AGR-596

DESSERTATION -1

SYNOPSIS

Impact of different doses of weed bio char on Phosphorus growth and productivity of rice. *(Oryza sativa L.)*

Submitted by:-

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Submitted to Lovely Professional University in partial fulfilment of the requirements for the degree of

Master of Science in Agronomy

Under the Guidance of

Dr. Arun Kumar K

HOD, Agronomy

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CERTIFICATE

This is to certify that the synopsis work Impact of different doses of weed bio char on Phosphorus growth and productivity of Rice *Oryza sativa L.* submitted by Lamneivah Misao, 11717579, at Lovely Professional University, Phagwara, India is an original and genuine work carried out under my supervision .I hereby declare that this work has not been submitted elsewhere for any other degree.

(Signature of the student)

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(Signature of the mentor)

Dr.Arun Kumar

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HOD Agronomy

DECLARATION

I hereby declare that the work which is being presented Impact of different doses of weed bio char on Phosphorus growth and productivity of Rice Oryza sativa L. In partial fulfilment of the requirement for the award of the **"MASTER OF SCIENCE IN AGRICULTURE"** and submitted to the school of Agriculture of Lovely Professional University is a work carried out under the supervision of **Dr. Arun Kumar K(HOD ,Agronomy)Department of Agronomy , School of Agriculture , Lovely Professional University ,Phagwara ,Punjab**. The work presented in the report has not been submitted by me for the award of any other degree elsewhere.

(Signature of the student)

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INTRODUCTION

Bio char is a carbon rich charcoal like substance which is created by heating bio mass (organic matter like weeds) and in least presence of oxygen condition, through a process called pyrolysis. It is commonly defined as charred organic matter deliberately apply to soils or carbon sequestration and to improve soil physical chemical and biological properties.

Sewage sludge is a product of wastewater treatment. Wastewater and storm water enter the sewage system and flow into wastewater treatment facilities, where the solid wastes are separated from the liquid wastes through settling. At this point, they are processed and "digested," or decomposed by bacteria. These separated processed solids – sewage sludge – contain numerous known and unknown hazardous materials. This includes everything that is flushed into the sewer system, including: household, medical, chemical, and industrial waste; chemicals and metals that leach from the sewer pipes themselves; and novel materials that are created in the wastewater treatment plant as a result of the combination of chemicals and organic compounds present.

Applying **Biochar** products from **sewage sludge** (SS) pyrolysis as soil amendment for plant cultivation was investigated in this study with special attention paid to heavy metal accumulation in the plants when pyrolysis temperature and Biochar-to-soil mass ratio were changed. Biochar obtained at above 300 degree Celsius temperatures were adopted as soil amendment for Rice *(Oryza sativa L.)* plant cultivation. Experimental results revealed that Biochar were rich in nutrient contents and they will improve Rice yields. Although contents of heavy metals including As, Zn, Pb, Ni, Cd, Cr and Cu, etc. were elevated in the Biochar compared to local soil, they fell within the acceptable limits for land application and SS is a suitable Biochar resource, especially Biochar produced at more than 300°C had rich microspores, relatively stable functional groups in structure and rugged surface to contact well with soil, conducive to its usage as a Biochar. Rice will grow faster when planted in the Biochar-amended soil and had higher final dry matter yields than those planted in the reference soil, especially Biochar produced at above 300 °C corresponding to the highest final yields.

Bio char, a solid coproduce from the thermochemical production of bioenergy, has been reported to increase nutrient availability in soils through increased cation retention and decreased phosphate adsorption. The objectives of this study were to determine bio char effects

on P availability in the presence and absence of external nutrient inputs. Bio char was obtained from hydrothermal pyrolysis of weeds at 305°C with 20 min of retention time.

EFFECT ON SOIL pH

Bio char is alkaline in nature pH less than 7. In order to neutralize acidic soils farmers apply tones of lime / dolomite to farm soils at great expense. Bio char have an effect on soil pH as it can react similarly as agricultural lime do (by increasing soil pH). If a soil has low cation exchange capacity, it is not able to retain nutrients and the nutrients are often washed out leaching. Bio char in its pores having large surface area develop some negative charges and thus provides more negatively charged sites for cations to be retain when added to soil. Due to its high alkaline nature it has been demonstrated to reduce aluminium toxicity in acid soils

Application of bio char in soil

Generally farmers apply **Bio char** in their own field only by hand but due to prolonged contact with air borne Bio char particulates it is not viable on large scale considering human health broadcasting application needs large amount to cover whole field suitable method of application deposits Bio char directly into the Rhizosphere, and maybe viable for perennial cropping systems, and previously established crops. Deep bending of bio char has been successfully implemented in several wheat fields in Western Australia. Mixing of Bio char with compost manure and other organic input may reduce odour , colour and improve nutrient performance overtime due to slower leaching rates mixtures maybe applied for uniform top soil mixing with incorporation.

