

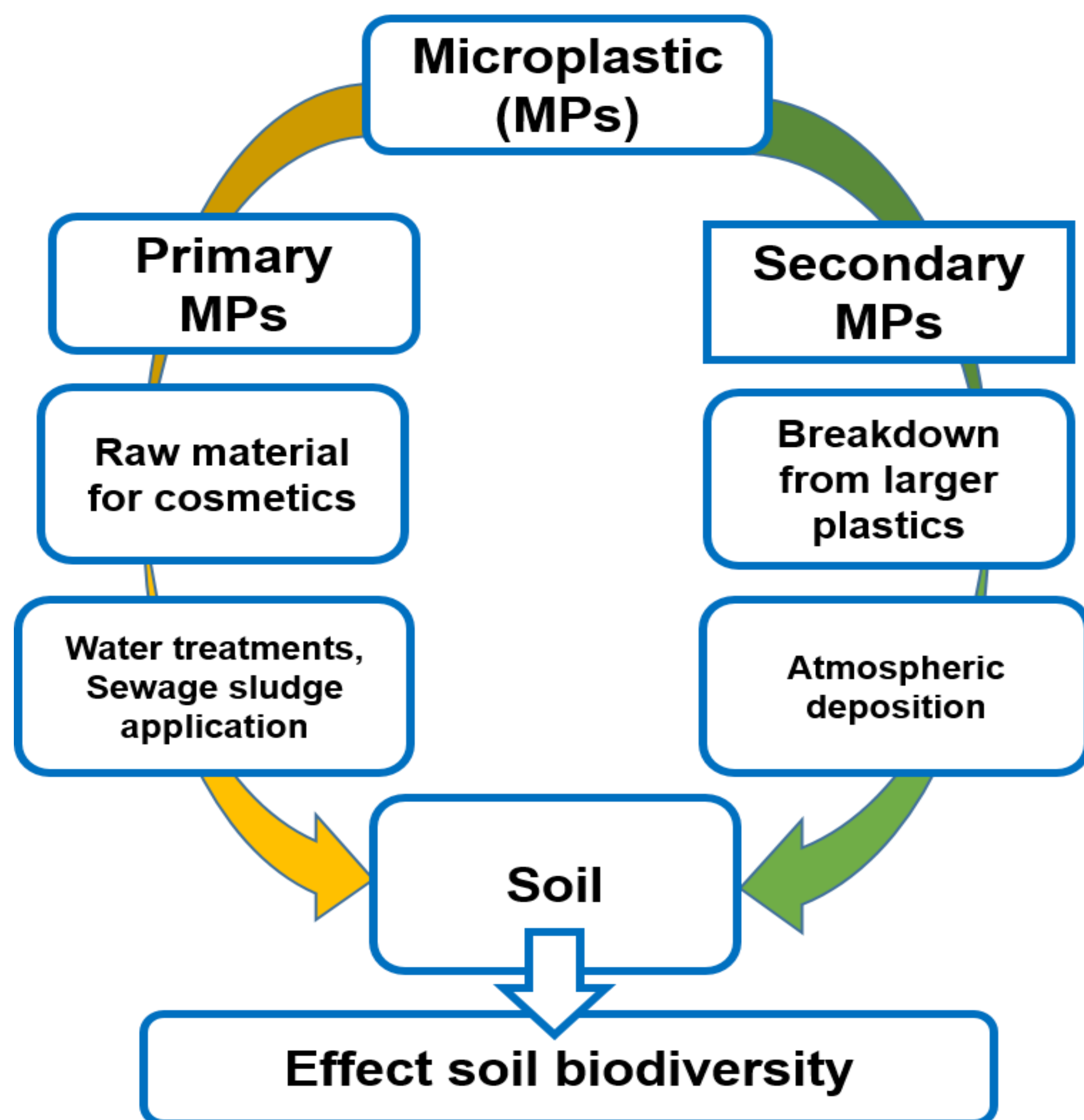
# Interactive effect of biochar and PVC microplastic on soil microbes and enzyme activity



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## Introduction



## Problem statement

Microplastic discharge to agricultural soil via sewage sludge and other pathway in terrestrial ecosystem is becoming an emerging issue due to less recycling than total plastics production. This is huge research gap and lack of information on effects of microplastics on plant and soil biodiversity.

## Objectives

- I. Investigation of polyvinyl chloride-microplastics (PVC-MPs) contamination effects on soil microbes and enzymes activity.
- II. To evaluate, if co-application of biochar with PVC-MPs can reduce/enhance their effects on microbes and soil enzymes activity.

