sheetalthakur2912@gmail.com

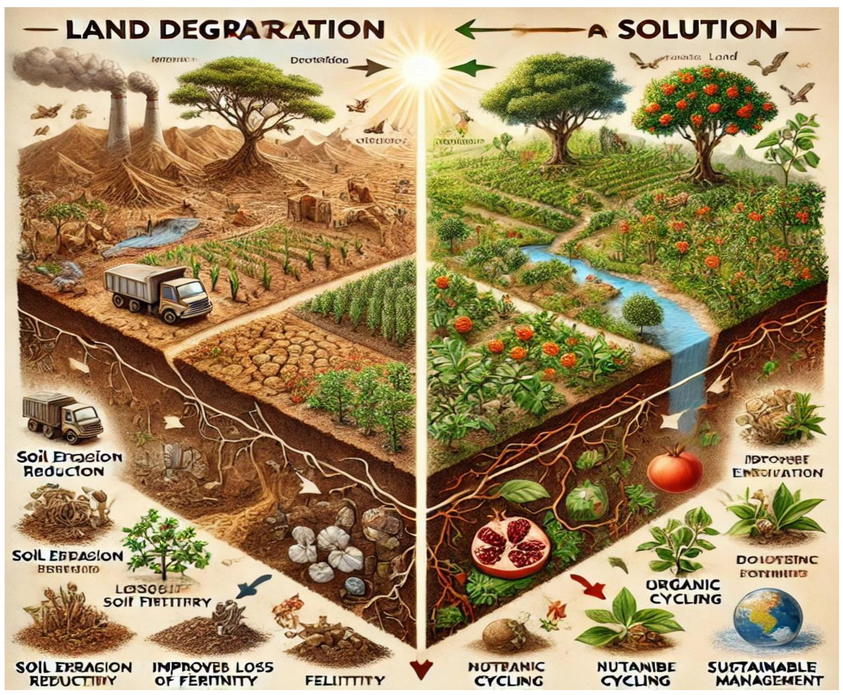
Agroforestry as a mitigatory tool for land degradation: Effect of organic manures on soil physicochemical properties in a newly established wild pomegranate based agroforestry system

Ms. Sheetal Thakur[1], Dr KS Pant[2], Dr Prem Prakash[1], Dr Harish Sharma [3]

[1] Department of Silviculture and Agroforestry, Dr Yashwant Singh Parmar University Of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, 173230, India
[2] Additional Director, Veer Chandra Singh Gharwali Uttarakhand University of Horticulture and Forestry, Bharsar, Puri Gharwal, Uttrakhand, 246123, India
[3] Assistant Professor, Department of Agriculture Sciences, DAV University Jalandhar

Introduction

- Land is a non-renewable resource essential for human development, supporting our need for food, shelter, and growth.[1]
- However, since the 20th century, land degradation has rapidly increased due to environmental damage, population growth, urbanization, industrial expansion, and unsustainable land use. [2]
- This degradation has become a critical environmental, social, and economic problem worldwide.
- Sustainable land management practices, such as agroforestry, are promising solutions for restoring degraded lands and maintaining soil health. [3]
- Therefore this study was conducted with the aim to evaluate the effects of organic manures on soil physicochemical properties within a newly established wild pomegranate-based agroforestry system on land that had been abandoned for several years.



Objectives Of The Study

To assess the effects of organic manures on soil physicochemical properties in a degraded land

And compare changes in the soil properties before and after the experiment

Why do we need organic manures for soil health improvement

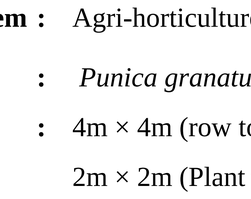
Inorganic Manures → **Degrade soil in long run**

Inorganic manures are synthetic fertilizers that provide essential nutrients to plants quickly but can harm soil health and the environment if overused.

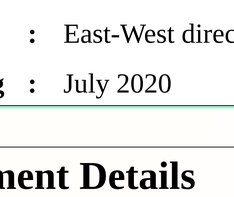
Over the time, inorganic manures can deplete soil organic matter, disrupt microbial ecosystems, and cause soil acidification, reducing long-term soil fertility.

Organic Manures as a sustainable alternates to improve soil health

1. Promote soil microbial activity
2. Increase nutrient availability for plants
3. Enhance soil fertility and productivity
4. Enhance soil resilience to environmental stresses
5. Enhance soil water-holding capacity
6. Mitigate climate change by sequestering carbon
7. Reduce soil erosion and compaction
8. Mitigate climate change by sequestering carbon
9. Reduce dependence on synthetic fertilizers



