DISSERTATION REPORT

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IMPACT OF DIFFERENT DOSES OF WEED BIOCHAR ON NITROGEN, GROWTH AND PRODUCTIVITY OF RICE

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By

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SYNOPSIS

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DECLARATION

I hereby declare that the project work entitle " **IMPACT OF DIFFERENT DOSES OF WEED BIOCHAR ON NITROGEN,GROWTH AND PRODUCTIVITY OF RICE** " is an authentic record of my work carried out at lovely professional university as requirements of project work for the award of degree of Master of Science in Agronomy, under the guidance of Dr. Arun Kumar, Assistant professor, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India.

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(1)INTRODUCTION

Biochar is a biomass charcoal that is used as soil amendment .It is rich in carbon,stable, and can last in soil for thousands of years.It is created when organic matter is burned slowly and then stopped when material reaches charcoal stages.Biochar, when used in combination with the compost and other fertilizers,can drastically improve plant growth.Biochar can also help and retain nutrients in seriously depleted soil and it is produced from plant matter and stored in the soil as a means of removing carbon dioxide from atmosphere.

Biochar carbon material produced by a method called pyrolysis . This method consist of combustion of any plant residue under low oxygen condition and high temperature condition . As a result, oil , gas and biochar are generated . Although biochar can be burned as regular charcoal , it can also be used as soil amendment . A biochar behaves like a sponge retaining water and nutrients in the soil for plant uptake that could benefit growth of crop . Decomposition of biochar in soil occurs very slowly which means the beneficial properties of the material can last for longer period of time . Biochar also binds polutents an industrial wastes in the soil an also reduce the risk of reaching ground water an mitigating their potential negative environmental impact.

1.1**Biochar Effect On Weed Growth And Weed Germination**

Biochar can increase plant growth and provide better conditions in the soil . However , research has shown the emergence pattern with the addition of biochar and the weed species show minimal changes in germination . Regardless, biochar is important to monitor for changes in the weed populations if used in the field .This is important because biochar can decrease herbicide efficiency.

1.2Preparation of Biochar

Build pyramid like structure (brick kiln) of bricks and clay – raised to a height of 7 feet filled with straw .

1) The weeds is ignited to start combustion from the top of the dome , covered with iron lit .
2) Then, immediately sealed it with mud

3) To allow combustion products to escape, vents are kept open .
4) Weeds is subjected to partial combustion until the fire becomes clear and until blue smokes starts coming out of the vents, which is located in the upper portion of the dome .
5) Vents located located in the upper portion of the dome are than seal with clay .
6) Now the combustion advances to the middle portion of the dome from which smokes starts coming out .
7) When very thin blue smokes comes out , seal the vents located in the middle portion of the dome with clay .
8) Now , the biochar is ready in this portion and so now the combustion will reach the lower portion of the dome .
9) Again, seal the vents located in the lower portion of the dome as soon as the blue smoke starts coming out of these vents .

The whole process takes 10 – 12 hrs and by this process 12 quintal of sample collected can be converted into 8 quintiles of biochar .

1.3Benefits of Biochar

Reduces environmental pollution

1) Helps in improving grain yield .
2) If used as manure helpsin improving soil healthy
3) leads in improvement in infiltration rate and water holding capacity of soil .

2.OBJECTIVES

Use of biochar significantly increases organic matter content of soil, N, P, K, Ca, Mg . Keeping in view the existing scenario a field experiment has been conduct to study the impact of different combination of weeds biochar with inorganic amendment on soil carbon , nitrogen sequestration , growth a yield attributes of maize with the following **objectives:.**

1) To determine the crop responses to biochar addition ,
2) To understand the effect of biochar addition on nitrogen use efficiency, pH , organic carbon etc.
3) To study the impact of different doses of weed biochar on rice crop.
4) To analyse nitrogren content and rice productivity.
5) To study the impact of land used systems and management practices on microbial community composition and diversity at ecosystem level
6) To study the growth parameters on rice productivity using different kinds of combination of weed Biochar.
7) To study rice yield and nutrition check using Biochar
8) Our vision is to create a situation where waste is used in a positive way that is beneficial to society
9) To determine biochar effects on nitrogen availability in the presence and absence of external nutrient inputs.
10) To study was to investigate the effect of Biochar application (CA) on soil physical properties and grain yields of Rice (*Oryza sativa* L.) in Punjab.

