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Field Study Summary
"La Rivera"

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1 Introduction

During the 2023–2024 summer season, severe drought in the Santa Cruz region highlighted the urgent need for innovative agricultural solutions. On the farm at La Rivera, **the study aimed to restore arable land, improve crop productivity, and regenerate degraded soils.** The producer faced low yields due to acidic soils, low organic matter, and poor moisture retention, severely affecting cultivation. The study focused on applying our biochar amendment, particularly to the most degraded soils, while leaving other sections as a control to evaluate and compare its performance under these challenging conditions.

2.1 Location

La Rivera, located in the **Concepción municipality** of the Santa Cruz region, Bolivia. **Rainfall in Concepción was critically low**, dropping to 236.6mm in November and 83.4mm in December, compared to normal precipitation levels exceeding 200mm per month. **The soils at La Rivera were highly degraded, characterized by high acidity (pH 5.2), low organic matter (15 mg per dm³), and poor moisture retention.** While droughts do not directly cause acidity or reduce organic matter, they exacerbate soil degradation by reducing vegetation growth, organic inputs, and increasing vulnerability to erosion.

2.2 Location Details

Country	Bolivia
State	Santa Cruz
Municipality	Concepcion
Farm	La Rivera

2.3 Soil Health

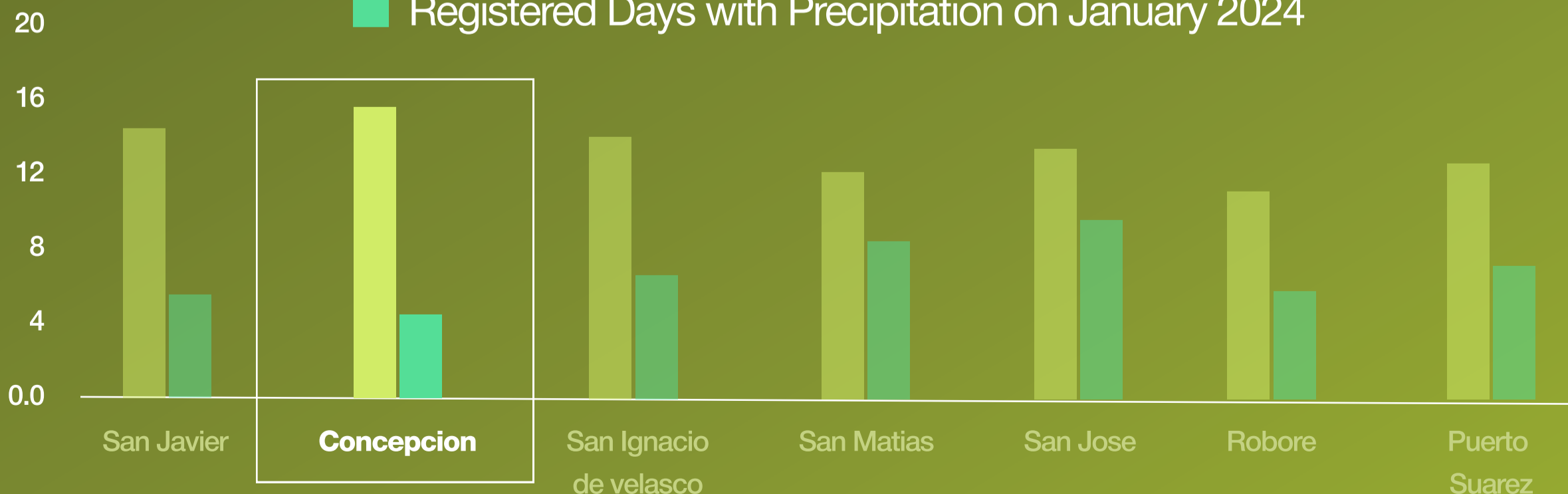| PARAMETERS	UNITS	TEST
pH (H20)	-	**5.2**
Acidity (Al)	mmolc dm3	3
H + Al	mmolc dm3	36
Nitrogen (N)	%	0.068
Phosphorus (P)	mg dm3	3
Potassium (K)	mmolc dm3	1.8
Sulfur (S)	mg dm3	5
Organic Matter	mg dm3	**15**
Copper (Cu)	mg dm3	0.5
Zinc (Zn)	mg dm3	0.7
Iron (Fe)	mg dm3	33
Boron (B)	mg dm3	0.35
Sand	%	65.32
Clay	%	22.12
Silt	%	12.56
Texture	-	FYA

