

SOIL DIAGNOSTIC ASSESSMENT

Sudan Grass Growth Trial-Sierra Ranch

Sudan grass plot

El Paso, Texas

Sample SUDAN-001 | Field ID: SR-13FEB26

Prepared by:

AURUM TECH, LLC

El Paso, Texas

February 2026

Executive Summary

Aurum Tech, LLC conducted a comprehensive soil and water diagnostic assessment of a Sudan grass experimental plot in El Paso, Texas. This assessment integrates three complementary analytical methods: standard soil chemistry, Haney Soil Health testing, and Phospholipid Fatty Acid (PLFA) microbial community analysis, supplemented by a full irrigation water chemistry panel. The multi-method approach provides both chemical and biological perspectives on soil function and identifies constraints to successful Sudan grass establishment.

FINDING: The site exhibits moderate soil health limitations compounded by severely compromised irrigation water quality. Remediation of both soil biology and water management practices is required for successful Sudan grass production.

Critical Findings

Finding	Severity	Data Source
Severely saline irrigation water (EC 5.5 mmhos/cm)	CRITICAL	Water Chemistry
High sodium in irrigation (SAR 10.72, Na 772.5 mg/L)	CRITICAL	Water Chemistry
Toxic chloride in irrigation (1,260 mg/L)	CRITICAL	Water Chemistry
Alkaline pH (8.3) with HIGH lime buffering	HIGH	Soil Chemistry
Elevated soil sodium (125 ppm, 2% base sat.)	HIGH	Soil Chemistry
Low organic matter (1.7%)	MODERATE	Soil Chemistry + Haney
Below-average microbial biomass (1100 ng/g)	MODERATE	PLFA
Zero protozoa detected	HIGH	PLFA
Zinc deficiency (0.81 ppm)	MODERATE	Soil Chemistry
Low microbially active carbon (20.9%)	MODERATE	Haney

Remediation Feasibility

Despite significant challenges, this site is a viable candidate for successful remediation. Positive indicators include:

Site Background

This assessment covers a Sudan grass experimental growth plot in El Paso. Soil and water samples were collected on February 13, 2026 from the plot area (0-7" depth) along with a well water sample from the irrigation source serving this field.

Irrigation Source

The site is irrigated with well water. Laboratory analysis reveals severely elevated salinity (EC 5.5 mmhos/cm, TDS 4,400 mg/L) with high sodium (772.5 mg/L, SAR 10.72) and chloride (1,260 mg/L). This water quality is an ongoing and primary management concern for crop production at this site. A detailed water analysis is presented in the Diagnostic Findings section below.

Sample Inventory

Lab ID	Field ID	Sample ID	Depth	Analysis	Date
2214	SR-13FEB26	SUDAN-001	0-7"	Soil Chemistry	2/18/2026
2214	SR-13FEB26	SUDAN-001	0-7"	Haney Soil Health	2/18/2026
2214	SR-13FEB26	SUDAN-001	0-7"	PLFA Microbial	2/18/2026
31	SR-13FEB26	SUDANWELL-001	-	Water Chemistry	2/18/2026

Diagnostic Findings

Soil Chemistry

Parameter	SUDAN-001	Optimal
pH	8.3	6.0-7.0
EC (mmho/cm)	0.28	<1.0
Organic Matter (%)	1.7	3.0-5.0
Excess Lime	HIGH	None-Low
CEC (me/100g)	22.8	-
Sodium (ppm)	125	<50
Sodium (% Base Sat.)	2%	<3%
Phosphorus (ppm)	36	>25
Potassium (ppm)	263	>150

Interpretation:

pH: The soil is strongly alkaline (pH 8.3) with HIGH lime buffering, meaning pH correction will be slow and difficult. At this pH, micronutrient availability is significantly reduced.

Sodium: At 125 ppm (2% base saturation), sodium is above the critical threshold of 100 ppm. This is consistent with irrigation using high-sodium water and requires active management.

Organic Matter: At 1.7%, organic matter is below the minimum target of 3.0%. This limits the soil's capacity to support microbial communities and cycle nutrients.

Micronutrient Availability

Iron (5 ppm) and manganese (2.4 ppm) are limited by the alkaline pH. At pH > 7.5, these nutrients convert to plant-unavailable forms regardless of total concentration. Sudan grass is moderately tolerant but still at risk of interveinal chlorosis without targeted micronutrient management. Standard soil-applied iron is ineffective at this pH; chelated forms (Fe-EDDHA) are required. Zinc at 0.81 ppm is deficient.