3. LITERATURE REVIEW

3.1WEEDS:

The term “weed” has no significance, because a plant that is a weed in one context is not weed when growing in a situation where it is in fact wanted, and where one species of plant is a valuable crop plant ,another species of plant in the same genus might be serious weed .A weed is a plant growing where it is not wanted .weeds are plants considered undesirable and which grow out of its place and out of its time weeds are which are completely noxious, useless, unwanted or poisonous.weeds can also be defined as any plant or vegetation ,excluding fungi, interfering with the objectives or requirements of people .weeds are plant considered undesirable in a particular situation. weeds are plants in the wrong place. Weeds deplete crop’s environment of nutrients, water and light. crops yield are also reduce considerably. In addition ,weeds interfere and cause inconvenience to agricultural operations. The quality of produce is reduced by weed infestation. The extent of losses due to weeds depends on intensity of infestation ,time of occurrence and type of weeds. There are about 30,000 species of weeds around the world of which about 18,000 cause serious losses to crops. Weeds present in the off-season on field bunds, wastelands ,and irrigation channels ,harbour pests and diseases which attack the crops sown subsequently. The term weed also applied to any plant that grows or reproduces aggressively, or invasive outside its native habitat.

3.2PROBLEMS DUE TO WEED/HARMFULL EFFECTS OF WEED:

Weeds extend the harmful effects slowly, steadily and inconspicuously and the effect is almost unchangeable.1)Reduction in crop yield: weeds compete with crops for water, nutrients, and light. Being hardy and vigorous in growth habit, they grow faster then crops and consume large amount of water and nutrients, thus causing heavy losses in yields.2)Increases the cost of cultivation and hinders the progress work.Tillage operations are done to control weeds and it is generally estimated that on average about 30% of the total expenditure of the crop production is on tillage operations and more labour is employed for 3)The quality of livestock products is reduced.4)The quality of field produce is reduced.5)weeds harbour insect, pests and diseases and diseases.6)weeds check the flow of water, the irrigation efficiency is reduced.7)Causes health hazard to human and animal, it causes irritation of skin, allergy and poisoning in human being.8)Heavy growth of certain weeds like quack grass or motha lower the germination and reduce the growth of many crop plants.9)land and water degradation.10)weeds also nuisance and a fire hazard along railway lines ,roads, right-of-ways, airports and industrial sites.11)In aquatic environment, weeds block the flow of water in canals, water-transport system and drainage system, rendering navigation difficult.12)they reduce the value of land.13)presences of weeds will impair the impurity of varieties by chances of cross pollination.14)weeds cause allelopathic effect.

3.3WEEDS AVAILABLE IN PUNJAB:

BOTANICAL NAME AND FAMILY	ENGLISH NAME	LOCAL NAME
Eragrostis pilosa **(L.) P.Beauv.** **(*Poaceae*)**	**Indian love grass, soft love grass**	***Chiri ghaas***
Setaria italica **(L.) Beauv.** **(*Syn. Panicum italicum*** **L.)** **(*Poaceae*)**	**Italian millet,** **foxtail millet**	***Kangni***
Corchorus antichorus Raeusc {Syn. C. depressus} **(*Tiliaceae*)**	**Jew's mallow**	***Bhao phalli,*** ***Baphali***
Sorghum halepense **(L.) Pers. *(Syn. Andropogon halepensis)*** **(*Poaceae*)**	**Johnson grass,** **Arabian millet,** **Syrian grass**	***Baru ghas,*** ***Kala mucha***
Echinochloa colona **(L.) Link.** **(*Syn. Panicum colonum*** **L.)** **(*Poaceae*)**	**Jungle rice grass,Deccan grass, millet rice, swamp grass**	***Jangli swank,*** ***Kala swank,*** ***Swanki,Sharma***
Astragalus spp. ***Papilionaceae***	**Milk vetch**	***Rotphullai***
Ipomoea carnea **Jacq.** **(*Convolyulaceae*)**	**Morning glory,** **railway creepers**	***Besharmi booti***
Cannabis sativa **L.** ***(Syn. C. indica)*****(*Cannabinaceae*)**	**Neck weed, indian hemp, marijuana**	***Bhang, Charas,*** ***Hasheesh***
Parthenium hysterophorus L. ***(Compositae)***	**Parthenium weed, congress weed, carrot weed, ragweed**	***Chatak chandni***
Paspalidium flavidum (Retz.)Camub.(Poaceae)	***Paspalidium***	
Sonchus arvensis **L.** **(*Compositae/asteraceae*)**	**Perennial sowthistte** **Field sowthistle**	***Daimi dodhak,*** ***Peeli dodhak***
Panicum verticillatum **L.** ***{Syn. Setaria verticillata*****(L.)**	**Pigeon grass**	***Lehdra***