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2.4 Precipitation

Total Precipitation (mm) on January 2024

- Average Precipitation on January
- Registered Precipitation on January 2024

Y-axis: 250, 200, 150, 100, 50, 0.0

Categories: San Javier, **Concepcion**, San Ignacio de velasco, San Matias, San Jose, Robore, Puerto Suarez
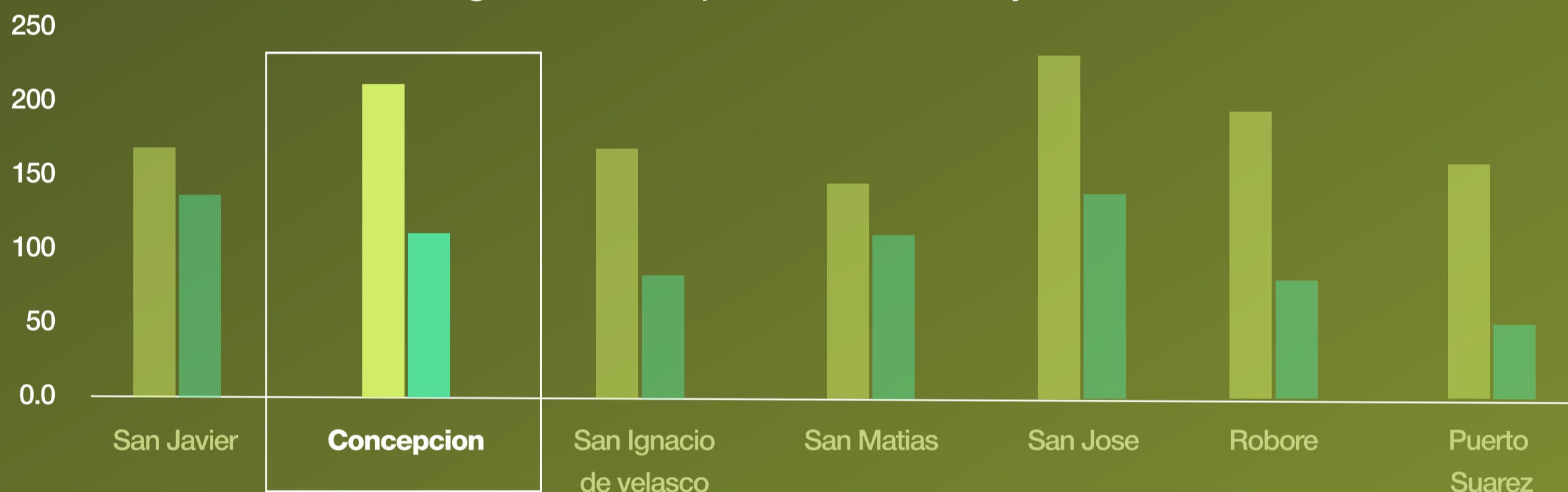
Days with Precipitation on January 2024

- Average Days with Precipitation on January
- Registered Days with Precipitation on January 2024

Y-axis: 20, 16, 12, 8, 4, 0.0

Categories: San Javier, **Concepcion**, San Ignacio de velasco, San Matias, San Jose, Robore, Puerto Suarez

3.1 Preparation & Planting

The study at La Rivera focused on evaluating the impact of our Biochar on soil health and crop yield under challenging drought conditions. The evaluation was conducted within 10-hectare area, incorporating precise application techniques with biochar to ensure optimal soil integration. **Soybean planting followed established agricultural best practices, and fertilization was uniformly applied across treated and control plots to maintain consistency in comparative results.** The experiment emphasized sustainable practices to address soil degradation and enhance moisture retention.

