treatments (P>0.05). There was no visual evidence of any adverse effects of Al-WTR on root growth.

To achieve the best results for reducing P loss in both surface runoff and subsurface flow/leachate from highly impacted soils, Al-WTR (2.5 % of dry weight of soil) should be first mixed with the impacted soil depth to reduce subsurface flow/leachate P loss AND then added to the soil surface to minimize P loss in runoff. For an un-impacted area with low initial soil P concentration that is going to be used for manure application, surface application of WTR would likely be sufficient to minimize P loss. Application of Al-WTR at 2.5% is not expected to adversely affect forage yield or quality of stargrass based on the uniform values of yield and P, N, and Al concentrations between treatments.

Table 1. Treatments used in rainfall simulation study.

Treatment	Descriptions
C1†	No WTR applied
T1†	WTR surface applied.
T2†	WTR incorporated into 0-10 cm soil layer.
T3‡	WTR incorporated into 0-20 cm soil layer.
C2‡	No WTR applied

†0-10cm and 10-20cm soil layers placed in box in sequence.
**0-10 and 10-20 cm soil layers mixed prior to placement in box.

Table 2. Stargrass shoot and root biomass prior to each simulation event as influenced by Al-WTR application.

	Shoots (g dry weight)								Roots
Treatment	**Sim 1**	**Sim 2**	**Sim 3**	**Sim 4**	**Sim 5**	**Sim 6**†	**Avg**	**Final**‡	
C1	35a	17a	38a	16a	8a	n/a	23	57a	34a
T1	17b	8b	24b	19a	4b	n/a	14	41a	30a
T2	35a	21a	35ab	18a	7a	n/a	23	50a	32a
T3	31a	14a	30ab	17a	7a	n/a	20	56a	34a
C2	14b	6b	28ab	21a	9a	n/a	15	47a	29a

† No harvest due to slow winter growth.
‡ Final = All above-ground biomass harvested after simulation 7.
Treatments with the same letter are not significantly different *P*<0.05.

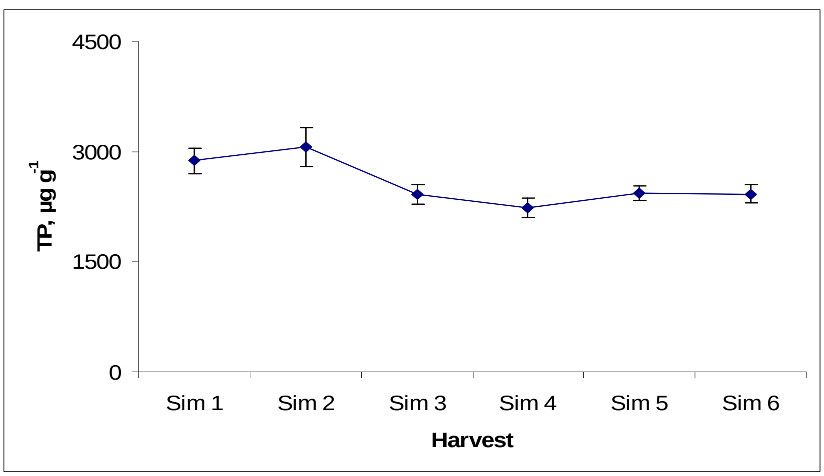

Figure 1. Average phosphorus concentrations and standard deviations per simulation in stargrass as affected by WTR.

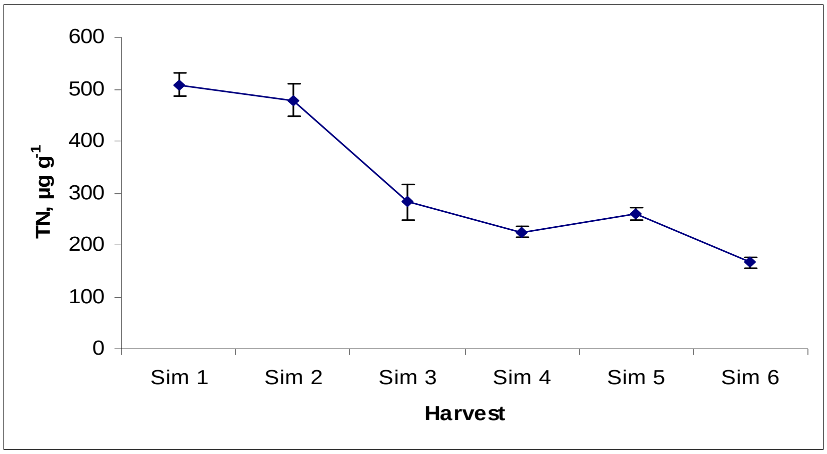

Figure 2. Average nitrogen concentrations and standard deviations per simulation in stargrass as affected by WTR.