Benefits of Bio char on Soil properties

Bio char promises a very long term advantage for soil fertility and productivity. It can enhance plant growth by improving soil physical characteristics like bulk density, water holding capacity, infiltration, porosity, soil chemical characteristics pH,nutrient retention, nutrient availability, and soil biologic al properties(microbial biomass carbon) all contributing to increased crop productivity. Biochar application improved the saturated hydraulic conductivity of the top soil. It also increases the water holding capacity in sandy soil. The pores in Biochar

provide suitable habitat for many micro-organisms by protecting them predation and drying while providing many of their diverse carbon, energy and mineral nutrient needs

Field experiment

Biochar unit is made with the help of bricks and cement and is totally covered so that the weeds are burnt in the least presence of Oxygen. The weeds used for the Biochar process are (*Parthenium hysterophorus*, *Sida acuta* and Achyranthus).After burning, the samples are then collected and analysis are done in the laboratory. Estimation of available and total available of Organic carbon, NPK and Phosphorus were done in the laboratory. Further sowing will be done on June 15, 2018 in pots structures of 150 clay pots. The experiments and observation will be carried out further within the following months. Our main objective is to find out the impact of different doses of weed Biochar on Phosphorus growth and productivity of Rice by adding Sewage Sludge to it.

Previous trials have showed that Biochar can or will in small scale farming:

- Add nutrients and improve uptake of applied fertilizers
- Increase water holding capacity of the soil
- Increase carbon concentration in the soil
- Remain resident in the soil over a long period of time
- Affect decomposition rates of organic compounds

OBJECTIVES

1) To study the impact of weed Bio char on rice and also analyse phosphorus content and rice productivity.
2) To study the impact of land used systems and management practices on microbial community composition and diversity at ecosystem level
3) To study the growth parameters on rice productivity using different kinds of combination of weed Bio char.
4) To study rice yield and nutrition check using Bio char
5) Our vision is to create a situation where waste is used in a positive way that is beneficial to society
6) The objectives of this study is to determine bio char effects on P availability in the presence and absence of external nutrient inputs.
7) The objective of this study was to investigate the effect of Biochar application (CA) on soil physical properties and grain yields of Rice (*Oryza sativa* L.) in Punjab.

REVIEW OF LITERATURE

A review of literature reveals a significant number of early studies on Biochar type materials as soil amendments either for managing pathogens, as inoculant carriers however, no studies exists in the soil biology literature that recognise the observed large variations of Biochar physical chemical properties. This shortcoming has hampered inside into mechanisms by which Biochar influences soil micro-organisms , Fauna and plant roots, Biochar has made a huge curiosity in the minds of various environmental and agronomy researchers to improve the soil quality and increase the production of the crop yield.

This 2,000 year-old practice converts agricultural waste into a soil enhancer that can hold carbon, boost food security, and increase soil biodiversity, and discourage deforestation. The process creates a fine-grained, highly porous charcoal that helps soils retain nutrients and water. Biochar is found in soils around the world as a result of vegetation fires and historic soil management practices. Intensive study of Biochar-rich dark earths in the Amazon, has led to a wider appreciation of bio char's unique properties as a soil enhancer. Biochar can be an important tool to increase food security and cropland diversity in areas with severely depleted soils, scarce organic resources, and inadequate water and chemical fertilizer supplies. Biochar also improves water quality and quantity by increasing soil retention of nutrients and agrochemicals for plant and crop utilization. More nutrients stay in the soil instead of leaching into groundwater and causing pollution.

Rice or *Oryza Sativa* (as botanists prefer to call it) is not a tropical plant but is still associated with a wet, humid climate. It is generally believed that the domestication of rice began somewhere in the Asian arc. From its place of birth, lost forever in the mists of time, the plant and its grain spread all over the world. According to some schools of thought, It is probably a descendent of wild grass that was cultivated in the foothills of the Eastern Himalayas and the upper tracts of the Irrawady and Mekong river basins. Another school of thought believes that the rice plant may have originated in southern India and then spread to the north of the country.

ICAR Research Complex for NEH Region, Sikkim centre, Gangtok has conducted Biochar Technology from locally Available Weed Biomass for Acid Soil Management in Sikkim. Suitable method of application deposits Biochar directly into the Rhizosphere, and may be

viable for perennial cropping systems, and previously established crops. Deep banding of Biochar has been successfully implemented in several wheat fields in Western Australia. Mixing of Biochar with composts, manures and other organic input may reduce odour, colour and improve nutrient performance over time due to slower leaching rates. Mixtures may be applied for uniform topsoil mixing without incorporation. There is no specific rate of application of Biochar in soil. It depends on many factors including type of biomass used, the types and proportions of various nutrients (N, P, K etc.), the degree of metal contamination in the biomass, and also climatic and topographic factors of the land. It was found that rates between 5-10 t/ha (0.5-1 kg/m2) have often been found better. Even low rates of Biochar application can significantly increase crop productivity assuming that the Biochar is rich in nutrients.