Irrigation Water Quality

Parameter	Value	Threshold / Notes
pH	7.4	6.5-8.4 normal
EC (mmhos/cm)	5.5	<0.75 none; >3.0 severe
TDS (mg/L)	4,400	<500 ideal; >2000 severe
Sodium (mg/L)	772.5	<70 ideal; >200 severe
SAR	10.72	<6 low; >12 severe sodicity
Adj. SAR	12.45	Carbonate-adjusted
Chloride (mg/L)	1,260	<140 none; >350 severe
Boron (mg/L)	0.5	<0.7 none; >2.0 severe
Bicarbonate (mg/L)	136.2	<120 normal

Interpretation:

This irrigation water is unsuitable for agricultural use without active salt management. EC of 5.5 mmhos/cm (TDS 4,400 mg/L) exceeds severe restriction thresholds by a wide margin. Sodium at 772.5 mg/L with a SAR of 10.72 (Adj. SAR 12.45) creates direct sodicity risk, degrading soil structure over time. Chloride at 1,260 mg/L is toxic to most crops through both root absorption and foliar contact.

Continued use of this water without leaching fraction irrigation, gypsum application, and regular soil monitoring will result in progressive salinization of the root zone.

Soil Health Indicators (Haney Test)

Parameter	SUDAN-001	Interpretation
Soil Respiration (ppm CO ₂ -C)	23.1	Moderate (10-30)
Soil Health Calculation	5.53	Below threshold (>7.0)
Microbially Active C (%)	20.9	Below ideal (50-75%)
C:N Ratio	11.12	Good (8-15 ideal)
Available N (lbs/A)	30.7	Haney-estimated plant-available N
Available P (lbs/A)	22.7	Haney-estimated plant-available P

Soil respiration of 23.1 ppm falls in the moderate range (10-30 ppm), indicating microbial activity is present but limited. The Soil Health Calculation of 5.53 is below the 7.0 threshold. Microbially active carbon at 20.9% is well below the ideal 50-75% range, confirming that most soil organic carbon is in recalcitrant forms that do not support active biology.

Positive indicator:

The C:N ratio of 11.12 is within the ideal range (8-15), meaning organic amendments added to this soil will be metabolized efficiently without nitrogen immobilization.

Microbial Community (PLFA Analysis)

Parameter	SUDAN-001	Reference
Total Biomass (ng/g)	1099.7	BELOW AVERAGE (>1500 Good)
AMF (Mycorrhizal Fungi)	31.8	Present and active (>20 Good)
Protozoa	0.0	Absent - should be present
Fungi:Bacteria Ratio	0.2245	ABOVE AVERAGE (0.25-0.50 Good)
Overall Rank	ABOVE AVERAGE	-

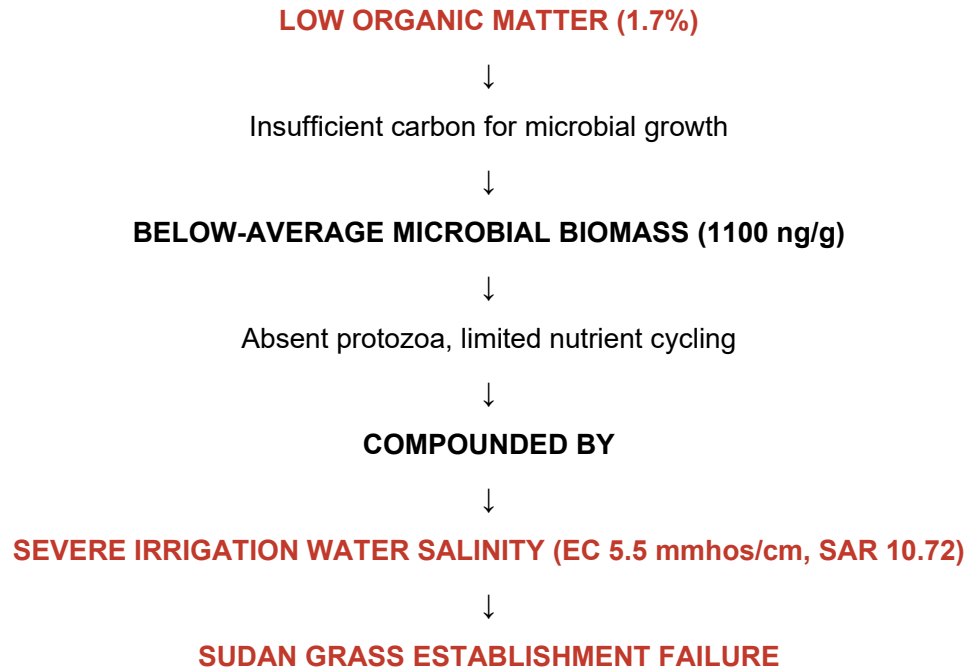
Zero protozoa detected. Missing bacterial grazers impair nitrogen mineralization and reduce nutrient cycling efficiency in the root zone.