Beauv}(*Poaceae*)		
***Achyranthes aspara* L.** **(*Amaranthaceae*)**	**Prickly chaff flower, devel's horse whip**	***Putth Kanda,*** ***Chirchita***
Alhagi maurorum* Medic.** ***{Syn. A camelorum Fischer.}Fabaceae	**Prickly clover, camelthorn bush, Persian manna**	***Juvansa,*** ***Juvahan***
Argemone mexicana L ***(Papaveraceae)***	**Prickly poppy, Devil's fig, Mexican poppy**	***Sialkanta***
***Polygonum plebejum* L.** **(*Polygonaceae*)**	**Prostate knotweed,** **smartweed,** **wireweed**	***Dranak, Santhal Raniphul,Drani booti,***

3.4 CONTROL METHOD

Principles of weed control are;

a) Prevention

b) Eradication

c) Control

d) Management

A.Preventive weed control:

It encompasses all measures taken to prevent the introduction or establishment and spread of weeds. No weed control programme is successful if adequate preventive measures are not taken to reduce weed infestation. It is a long term planning so that the weeds could be controlled or managed more effectively and economically than is possible where these are allowed to disperse freely. Following preventive control measures are suggested for adoption wherever possible & practicable.

1. Crop that are infested with weed seeds for sowing are avoided.

2. Feeding screenings and other material containing weed seeds to the farm animals are avoided.

3. Adding of weeds to the manure pits are avoided.

4. Farm machinery are clean thoroughly before moving it from one field to another.

5. Use of gravel sand and soil from weed-infested is avoided.

6. Inspection of nursery stock for the presence of weed seedlings, tubers, rhizomes, etc.

7. Irrigation channels, fence-lines, and uncropped areas are kept cleaned.

8. vigilance are used and Inspection of farm frequently for any strange looking weed seedlings are done.Patches of a new weed are destroyed by digging deep and burning the weed along with its roots. Sterilization of the spot with suitable chemical are done.

9. Quarantine regulations are followed.

B. Eradication Method

It is done by inferring the given weed species, its seed & vegetative part are being killed or completely removed from a given area .Because of its difficulty & high cost, eradication is usually attempted only in smaller areas such as few hectares or a few thousand m^2 or less. Eradication is often used in high value areas such as green houses, ornamental plant beds & containers. This may be desirable and economical when the weed species is extremely noxious and persistent as to make cropping difficult and economical.

C. Control Method

It encompasses those processes where by weed infestations are reduced but not necessarily eliminated. It is a matter of degree ranging from poor to excellent. In control methods, the weeds are seldom killed but their growth is severely restricted, the crop makes a normal yield. In general, the degree of weed control obtained is dependent on the characters of weeds involved and the effectiveness of the control method used.

D. Weed management

Weed control aims at only putting down the weeds present by some kind of physical or chemical means while weed management is a system approach whereby whole land use planning is done in advance to minimize the very invasion of weeds in aggressive forms and give crop plants a strongly competitive advantage over the weeds.

Weed control methods are grouped into cultural, physical, chemical and biological. Every method of weed control has its own advantages and disadvantages. No single method is successful under all weed situations. Many a time, a combination of these methods gives effective and economic control than a single method.

(I)Mechanical weed control

Mechanical or physical methods of weed control are being employed ever since man began to grow crops. The mechanical methods include tillage, hoeing, hand weeding, digging chiselling, mowing, burning, flooding, mulching etc.

1. Tillage: Tillage removes weeds from the soil resulting in their death. It may weaken plants through injury of root and stem pruning, reducing their competitiveness or regenerative capacity. Tillage also buries weeds. Tillage operation includes ploughing, harrowing and levelling which is used to promote the germination of weeds through soil turnover and exposure of seeds to sunlight, which can be destroyed effectively later. In case of perennials, both top and underground growth is injured and destroyed by tillage.

2. Hoeing: Hoe has been the most appropriate and widely used weeding tool for centuries. It is however, still a very useful implement to obtain results effectively and cheaply. It supplements the cultivator in row crops. Hoeing is particularly more effective on annuals and biennials as weed growth can be completely destroyed. In case of perennials, it destroyed the top growth with little effect on underground plant parts resulting in re-growth.

3. Hand weeding: It is done by physical removal or pulling out of weeds by hand or removal by implements called khurpi, which resembles sickle. It is probably the oldest method of controlling weeds and it is still a practical and efficient method of eliminating weeds in cropped and non-cropped lands. It is very effective against annuals, biennials and controls only upper portions of perennials.

4. Digging: Digging is very useful in the case of perennial weeds to remove the underground propagating parts of weeds from the deeper layer of the soil.

5. Chiselling: It is done by hand using a chisel hoe, similar to a spade with a long handle. It cuts and shapes the above ground weed growth.