Biochar as Soil Amendment (A comparison between plant materials for Biochar production from three regions in Kenya) suggested that the results from analyses showed that nutrient concentration correlated with the yield from pot trials where three treatments stood out: Biochar from cassava stems, coffee leaves and fresh banana leaves. Biochar from these materials in general had the highest nutrient concentration as well as pot trial crop yield, indicating a fertilizer effect. Plant materials with different properties may be important for plant growth, but Biochar rate seems to be a more significant factor, confirmed by the statistical test. The great need of improvement in soil fertility and the farmers' interest towards Biochar indicate that this approach might be possible to use in the future. However, more research on the subject is necessary if it is going to be implemented in the field, since these farmers cannot afford failures.

Dr RK Gupta, a senior soil chemist, Department of Soil Sciences at PAU said burning of the rice and wheat stubble leads to on loss of Nutrients and the smoke caused by it, leads to air pollution so they have worked on this project from the past 3 years and the experiments conducted have given positive results. They have found out that making Biochar from stubble, instead of burning it will help in reducing the environmental pollution caused by it, by 70%. After their Successful, they will be asking the Krishi Vigyan Kendra's (KVK), PAU to make Biochar and enlighten the knowledge to the farmer during Seminars.

According to a US Magazine named Technical Progress Biochar Market will become a buoyant during 2025. The global Biochar market is observing a significantly high rise in its valuation, thanks to the increasing preference for organic food among consumers across the

world. The ability of Biochar to improve the fertility of soil and enhance the growth of plants has surfaced as the main factor behind the growth of this market. Currently, synthetic and several other bio-based fertilizers are dominating the agricultural scenario, globally. However, the awareness about the benefits of Biochar is spreading gradually among farmers and agriculturists, thereby, creating massive opportunities for further growth of this market in the coming years. The Biochar sector is envisaged to be developed at a telling rate on the back of regions such as Europe and North America, registering an elevating rise in the count of small and medium scale manufacturers. A steady progress is foreseen to be witnessed by Australia as the awareness about the advantages and benefits of Biochar escalates across the country. Followed by Europe, North America is prognosticated to record a dominant share in the global Biochar market. Producers of Biochar can also find opportunities in other markets such as Asia Pacific and Rest of the World.

In the recent article Science Trends a research on Properties of Biochar derived from Castor Plants have revealed that Researchers from Institute of Applied Biosciences and Chemical Process and Energy Resources Institute of CERTH in Greece produced Biochar by slow pyrolysis at 550 °C from castor stalks and de-oiled castor cake, both by-products of castor oil production, in view of sustainable valorisation of a potential large-scale cultivation of castor beans. Their work is published in the research journal, *Biomass and Bioenergy*. The extraction of castor oil generates large amounts of de-oiled castor cake containing ricin, a highly toxic glycoprotein that requires heat treatment prior to its valorisation. A less profound but noticeable effect was observed in tomato seedlings. In both species, Biochar treatments promoted lateral root initiation but increased the developmental rate only in castor. Furthermore, Biochar affected soil cation exchange capacity Based on the results, castor Biochar improved castor seed germination, achieving 90% success rate earlier when compared to control. On the contrary, Biochar did not affect significantly the germination of tomato seedlings. However, in both species, the Biochar treatments promoted lateral root initiation but increased the developmental rate only in castor. In addition, Biochar affected soil capacity to retain several macro- and micro-nutrients beneficial for plant growth.

MATERIALS AND METHODS

Name of experiment: Impact of different doses of weed bio char on Phosphorus growth and productivity of rice. ***(Oryza sativa L.)***

Location: The location of the research is held at Lovely Professional University research farm Phagwara Punjab.