Interpretation:

Microbial biomass of 1100 ng/g is below average, consistent with the low organic matter levels. AMF is present at 31.8 ng/g, which is a positive indicator for grass nutrient uptake. Zero protozoa indicates an incomplete soil food web. The existing microbes are metabolically active (low stress indicators), meaning the limitation is population size, not community health. Increasing carbon inputs will support biomass expansion.

Root Cause Analysis

The diagnostic findings reveal the following hierarchy of constraints:



The primary soil constraint is low organic matter driving limited microbial biomass and an incomplete food web. The secondary and more acute constraint is the irrigation water quality, which will accumulate sodium and chloride in the root zone with every irrigation event. Both must be addressed simultaneously.

Recommendations

Priority 1: Irrigation Water Management

The irrigation water source is the single greatest risk to this site. At EC 5.5 mmhos/cm with SAR 10.72, every irrigation event adds salt load to the root zone. Without mitigation, soil sodicity will increase regardless of other interventions.

Aurum Tech recommends: leaching fraction irrigation (15-20% above crop ET), gypsum application to supply calcium and improve infiltration, monitoring soil EC and sodium at regular intervals, and evaluation of alternative or blended water sources where feasible.

Priority 2: Carbon Restoration

At 1.7% organic matter, the soil cannot sustain the microbial populations needed for nutrient cycling. Aurum Tech recommends a biochar-based carbon restoration strategy. Biochar addresses multiple constraints simultaneously: permanent increase in soil organic carbon, porous structure providing microbial habitat, improved water-holding capacity, increased cation exchange capacity, and buffering of ionic stress from saline irrigation. Combined with quality compost, this approach builds long-term soil function rather than perpetuating a high-input fertilizer cycle.

Priority 3: Micronutrient Management

At pH 8.3 with HIGH lime, iron and manganese are unavailable to plants. Fe-EDDHA chelate is required for effective iron delivery. Zinc supplementation is recommended. Foliar applications may be needed during active growth if chlorosis symptoms appear.

Expected Outcomes

With proper implementation of carbon restoration and water management, Aurum Tech expects:

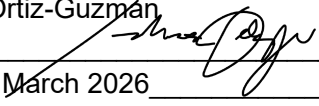
Timeline

Estimated timeline from authorization to plantable conditions: 10-12 weeks, including amendment charging, incorporation, and soil equilibration. Water management must begin immediately and continue indefinitely given the water source quality.

Next Steps

Aurum Tech recommends the following immediate actions:

Dr. Joshua Ortiz-Guzman

Signature: 

Date: 30 March 2026

Prepared by Aurum Tech, LLC | El Paso, Texas | February 2026

Appendix: Complete Analytical Data

The following tables contain the full laboratory datasets for reference. Key parameters discussed in the body of this report are highlighted.

A. Standard Soil Chemistry

Lab #2214 | Sample: SUDAN-001 | Depth: 0-7" | Field: SR-13FEB26

Parameter	Value	Units	Method
Soil pH	8.3	S.U.	1:1 H2O
Excess Lime	HIGH	-	Rating
Soluble Salt (EC)	0.28	mmho/cm	1:1 H2O
Organic Matter	1.7	% LOI	LOI
Nitrate-N	5.3	ppm	1N KCl
Nitrate-N	11	lbs/A	1N KCl
Phosphorus	36	ppm	M3
Potassium	263	ppm	NH4OAc
Calcium	3867	ppm	NH4OAc
Magnesium	272	ppm	NH4OAc
Sodium	125	ppm	NH4OAc
CEC	22.8	me/100g	NH4OAc
Base Saturation	100%	%	NH4OAc
% Ca	85%	% Sat.	NH4OAc
% Mg	10%	% Sat.	NH4OAc
% K	3%	% Sat.	NH4OAc
% Na	2%	% Sat.	NH4OAc
Sulfur	47.47	ppm	M3
Zinc	0.81	ppm	DTPA
Iron	5	ppm	DTPA
Manganese	2.4	ppm	DTPA
Copper	0.92	ppm	DTPA
Boron	0.38	ppm	H2O