## Materials & Methods

Material	Type	Size	Concentration
Microplastics	PVC (polyvinyl chloride)	<0.5 $\mu\text{m}$ – 10 $\mu\text{m}$	0.25% , 0.5%
Biochar	Cotton stalk (Pyrolysis 500°C)	1 $\mu\text{m}$ – 10 $\mu\text{m}$	0.5%

Soil enzyme activity



Microbial abundance



Phospholipids fatty acid analysis

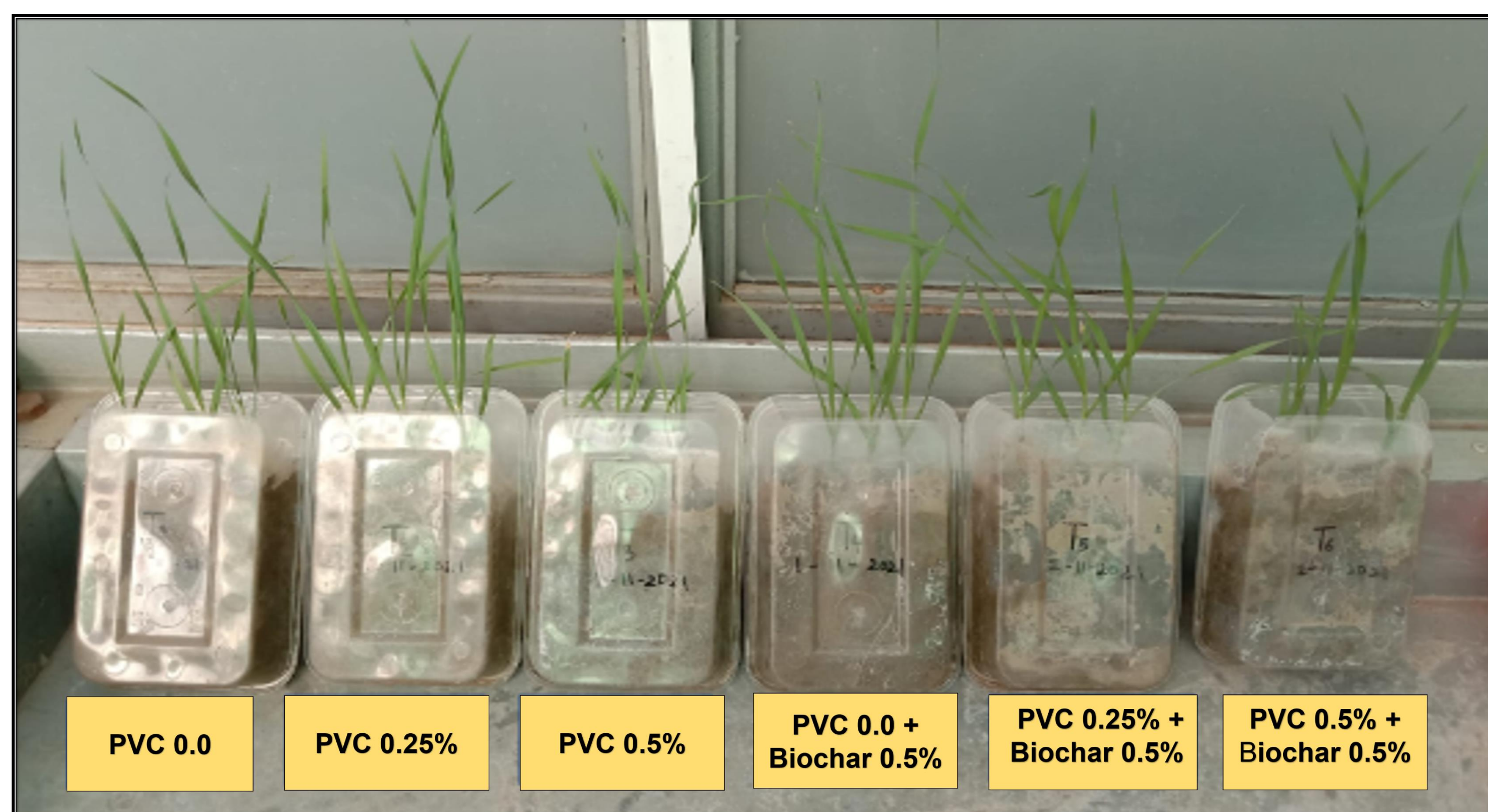


Figure 1. Experimental cultures (glasshouse studies) representing different treatments; PVC 0.0 (Control), PVC 0.25% (w/w), PVC-MPs 0.5% (w/w), Biochar 0.5% (w/w), PVC 0.25% + Biochar 0.5% (w/w), and PVC 0.5% + Biochar 0.5% (w/w)

## Results

PVC-MPs reduced the urease activity (-15.3%), Arbuscular mycorrhizal fungi AMF (-14.2%), bacterial abundance (-30.2%) and fungal abundance (-38.3%) (Figure 2).

