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Biochar Application - A Strategy to Sustain Soil Microflora in Chillies (*Capsicum frutescens* L.)

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Abstract: ***Soil is the most important natural resource with abundant variety of life. Growing population developmental progresses, use of chemical pesticides have detrimental effects on soil microflora which play significant role in crop productivity. Biochar application is an effective way to arrest the worsening of soil's biological health. Biochar amendment can alter soil's physico-chemical-biological properties. The objectives of this study are to determine the effect of chemical pesticide and biochar on the soil microfloral population in soil in chillies field. On application of biochar, the harmful effect of chemical pesticide on the soil microflora in the studied soil decreased significantly, the adsorption property of biochar is directly correlated with the increase in number of useful soil microflora. However, this enhanced the soil fertility and crop productivity.***

Keywords: Soil, chemical pesticides, soil microflora, leaching, biochar

1. Introduction

Soil is the thin outer veneer of the Earth between the top of the tree canopy and the bottom of groundwater aquifers. It is a vital resource teeming with variety of macro and micro flora and fauna. The health of soil has a direct relationship with agriculture. But exponentially growing population, man's progress towards development indiscriminate uses of chemicals in agriculture have considerably damaged the quality of soil especially resulted in the reduction of biodiversity. The study was carried out in one of the fields of Yemmiganur area of Kurnool District, Andhra Pradesh.. Pest attack is found to be more in chillies. Nearly 45% of total pesticide is used to combat pest attack on chilli. Myriad of pesticides use creates microbial imbalance, environmental pollution and health hazards. Plethora of soil microbes including bacteria, actinomycetes and fungi help in release of nutrients, transformation of organic matter and degradation of xenobiotics. Pesticides tend to have long persistence in the soil thereby disturbing soil microfloral health. Apart from various cropping practices, use of biochar has the potentiality to diminish the action of chemical pesticide on soil.

Biochar

Biochar is a stable carbon rich biomass obtained from sustainable sources through the process of pyrolysis. It can endure in soil for thousands of years with porosity and large surface area with absorption capacity. Biochar addition boosts soil fertility, alters soil pH, retains water, reduces emissions of greenhouse gases, prevents leaching of chemical pesticides and thereby sustaining the soil biota.

2. Materials & Methods

Kurnool District lies in the Rayalaseema region of Andhra Pradesh with scarce seasonal rainfall and high temperature. Due to extreme weather conditions and unseasonal rains pest attack on crops in our study area was quite high. So indiscriminate use of pesticide was a certain issue. This ultimately resulted in outbreak of secondary pests, development of pesticide resistance, contamination of ecosystem.

To study biochar application in order to sustain the soil microflora, Soil samples were collected from fields of chillies fields from a depth of 30 cm for soil microbial analysis to microbiology lab. Later biochar was mixed with the soil of a small plot (10ft × 10 ft) in the fallow land. Chilli seeds were sown in that plot and pesticide was also applied once on requirement. After one and half month soil sample from experimental plot was collected and tested in microbiology lab for assessing the richness of soil microflora. For microbial analysis dilution plate technique was followed. Nutrient agar for bacteria, MRB agar media for fungi and Kuster's and William's agar media for actinomycetes was used in the present study for isolation of soil microflora. The viable count of soil microflora was calculated in cfu/gm of soil.

3. Results and Discussion

Table 1: Enumeration of soil microflora obtained in different soil samples

S. No	Microbial Species	Land with chemical pesticide	Fallow land
I	**Fungi**		
1	*Aspergillus*	10	22
2	*Penicillium*	10	25
3	*Rhizopus*	13	23
4	*Fusarium*	15	19
5	*Alternaria*	10	16
6	*Trichoderma*	12	25
II	**Bacteria**		
1	*Rhizobium*	18	10
2	*Azospirillum*	9	6
3	*Azatobacter*	10	4
4	*Bacillus sp.*	11	5
5	*Pseudomonas fluorescens*	18	11

From the above table it can be assessed that fungal isolates are more in before pesticide application than the pesticide applied crops.

Table 2: Enumeration of soil microflora in experimental plots before and after application of biochar

Type of Microflora	Name of the Microbial species	Soil Sample before application of biochar (cfu/ml)	Soil Sample after application of biochar (cfu/ml)
Fungi	Aspergillus	22	20
	Penicillium	25	27
	Rhizopus	23	21
	Fusarium	19	17
	Alternaria	16	14
	Trichoderma	25	33
Bacteria	Rhizobium	10	10
	Azospirillum	6	6
	Azatobacter	4	4
	Bacillus sp.	5	5
	Pseudomonas fluorescens	11	17

From the above table it is evident that in the biochar applied soils the population of the microflora Penicillium, Trichoderma and Pseudomonas fluorescens have increased in their number paving way to identify the interaction of biochar application with microfloral growth in crop fields. Application of biochar not only reduced the activity of pesticide on beneficial microbial flora by causing leaching of chemical pollutes in a pesticide but also increased the species richness of beneficial microflora. After first time application of pesticide the microfloral species richness is maintained indicating that the biochar prevents leaching of a chemical pesticide and diminishes its harmful effect on soil microbes.

4. Conclusions

Despite the problems faced, there are a lot of opportunities in leveraging the appropriate technique to sustain soil ecosystem. Use of Biochar contributes to improve both soil microfloral health and environmental health. Thus a healthy soil will ensure global ecological sustainability and food security for a better today and prosperous future. However more research studies have to be carried out to show that biochar decreases the chemical pollutes of the pesticide and thus contributes in increasing the species richness of beneficial microflora in the soil.

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