Fig 1: Map of Punjab

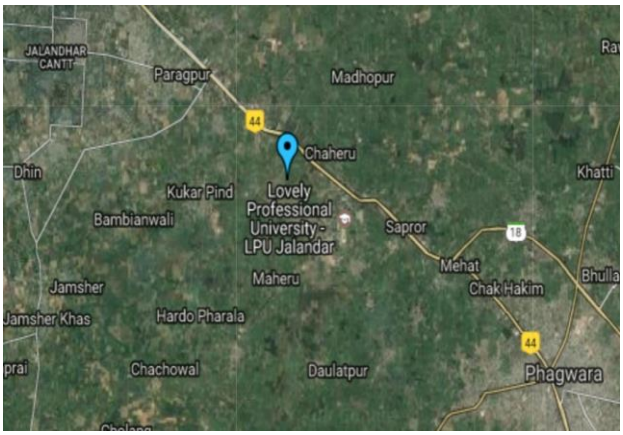

Fig 2: Satellite map of LPU

Experimental site

The experiment will be conducted on agriculture farm Lovely Professional University and the lab analysis is done in LPU 27-406X. Geographically it is situated at 31 degree 22 minutes and 31.81 sec north latitude and 75 degree and 23 minutes and 3.02 seconds east longitude with an altitude of about 252 meters above sea levels which falls under the trans-gangetic plain region of agro climatic zone of Punjab .

Experimental details

- Year of experiment : 2018
- Weeds used *: Parthenium hysterophorus, Sida acuta and Achyranthes aspera*
- No of treatments : 9
- No of replication :3
- No of pots: 150
- Weight of pot without soil: 3kgs
- Weight of pot with soil : 4 kgs
- Burning of Biochar: April 2018
- Laboratory analysis of Biochar: May 2018
- Date of sowing : 15 June
- Crop and variety : Rice (Pusa Basmati 3386)
- Row spacing : 3 rows (pots)

TYPES OF WEEDS USED FOR BIOCHAR

1) *Parthenium Hysterophorus*
2) *Sida acuta*
3) *Achyranthus aspera*

TREATMENT DETAILS

T0	Control
T1	100% RDF
T2	75%RDF+4%WB-1+25%SS
T3	75%RDF+6%WB-1+25%SS
T4	75%RDF+4%WB-1+25%SS
T5	75%RDF+6%WB-1+25%SS
T6	75%RDF+4%WB-1+25%SS
T7	75%RDF+6%WB-1+25%SS
T8	75%RDF + 4%(WB1+WB2+WB3)+25%SS
T9	75%RDF+6%(WB1+WB2+WB3) +25%SS
10*3*5 =150 POTS	

LAYOUT

R1	R2	R3
T0	CONTROL	CONTROL
T1	T2	T3
T2	T3	T4
T3	T4	T5
T4	T5	T6
T5	T6	T7
T6	T7	T8
T7	T8	T9
T8	T9	T1
T9	T1	T2

LABORATORY ANALYSIS OF SOIL AND BIOCHAR SAMPLES TO BE CONDUCTED

1) Soil Physio-Chemical Analysis
2) Soil and Biochar pH
3) Electrical conductivity (EC) of soil and Biochar
4) Soil Texture
5) Total Organic Carbon
6) Available Nitrogen
7) Total Nitrogen
8) Available phosphorous

9) Available potassium

AGRONOMIC PARAMETERS TO BE EVALUATED

1) Plant Height, Tiller Numbers
2) No of leaves per plant
3) Stem Girth
4) Clum length, Panicle length and No of panicles
5) Yield Attributes
6) Seeds per panicle
7) Grain weight
8) Straw yield

STATISTICAL ANALYSIS

The data obtained from all the observations shall be analysed using the standard procedures using SPSS 16 to arrive at valid conclusions.

OBSERVATIONS

1. Symptoms for Stem Borer
2. Symptoms for late blight
3. Symptoms for leaf roller and sheath blight
4. Booting
5. Starting of panicle Initiation
6. Proper heading

YIELD ATTRIBUTES

Forage yield (kg/ha)

B: C RATIO

B: C RATIO will be determined to summarize the overall value for money of a project

RESULT

I. Agronomic Parameters to be conducted

Agronomic Parameter	25 DAT	40 DAT	55 DAT	70 DAT	85 DAT	100 DAT
No. of leaves/ Plant	NA	NA	NA	NA	NA	NA
No. of tillers/ Plant	NA	NA	NA	NA	NA	NA
Plant Height (cm)	NA	NA	NA	NA	NA	NA
Clum Length (cm)	NA	NA	NA	NA	NA	NA
Leaf Length (cm)	NA	NA	NA	NA	NA	NA
Stem Girth	NA	NA	NA	NA	NA	NA
No. of panicle/ plant	NA	NA	NA	NA	NA	NA
Panicle Length (cm)	NA	NA	NA	NA	NA	NA
No. of Grains/ panicle	NA	NA	NA	NA	NA	NA

II. Harvesting Data

Best Grain Yield

Best Straw Yield:

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8) **Sewage Sludge Biochar Influence upon Rice (*Oryza sativa* L) Yield, Metal Bioaccumulation and Greenhouse Gas Emissions from Acidic Paddy Soil**

Sardar Khan†‡, Cai Chao†, Muhammad Waqas‡, Hans Peter H. Arp§, and Yong-Guan Zhu†*