6. Sickling and mowing: Sickling is also done by hand with the help of sickle to remove the top growth of weeds to prevent seed production and to starve the underground parts. It is popular in sloppy areas where only the tall weed growth is sickle leaving the root system to hold the soil in place to prevent soil erosion. **Mowing** is a machine-operated practice mostly done on roadsides and in lawns.

7. Flooding: Flooding is successful against weed species sensitive to longer periods of submergence in water. Flooding kills plants by reducing oxygen availability for plant growth. The success of flooding depends upon complete submergence of weeds for longer periods.

(ii)CULTURAL WEED CONTROL:

Several cultural practices like tillage, planting, fertilizer application, irrigation etc., are employed for creating favourable condition for the crop. These practices if used properly, help in controlling weeds. Cultural methods, alone cannot control weeds, but help in reducing weed population. They should, therefore, be used in combination with other methods. In cultural methods, tillage, fertilizer application. and irrigation are important. In addition, aspects like selection of variety, time of sowing, cropping system, cleanliness of the farm etc., are also useful in controlling weeds.

1. Field preparation: The field has to be kept weed free. Flowering of weeds should not be allowed. This helps in prevention of build up of weed seed population.

2. Summer tillage: The practice of summer tillage or off-season tillage is one of the effective cultural methods to check the growth of perennial weed population in crop cultivation. Initial tillage before cropping should encourage clod formation. These clods, which have the weed propagules, upon drying desiccate the same. Subsequent tillage operations should break the clods into small units to further expose the shrivelled weeds to the hot sun.

3. Maintenance of optimum plant population: Lack of adequate plant population is prone to heavy weed infestation, which becomes, difficult to control later. Therefore practices like selection of proper seed, right method of sowing, adequate seed rate protection of seed from soil borne pests and diseases etc. are very important to obtain proper and uniform crop stand capable of offering competition to the weeds.

4. Crop rotation: The possibilities of a certain weed species or group of species occurring is greater if the same crop is grown year after year.

5. Growing of inter crops: Inter cropping suppresses weeds better than sole cropping and thus provides an opportunity to utilize crops themselves as tools of weed management. Many short duration pulses viz., green gram and soybean effectively smother weeds without causing reduction in the yield of main crop.

6. Mulching: Mulch is a protective covering of material maintained on soil surface. Mulching has smothering effect on weed control by excluding light from the photosynthetic portions of a plant and thus inhibiting the top growth. It is very effective against annual weeds and some perennial weeds like *Cynodon dactylon.* Mulching is done by dry or green crop residues, plastic sheet or polythene film. To be effective the mulch should be thick enough to prevent light transmission and eliminate photosynthesis.

7. Solarisation: This is another method of utilization of solar energy for the desiccation of weeds. In this method, the soil temperature is further raised by 5 – 10 ºC by covering a pre-soaked fallow field with thin transparent plastic sheet. The plastic sheet checks the long wave back radiation from the soil and prevents loss of energy by hindering moisture evaporation.

8. Stale seedbed: A stale seedbed is one where initial one or two flushes of weeds are destroyed before planting of a crop. This is achieved by soaking a well prepared field with either irrigation or rain and allowing the weeds to germinate. At this stage a shallow tillage or non- residual herbicide like paraquat may be used to destroy the dense flush of young weed seedlings. This may be followed immediately by sowing. This technique allows the crop to germinate in almost weed-free environment.

9. Blind tillage: The tillage of the soil after sowing a crop before the crop plants emerge is known as blind tillage. It is extensively employed to minimize weed intensity in drill sowing crops where emergence of crop seedling is hindered by soil crust formed on receipt of rain or irrigation immediately after sowing.

(IV)BIOLOGICAL WEED CONTROL

Use of living organisms viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for the control of weeds is called biological control. In biological control method, it is not possible to eradicate weeds but weed population can be reduced. This method is not useful to control all types of weeds. Introduced weeds are best targets for biological control.

(V)CHEMICAL WEED CONTROL

Herbicide can be recommended for adverse soil and climatic conditions, as manual weeding is highly impossible during monsoon season. Herbicide can control weeds even before they emerge from the soil so that crops can germinate and grow in completely weed-free environment at early stages. It is usually not possible with physical weed comfort. Weeds, which resemble like crop in vegetative phase may escape in manual weeding. However, these weeds are controlled by herbicides.Herbicide is highly suitable for broadcast and closely spaced crops. Controls the weeds without any injury to the root system of the associated standing crop especially in plantation crops like Tea.