B. Haney Soil Health Analysis

Lab #2214 | Sample: SUDAN-001 | Depth: 0-7"

Nitrogen (H3A + H2O Extracts)

Parameter	Value	Units	Notes
Nitrate-N (H3A)	5.4	ppm	
Ammonium-N (H3A)	0.8	ppm	
Inorganic N	6.3	ppm	NO3-N + NH4-N
Total N	16	ppm	
Organic N	10	ppm	
Org N : Inorg N	1.66	-	
Org N Released (H2O)	8.3	ppm	Water-extractable
Org N Reserve	1.7	ppm	
Available N	30.7	lbs/A	Estimated plant-available

Phosphorus (H3A Extract)

Parameter	Value	Units	Notes
Total P	10.6	ppm	
Inorganic P (PO4-P)	8.6	ppm	
Organic P	2	ppm	
Org P Released	1.2	ppm	
Org P Reserve	0.7	ppm	
Available P	22.7	lbs/A	Estimated plant-available

Soil Health Metrics (H2O Extract)

Parameter	Value	Units	Notes
Soil Respiration	23.1	ppm CO2-C	>30 good
Organic C	111	ppm C	
Microbially Active C	20.9	%	50-75% ideal
C:N Ratio	11.12	-	8-15 ideal
Soil Health Calculation	5.53	-	>7 good

Fertility (H3A Extract)

Parameter	Value	Units	Notes
Potassium	159	ppm	
Calcium	2629	ppm	

Magnesium	178	ppm	
Sodium	108	ppm	
Zinc	0.03	ppm	
Manganese	2.3	ppm	
Iron	7	ppm	
Copper	0.08	ppm	
Aluminum	16	ppm	
Sulfur	27.01	ppm	

C. PLFA Microbial Community Analysis

Lab #2214 | Sample: SUDAN-001 | Depth: 0-7" | Overall Rank: ABOVE AVERAGE

Biomass & Community Breakdown

Functional Group	Value	% Biomass	Rank
Total Biomass	1099.70 ng/g	-	BELOW AVERAGE
Diversity Index	1.433	-	GOOD
Total Bacteria	448.78 ng/g	40.81%	
Gram +	147.76 ng/g	13.44%	
Actinomycetes	84.58 ng/g	7.69%	
Gram -	216.44 ng/g	19.68%	
Total Fungi	100.76 ng/g	9.16%	
AMF	31.76 ng/g	2.89%	
Saprophytic	69.00 ng/g	6.27%	
Protozoa	0.00 ng/g	0.00%	
Undifferentiated	550.16 ng/g	50.03%	

Community Ratios

Ratio	Value	Rank	Notes
Fungi:Bacteria	0.2245	ABOVE AVERAGE	0.25-0.50 Good
Protozoa:Bacteria	All Bact	VERY POOR	Predator-prey activity
Gram+:Gram-	1.0735	IDEAL	~1.0 ideal

Stress Indicators

Indicator	Value	Rank	Interpretation
Sat:Unsat	2.1255	LOW	Low = healthy
Mono:Poly	36.0311	GOOD	Membrane fluidity
Pre 16:Cyclo 17	All Pre16:1	VERY ACTIVE	Active precursors = low stress
Pre 18:Cyclo 19	20.2955	ACTIVE	Active precursors = low stress

D. Irrigation Water Chemistry

Lab #31 | Sample: SUDANWELL-001 | Field: SR-13FEB26

Analyte	Value	Units
pH	7.4	-
Electrical Conductivity	5.5	mmhos/cm
Est. Total Dissolved Solids	4,400	mg/L
Nitrate-N	1.9	mg/L
Calcium	275	mg/L
Magnesium	72	mg/L
Total Hardness	983	mg/L
Potassium	15.3	mg/L
Sodium	772.5	mg/L
Sulfur	262.8	mg/L
Iron	0.01	mg/L
Chloride	1,260	mg/L
Boron	0.5	mg/L
Carbonate	0	mg/L
Bicarbonate	136.2	mg/L
Total Alkalinity	111.6	mg/L
SAR	10.72	-
Adj. SAR	12.45	-