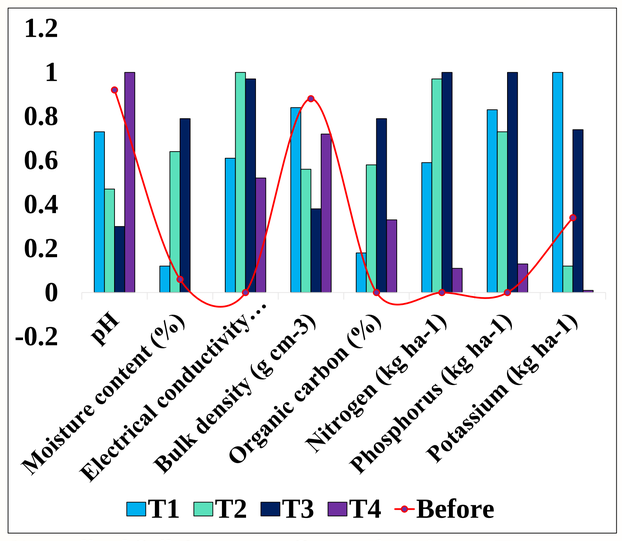
Degraded soil



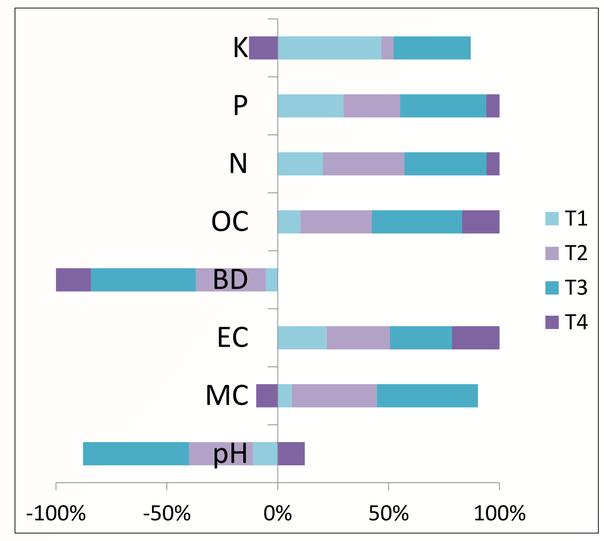
Application of organic manures make degraded soil fertile

Experimental Results

Sr. No.	Parameters	Before experiment	After Experiment			
			T1	T2	T3	T4
1	pH	7.47	7.373	7.208	7.045	7.582
2	Moisture content (%)	4.56	4.688	5.352	5.499	4.359
3	Electrical conductivity (dS m^{-1})	0.15	0.409	0.53	0.523	0.395
4	Bulk density (g cm^{-3})	1.24	1.231	1.18	1.154	1.206
5	Organic carbon (%)	0.38	0.445	0.566	0.621	0.483
6	Available Nitrogen (kg ha^{-1})	232.06	297.397	350.187	351.232	250.88
7	Available Phosphorus (kg ha^{-1})	36.74	61.351	58.025	68.858	41.776
8	Available Potassium (kg ha^{-1})	220.79	289.296	228.816	271.824	201.768



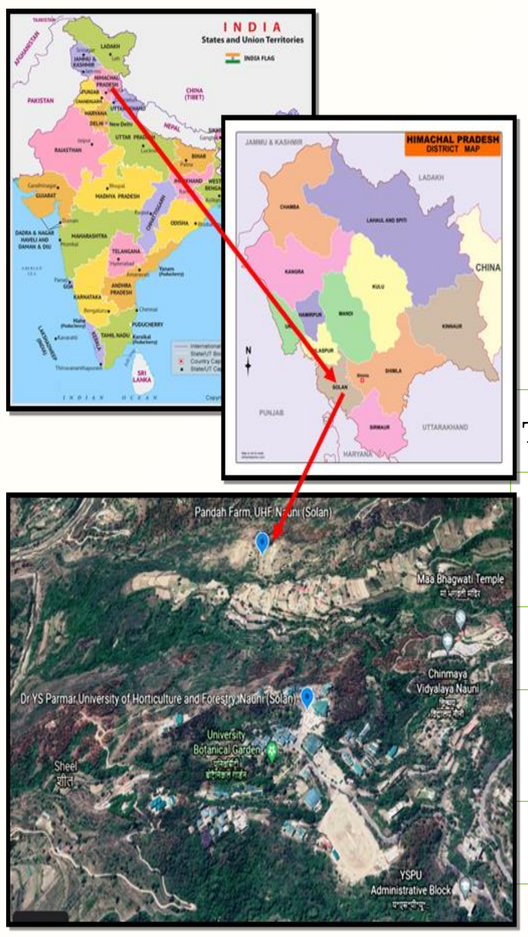
Normalized Soil Parameter Comparison Across Treatments



% Change In Soil Parameters After The Experiment

Methodology

Study area



Agroforestry system	:	Agri-horticulture
Tree species	:	*Punica granatum*
Spacing	:	4m × 4m (row to row) 2m × 2m (Plant to Plant)
Direction	:	East-West direction
Year of planting	:	July 2020

Treatment Details

Treatment	
T1	Recommended dose of fertilizers (RDF) RDF (pea): NPK 25:60:60 kg ha-1
T2	FYM (on nitrogen equivalent ratio i.e. 50 quintal ha-1)
T3	Goat manure (on nitrogen equivalent ratio i.e. 8.33 quintal ha-1)
T4	Control (without any fertilizer)

Newly planted wild pomegranate seedlings before the start of experiment

Intercropping of *Pisum sativum* in which treatments were applied during the experiment

Harvest stage of field crop with enhanced growth in wild pomegranate seedlings at the end of the experiment

Conclusion

The study demonstrated a significant improvement in soil quality parameters before and after the implementation of the agroforestry system, indicating its positive impact on soil health. Among the treatments, the application of organic manures resulted in a notably greater enhancement of soil quality compared to other treatments. Overall, the findings suggest that the integration of agroforestry practices, coupled with the use of organic manures, effectively contributes to the improvement of soil health, reinforcing their potential as sustainable land management strategies.

Future Plans

These enhancements contribute to a more favorable environment for plant growth and overall soil health. The model can be a potential land use system economically as well as ecologically for the region but needs more elaborative studies over the longer period of time

References

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