However weed control can also be achieved by the use of herbicides. Selective herbicides kill certain targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often based on plant hormones. Herbicides used are generally classified as follows:

Contact herbicides destroy only plant tissue that contacts the herbicide. Generally, these are the fastest-acting herbicides. They are ineffective on perennial plants that can re-grow from roots or tubers.

Systemic herbicides are foliar-applied and move through the plant where they destroy a greater amount of tissue, glyphosate is currently the most used herbicide.

Soil-borne herbicides are applied to the soil and are taken up by the roots of the target plant.

Pre-emergent herbicides are applied to the soil and prevent germination.

In agriculture large scale and systematic procedures are usually required.

3.5 WEEDS USED FOR BIOCHAR PRODUCTION:

(1) Chenopodium

Botanical Name:*Chenopodium album*

Common Name:Bathua,lamb’s quarters

Family:Amaranthaceae

Chenopodium album is a fast-growing weedy annual plant in the genus *Chenopodium*.

Though cultivated in some regions, the plant is elsewhere considered a weed. Common names include **lamb's quarters**, **melde**, **goosefoot** and **fat-hen**, though the latter two are also applied to other species of the genus *Chenopodium*, for which reason it is often distinguished as **white goosefoot**.. It is sometimes also called **pigweed**. However, **pigweed** is also a name for a few weeds in the family Amaranthaceae. *Chenopodium album* is extensively cultivated and consumed in Northern India as a food crop..

Impact of Chenopodium on conventional crops

It is one of the more robust and competitive weeds, capable of producing crop losses of up to 13% in corn, 25% in soybeans, and 48% in sugar beets at an average plant distribution. It may be controlled by dark tillage, rotary hoeing, or flaming when the plants are small. Crop rotation of small grains will suppress an infestation. It is easily controlled with a number of pre-emergence herbicides..Its pollen may contribute to hay fever-like allergies.

Beneficial use in ecological pest control

*Chenopodium album i*s vulnerable to leaf miners, making it a useful trap crop as a companion plant. Growing near other plants, it attracts leaf miners which might otherwise have attacked the crop to be protected. It is a host plant for the beet leafhopper, an insect which transmits curly top virus to beet crops.

These are high in protein, vitamin A, calcium, phosphorus, and potassium.. Bathua seeds also double up for rice and dal.

(2)Wire weed

Botanical Name:*Sida acuta*

Family:Malvaceae

Sida acuta, the **common wireweed** is a species of flowering plant in the mallow family, Malvaceae. It is believed to have originated in Central America, but today has a pantropical distribution and is considered a weed in some areas.In northern Australia, *Sida acuta* is considered an invasive species. They have alternate, simple, lanceolate to linear, rarely ovate to oblong, obtuse at the base, acute at the apex, coarsely and remotely serrate; petiole much shorter than the blade; stipulate, stipules free-lateral, unequally paired at the node, reticulate venation. Leaves are Simple with free lateral stipule.

Flower are bisexual,; petals 5, twisted; monadelphous stamen, anther one celled, reniformed. Leaf base are obtuse, apex and acute

3.Castor plant

Botanical Name:*Ricinus communis*

Family:Euphorbiaceae

Ricinus communis, the **castor bean** or **castor-oil-plant.It** is a species of perennial flowering plant in the spurge family, Euphorbiaceae. It is the sole species in the monotypic genus, ***Ricinus***, and subtribe, **Ricininae**. It reproduces with a mixed pollination system.

Castor seed is the source of castor oil, which has a wide variety of uses. The seeds contain between 40% and 60% oil that is rich in triglycerides, mainly ricinolein. The seed also contains ricin, a water-soluble toxin, which is also present in lower concentrations throughout the plant.

Ricinus communis can vary greatly in its growth habit and appearance. The variability has been increased by breeders who have selected a range of cultivars for leaf and flower colours, and for oil production. It is a fast-growing, suckering shrub that can reach the size of a small tree, around 12 m .

The glossy leaves are 15–45 cm long-stalked, alternate and palmate with five to twelve deep lobes with coarsely toothed segments. In some varieties they start off dark reddish purple or bronze when young, gradually changing to a dark green, sometimes with a reddish tinge, as they mature. The leaves of some other varieties are green practically from the start, whereas in yet others a pigment masks the green color of all the chlorophyll-bearing parts, leaves, stems and young fruit, so that they remain a dramatic purple-to-reddish-brown throughout the life of the plant. Plants with the dark leaves can be found growing next to those with green leaves, so there is most likely only a single gene controlling the production of the pigment in some varieties.The stems and the spherical, spiny seed capsules also vary in pigmentation.