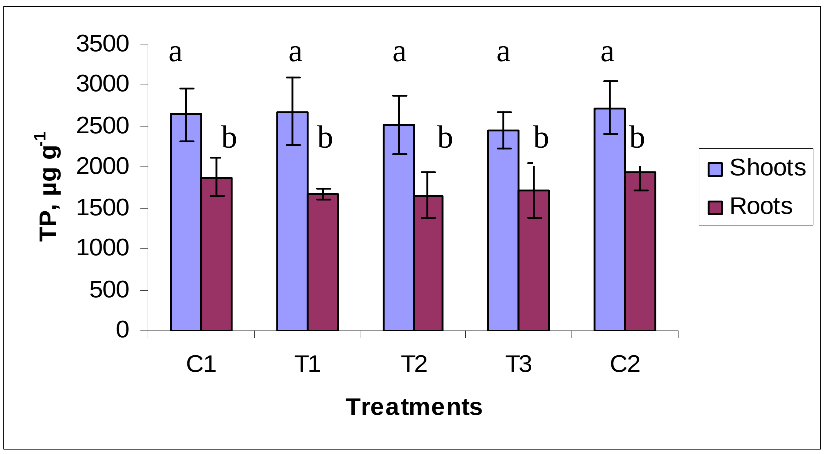

Figure 3. Average phosphorus concentrations and standard deviations in stargrass in treatments.

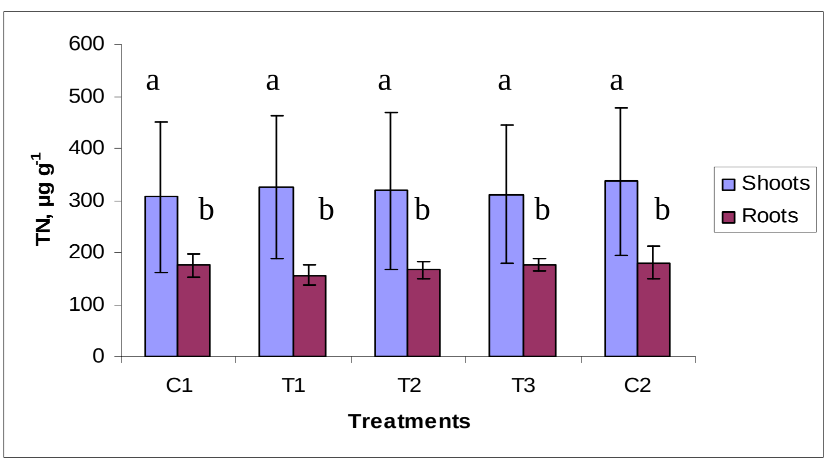

Figure 4. Average shoot and root nitrogen concentrations and standard deviations per treatment in stargrass as affected by WTR.

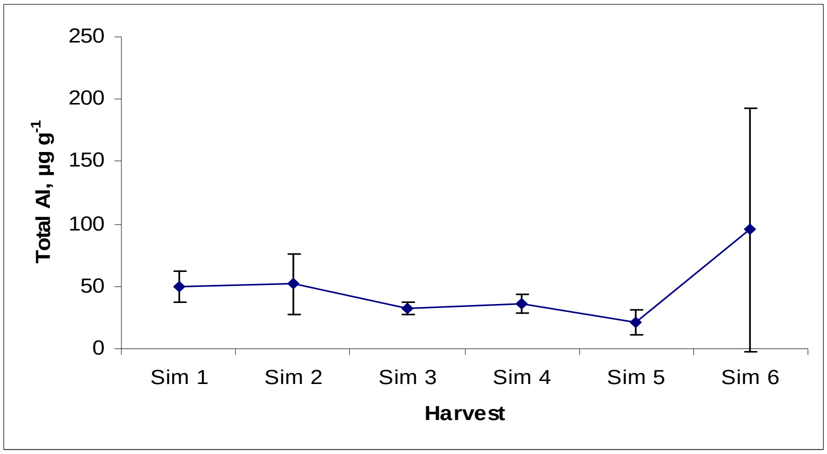

Figure 5. Average shoot aluminum concentrations and standard deviations per simulation in stargrass as affected by WTR.

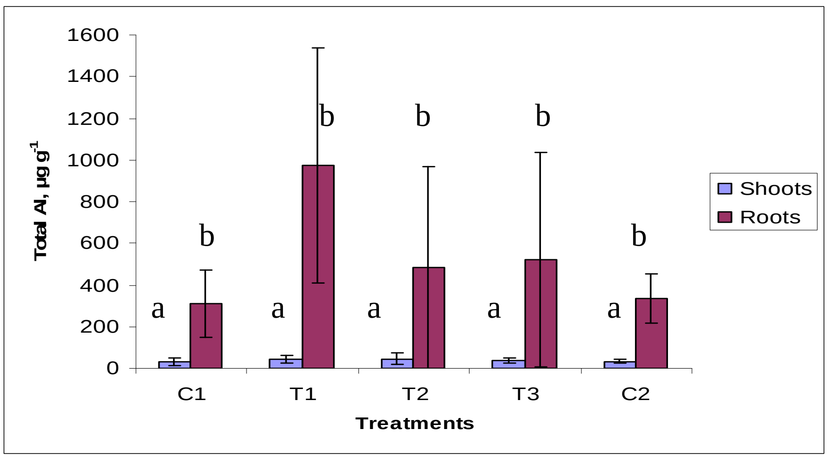

Figure 6. Average aluminum concentrations and standard deviations per treatment in stargrass as affected by WTR.