However application of biochar with PVC-MPs alleviated the affect of the PVC-MPs and increased the urease activity, AMF, bacterial abundance and fungal abundance (Figure 2).

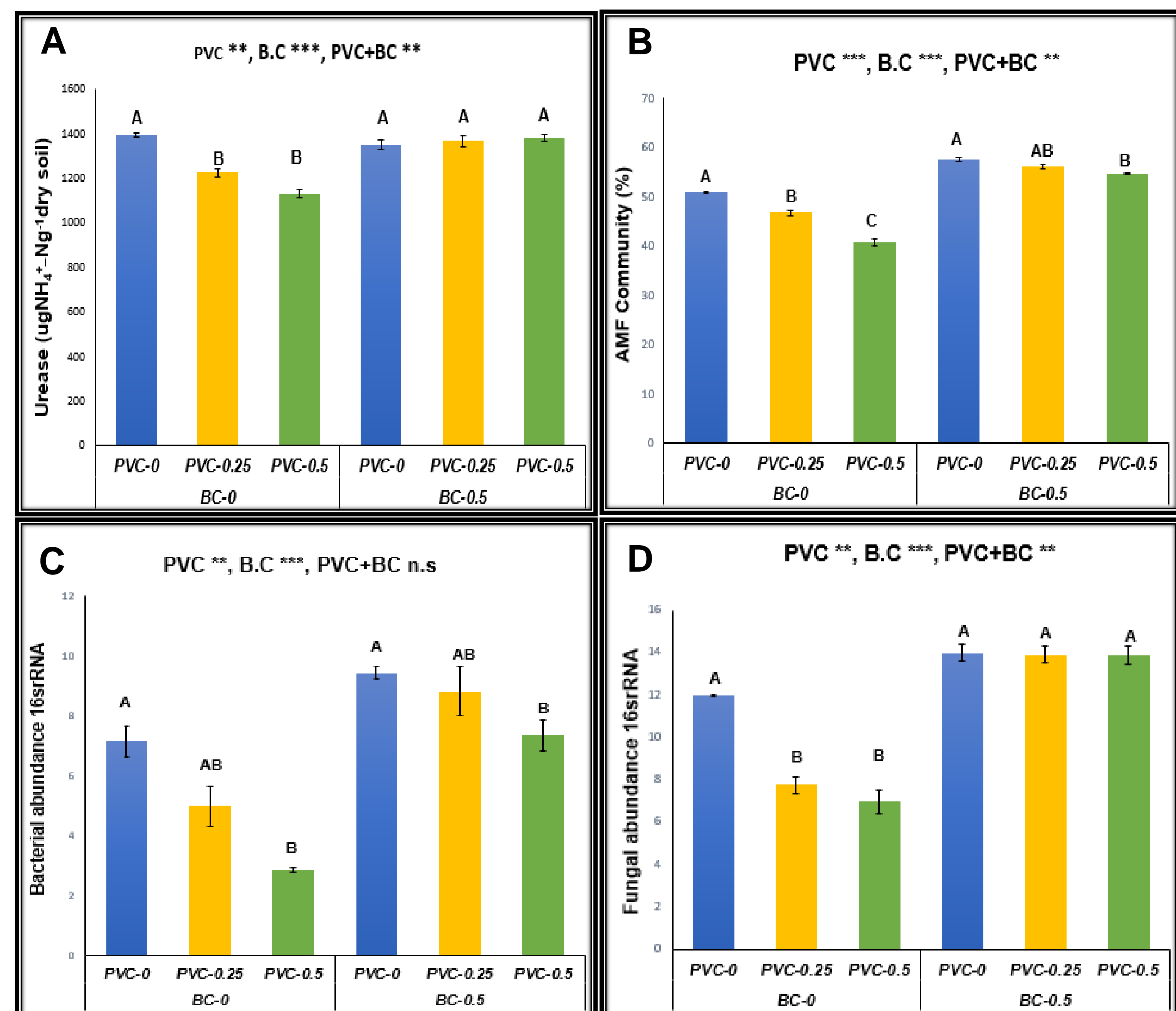


Figure 2. Effect of PVC-MPs and biochar on (A) urease activity, (B) AMF community, (C) bacterial abundance, and (D) fungal abundance. The vertical bars and their error bars are based on means  $\pm$  standard deviation ( $n = 3$ ). The lower and upper-case letters indicate the significant difference between without and with biochar treatment groups. Bars showing similar letters are not significantly different at  $p = 0.05$  %.