3.2 Application, Planting & Fertilization

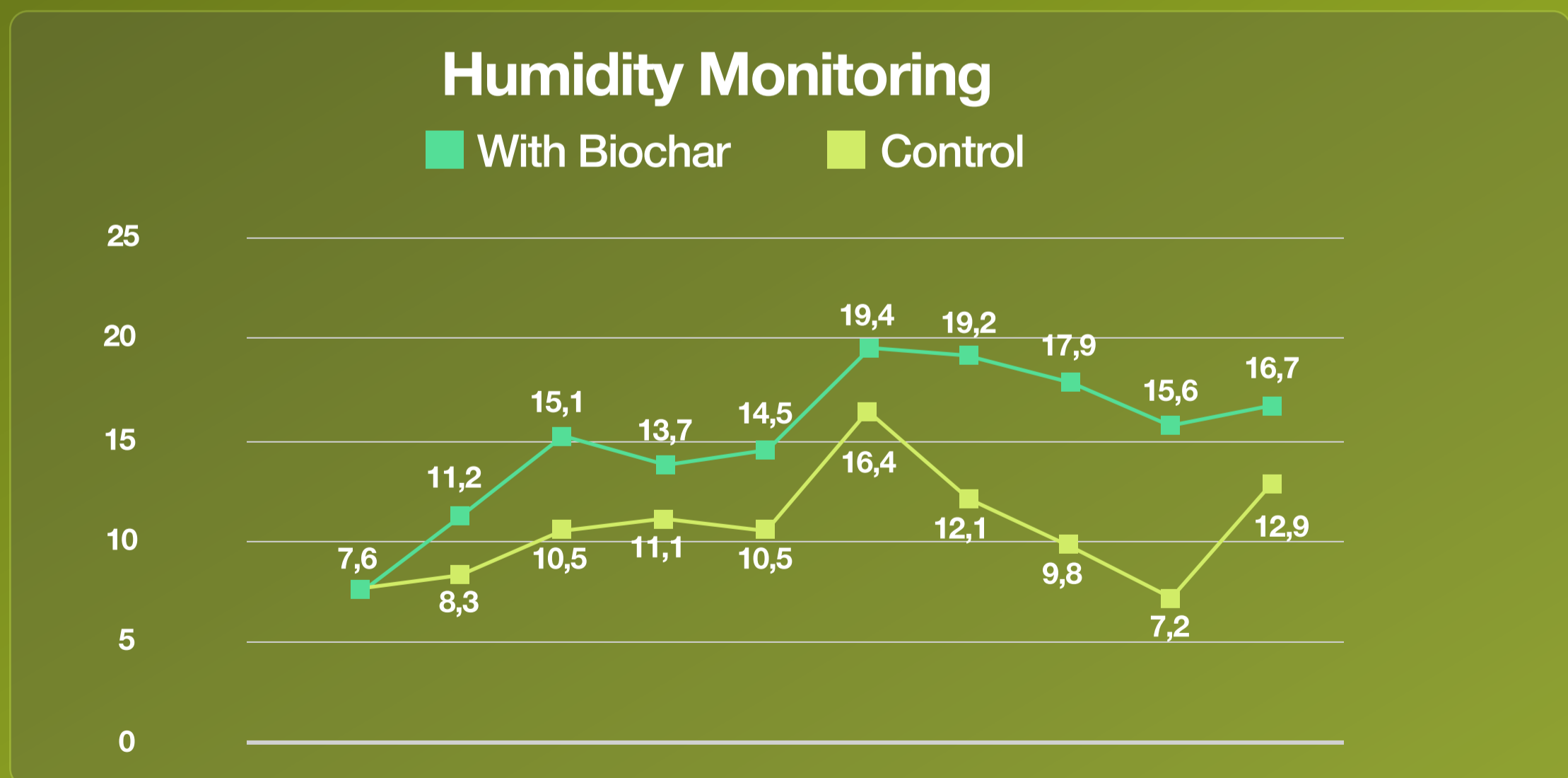|	**Treated Plot with Biochar**	**Control Plot no Biochar**
APPLICATION		
Biochar Application Rate	4.5 tons ha-1	N/A
Method	Mech. Spreader	N/A
Timing	Applied 30 days before planting & incorporated with row plow	N/A
PLANTING		
Crop	SoyBean	SoyBean
Planting Date	Dec / 1 /2023	Dec / 1 /2023
Seed Density	65 kg ha-1	65 kg ha-1
Row Spacing	40 cm	40 cm
FERTILIZATION APPLICATION		
Rate	150 kg ha-1	150 kg ha-1
Formula	7.5N-36P-11K + 1S + microelements	7.5N-36P-11K + 1S + microelements

4.1 Monitoring & Results

The monitoring and results highlightsrr the effectiveness of biochar in enhancing soil moisture retention, improving crop growth, and significantly increasing soybean yields under drought conditions. Regular soil and crop monitoring ensured precise tracking of biochar integration and performance throughout the trial. The final harvest demonstrated a marked improvement in yield, particularly in biochar-treated areas, showcasing its potential as a regenerative agricultural solution. Comparative results between control and treated plots underscored the benefits of biohar in mitigating environmental stressors like drought.

4.2 Monitoring & Tracking

- **Soil Monitoring:** Regular assessments were performed to evaluate the integration and behavior of our biochar within the soil profile (0–20 cm depth).
- **Moisture Retention:**
  - Observation: Higher moisture levels were observed in biochar-treated soils compared to control plots.
  - Measurement: Soil moisture levels were monitored using in situ sensors, confirming superior water retention in treated plots.
- **Crop Growth:** Enhanced crop vigor and growth were consistently noted in Biochar-treated plots

Humidity Monitoring

■ With Biochar   ■ Control

With Biochar: 7,6 · 11,2 · 15,1 · 13,7 · 14,5 · 19,4 · 19,2 · 17,9 · 15,6 · 16,7

Control: 7,6 · 8,3 · 10,5 · 11,1 · 10,5 · 16,4 · 12,1 · 9,8 · 7,2 · 12,9

Monitoring was conducted weekly, starting from January 1, 2024.

4.3 Results

Harvest
- Harvest Date: April 2, 2024.
- Performance:
  - Soybean yield in Biochar-treated plots showed significant improvements over the control plots.