The flowers are borne in terminal panicle-like inflorescences of green or, in some varieties, shades of red, monoecious flowers without petals. The male flowers are numerous, yellowish-green with prominent creamy stamens; the female flowers, borne at the tips of the spikes, lie within the immature spiny capsules, are relatively few in number and have prominent red stigmas.

Castor oil has many uses in medicine and other applications.

An alcoholic extract of the leaf was shown, in lab rats, to protect the liver from damage from certain poisons. Methanolic extracts of the leaves of *Ricinus communis* were used in antimicrobial testing against eight pathogenic bacteria in rats and showed antimicrobial properties. The pericarp of *Ricinus* showed central nervous system effects in mice at low doses. At high doses mice quickly died..A water extract of the root bark showed analgesic activity in rats.

Extract of *Ricinus communis* exhibited acaricidal and insecticidal activities.The Bodo tribals of Bodoland, Assam (India), use the leaves of this plant to feed and rear the larvae of muga and silkworms. Castor oil is an effective motor lubricant and has been used in internal combustion engines, including those of World War I airplanes, some racing cars and some model airplanes. It has historically been popular for lubricating two-stroke engines due to high resistance to heat compared to petroleum-based oils. It does not mix well with petroleum products, particularly at low temperatures, but mixes better with the methanol based fuels used in glow model engines. In total-loss-lubrication applications, it tends to leave carbon deposits and varnish within the engine. It has been largely replaced by synthetic oils that are more stable and less toxic.

3.6 BIOCHAR

Biochar is a stable carbon rich form of charcoal that can be added to soil to increase water and nutrient retention.It is produced by a method called pyrolysis where biomass (plant or animal waste) is heated at high temperature with little or no oxygen. This method consist of combustion of any plant residue under low oxygen condition and high temperature condition . As a result, oil , gas and biochar are generated . Although biochar can be burned as regular charcoal , it can also be used as soil amendment . A biochar behaves like a sponge retaining water and nutrients in the soil for plant uptake that could benefit growth of crop . Decomposition of biochar in soil occurs very slowly which means the beneficial properties of the material can last for longer period of time . Biochar also binds pollutant an industrial wastes in the soil an also reduce the risk of reaching ground water an mitigating their potential negative environmental impact .

Biochar is defined simply as charcoal that is used for agricultural purposes. It is created using a

pyrolysis process, heating biomass in a low oxygen environment. Once the pyrolysis reaction has

begun, it is self-sustaining, requiring no outside energy input. Byproducts of the process include

Syn gas (H2+ CO), minor quantities of methane (CH4), tars, organic acids - and excess heat.

Once it is produced, biochar is spread on agricultural fields and incorporated into the top layer of

soil. When biochar is created from biomass, approximately 50% of the carbon that the plants

absorbed as CO2 from the atmosphere is "fixed" in the charcoal. As a material, the carbon in

charcoal is largely inert, showing a relative lack of reactivity both chemically and biologically,

and so it is strongly resistant to decomposition. Research scientists have found charcoal particles

began on earth.*(Sediment Records of Biomass Burning and Global Change, James Samuel Clark)*

Hence, biochar offers us a golden opportunity to remove excess CO2 from the atmosphere and

sequester it in a virtually permanent and environmentally beneficial way.