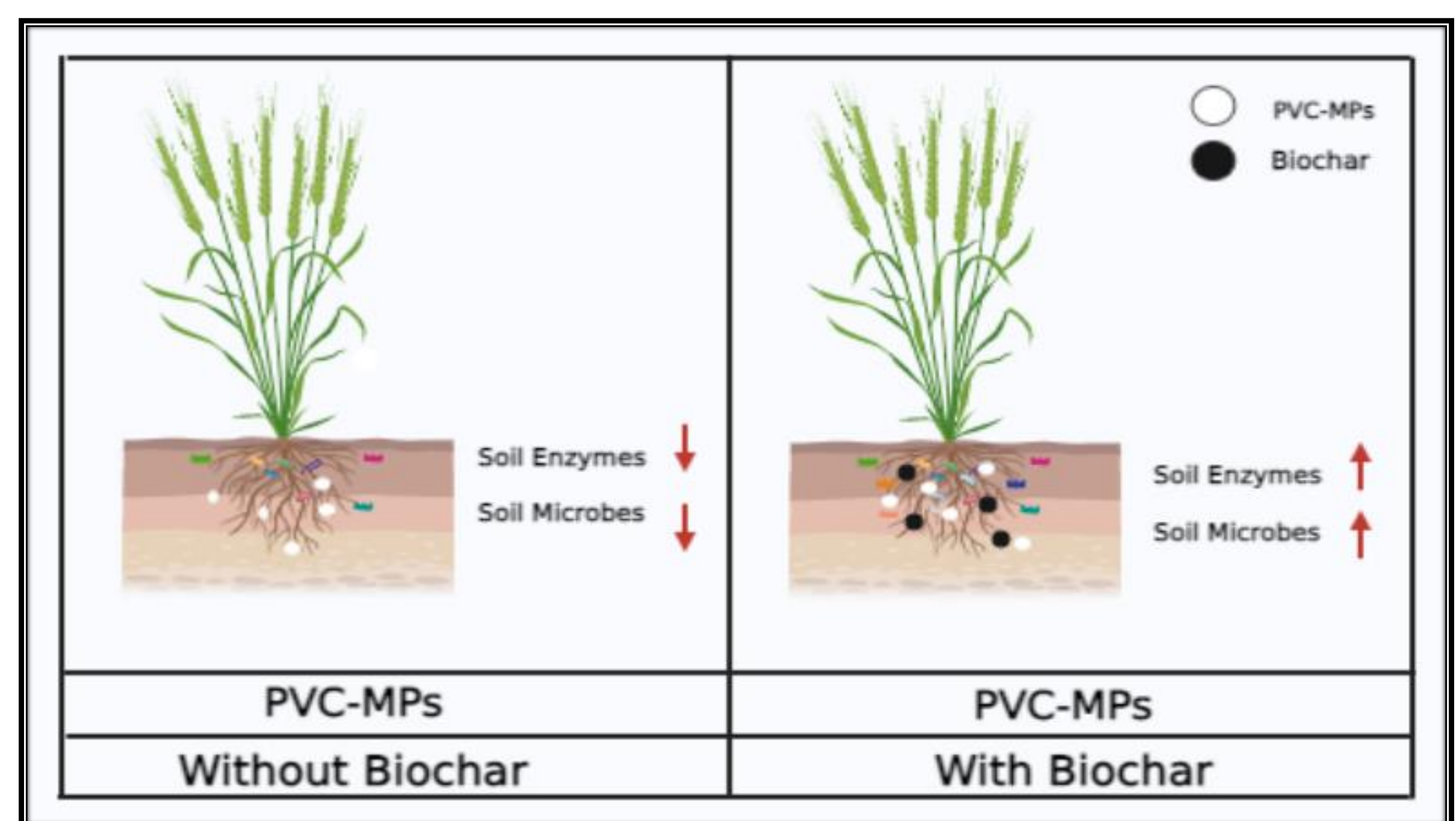


Figure 3: PVC-MP reduced the soil enzyme and soil microbes however biochar application with PVC-MPs increased the soil enzyme, and soil microbes .

## Conclusions

- PVC-MPs reduced the soil enzymes and microbial abundance.
- Biochar increased the bacterial and fungal community.
- Co-application of biochar with PVC-MPs alleviated hazardous effects and sustained the soil ecosystem services.