Field Trial		Precipitation (mm)	Height (cm)	Yields in (kg ha$_{-1}$)
T1 (Control)	■	470	58.52	**1305**
T2 (Biochar)	■	470	71.18	**1983**

SoyBean Performance

■ Control   ■ With Biochar
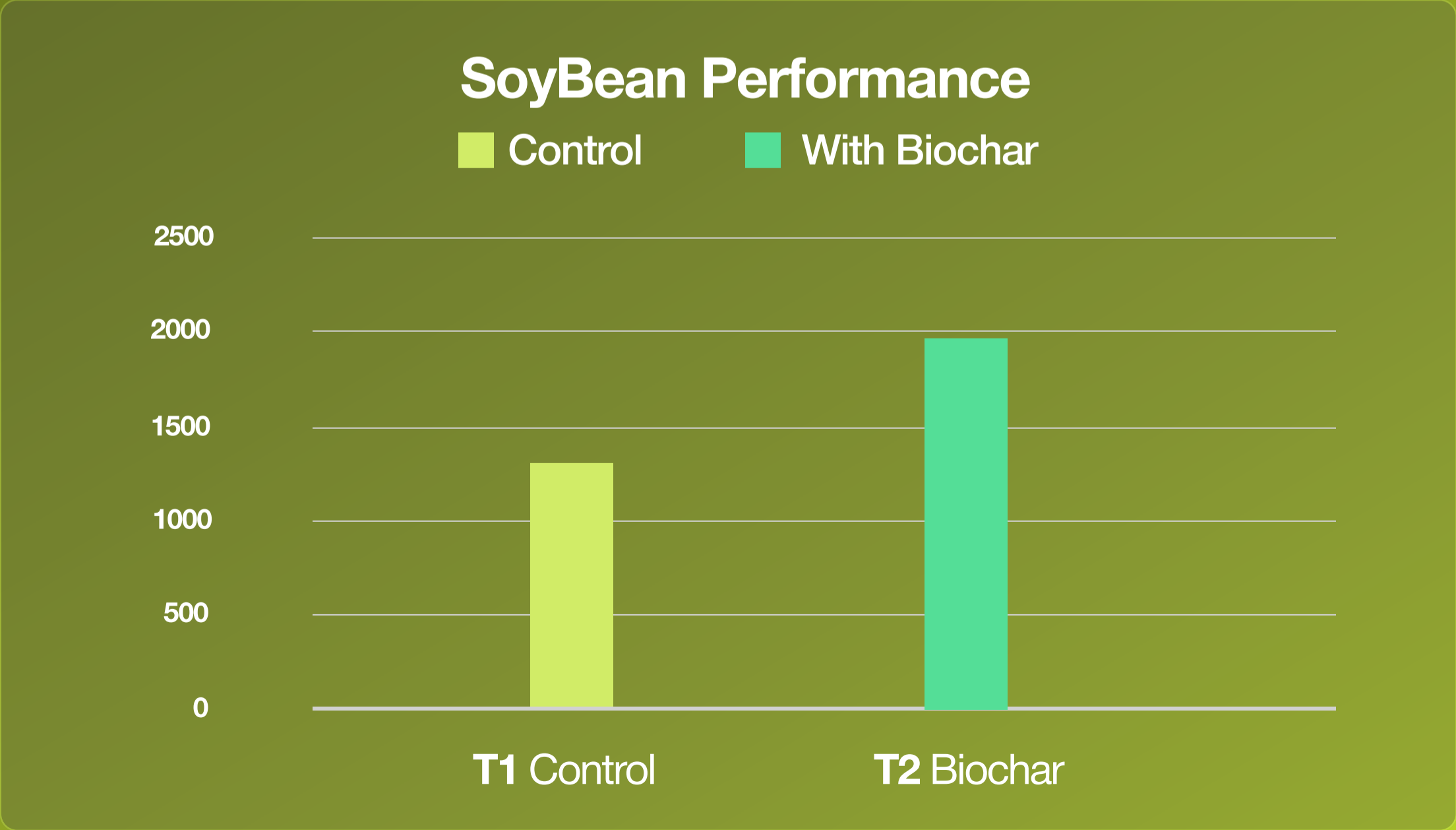
5 Conclusion

The application of biochar in the La Rivera trials demonstrated significant benefits in improving soybean yields, even under challenging drought conditions. **Compared to the control, biochar-treated area achieved a yield increase of 678 kg per ha, showcasing a significant improvement in productivity.** This improvement is attributed to Biochars ability to enhance soil moisture retention and nutrient availability, mitigating drought stress and fostering better crop growth and vigor. These findings underscore biochar's potential as an innovative solution for regenerative agriculture, offering a sustainable approach to combating soil degradation, improving productivity, and building resilience against climate challenges in Bolivia.