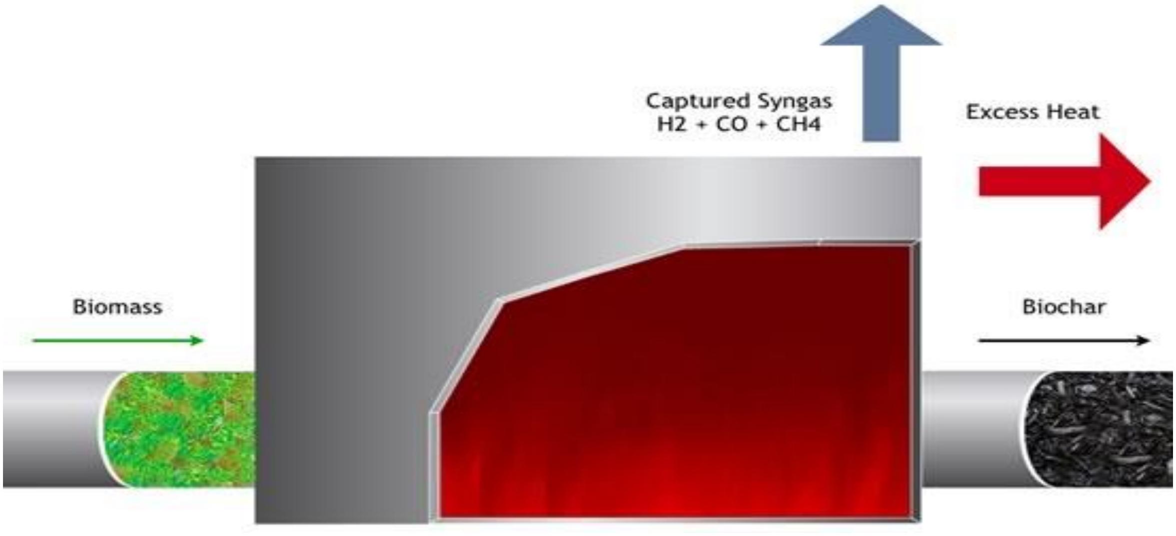

Figure:Process of biochar production

Biochar Effect On Weed Growth And Weed Germination

Biochar can increase plant growth and provide better conditions in the soil . However , researchhas shown the emergence pattern with the addition of biochar and the weed species show minimal changes in germination . Regardless, biochar is important to monitor for changes in the weed populations if used in the field .This is important because biochar can decrease herbicide efficiency.

Use of biochar significantly increases organic matter content of soil, N, P, K, Ca, Mg . Keeping in view the existing scenario a field experiment has been conduct to study the impact of different combination of weeds biochar with inorganic amendment on soil carbon , nitrogen sequestration , growth a yield attributes of Rice

Biochar has many Agricultural Benefits.:

It increases crop yields, sometimes substantially if the soil is in poor condition. It helps to prevent fertilizer runoff and leeching, allowing the use of less fertilizers and diminishing agricultural pollution to the surrounding environment. It retains some moisture, possibly helping plants through periods of drought more easily. Most importantly, it replenishes exhausted or marginal soils with organic carbon and fosters the growth of soil microbes essential for nutrient absorption, reduces environmental pollution It helps in improving grain yield ,If used as manure helps in improving soil health.It leads in improvement in infiltration rate and water holding capacity of soil , used as a energy carrier to meet the energy demand of rural people.It can also be used as fuel in rural house.Soil amendments.It reduce greenhouse gas emissions through carbon sequestration.Studies have indicated that the carbon in biochar remains stable for millenia, providing a simple, sustainable means to sequester historic carbon emissions that is technologically feasible in developed or developing countries alike. The syn gas and excess heat can be used directly or employed to produce a variety of biofuels.

Benefits of applying Biochar

(i) Increased nutrient retention and reduced leaching

(ii) Increased cation exchange capacity

(iii)Improved soil structure and water holding capacity

(iv)Decreased soil acidity and increased habitat for microbes.

(v)Biochar has the potential to reduce fertilizer requirements while crop productivity is maintained,or increase crop yields at lower rates of fertilizer use due to reduced leaching.

(vi)The benefits vary depending on the type of biochar and the nature of the soil in the treated padlock and in some combinations, the impact may be detrimental.

Effect of Biochar on Soil Fertility

Soil mineral depletion is a major issue due to soil erosion and nutrient leaching. The addition of biochar is a solution because biochar has been shown to increase soil fertility. Weed biochar is recognized as offering a number of benefits for soil health.Weed Biochar addition to agricultural soils can improve soil fertility with added bonus of climate change mitigation through carbon sequestration.weed biochar, similar to charcoal can be used as a soil amendment to increase soil quality as well as fertility..Biochar is comparatively inert, it doesn't break down like other organic soil amendments and resists chemical and microbial degradation, especially when buried. Many benefits are related to extremely porous nature of biochar.This structure is found to be very effective at retaining both water and water soluble nutrients. Positive effects from biochar on crop production in degraded and nutrient-poor soil Biochar application increases soil organic carbon levels and improves soil structure.Its application improves the soil's ability to retain moisture ,prevents nutrient leaching ,increases cation exchange capacity, reduce soil acidity,reduce irrigation and fertilizer requirements and hence ,raise agricultural .The various impacts of biochar can be dependent on the properties of biochar,as well as the amount applied, and there is still lack of knowledge about the important mechanisms and properties. Biochar impact may depend on regional condition, temperature and humidity.The burning and natural decomposition of biomass and in particular agricultural waste adds large amount of carbon to the atmosphere Biochar that is stable, fixed and can store large amount of greenhouse gases in the ground for centuries, potentially reducing or stalling the growth in atmospheric greenhouse gas levels,at the same time its presence in the earth can improve water quality,increase soil fertility,raise agricultural productivity.

Biochar and soil enzymes

Soil enzymes catalyze key biochemical processes in organic matter decomposition and nutrients cycles and regarded as indicators of soil quality.Soil biological and biochemical properties have a preeminent role driving nutrient cycling and can be considered as indicators of soil quality.Biochar interacts with soil fauna, on changes in soil biological and biochemical properties following heavy metal immobilization ,after biochar addition changes are important in relation to global change.Biochar's physical and chemical nature, it has a unique ability for attracting and holding moisture, nutrients, agrochemicals even retaining difficult to hold nutrients like nitrogen and phosphorus. Nitrogen tends to runoff regular soils, upsetting ecosystem balance in steams and riparian areas. Biochar also holds gasses, enriched soils reduce carbon dioxide and nitrous oxide emissions by 50-80%..Biochar's immense surface area and complex pore structure provides a secure habitat for microorganisms and certain fungi form a symbiotic relationship with plants root fibers and this allows for greater nutrient uptake by plants.Its is undisputed that biochar is more persistent than any form of organic matter commonly to soil because of biochar's long-term persistence in soil, all the associated benefits of nutrient retention,water retention and overall soil fertility are longer lasting than with common fertilizers alone.Biochar reduces soil acidity decreasing liming needs but doesn't actually add nutrients,it attracts and holds nutrients,it reduces fertilizer requirements-something common organic matter cannot do.As a result,fertilizer costs are minimized and so organic and chemical fertilizer is retained in the soil for far longer.Thus,biochar provides additional indirect climate change benefits by reducing fertilizer needs.Biochar ,a product of the pyrolysis of organic material ,has received wide attention as a means to improve soil fertility and crop productivity .biochar has a potential to stabilize extra cellular enzymes and prohibit the loss of potential enzyme activity in soil when exposed to a denaturing stress. Biochar treatment alone or in combination with the compost induced specific enzymatic variations. Biochar has been shown not only to improve soil physio chemical properties but also to changes oil biological properties (Pietikäinen et al.2000, Lehmann et al. 2006; Kim et al.2007; O'neill et al.2009; Grossman et al. 2010; Liang et al. 2010). These changes could ameliorate soil structure, containing increasing organic/mineral complexes (aggregates) and pore spaces (Rillig and Mummey 2006), It enhance nutrient cycles, which include the increase of nutrient retention and immobilization, as well as the decrease of nutrient leaching (Steiner et al. 2008), thus promote plant growth (Warnock et al. 2007). Besides, microorganisms, such as rhizosphere bacteria and fungi, may facilitate plant growth directly (Schwartz et al. 2006) Compant et al. 2010). In affect nutrient cycles and plant growth, as well as the cycling of soil organic matter (Wardle et al. 2008 ,Kuzyakov et al. 2009; Liang et al. 2010).There are growing interests in the application of biochar as a means to manage soil biota, Some of the mechanisms which explains how biochar affect microorganisms in soils are: (1) changes in nutrient availability(2) changes in other microbial communities(3) Alterations in plant-microbe signaling; and (4) Habitat formation and refuge from hyphal grazers. Microbial properties are largely affected by the soil food web. Furthermore, the trophic structure of the soil food web highly depended on the quantity, quality, and distribution of organic matter. Some possible reasons may be responsible for the increase of microbial abundance, such as higher availability of nutrients or labile organic matter on biochar surface (Pietikäinen et al. 2000).Nutrient and carbon availability can affect microbial abundance. This influence was greatly varied with the different types of biochar and the special microorganisms group. It can be considered that symbiotic relationships with biota through changing nutrient supplies were formed from the different demands of the plant. Similar explanations may hold for the effect of C supply increasing by exudation or root turnover in the rhizosphere and C as energy sources for heterotrophic microorganisms (Lehmann et al. 2011). The influence on microbial abundance was dissimilar with the different sphere of biochar additions, including rhizosphere and bulk soil. Under nutrient-limiting conditions, microbial abundance may be increased due to the greater nutrient availability after biochar application (Taylor ,1951). The possible reasons were biochar-driven improvements in nutrient retention or the release of nutrient by the biochar (Lehmann et al. 2011). The pH of soils may change, after biochar additions, because of the acidity or basicity of biochar.so different living conditions will be formed for microorganisms with different pH of biochar.With the increase of pH up to values around 7, bacterial populations were possible to increase, whereas, no change in fungi abundance was observed (Rousk et al.2010). Microbial abundance could be increased after microorganisms absorb to biochar surfaces, which render them less susceptible to leaching in soil.Moreover, biochar, containing a well-developed pore structure, may provide living environment for microorganisms. Both bacteria and fungi are hypothesized to be better protected against predators or competitors by exploring pore habitats in biochar (Ezawa et al. 2002; Saito and Marumoto 2002; Thies and Rillig 2009).Biochar could be used to absorb toxins and chemical signals which would hinder microbial growth. Pollock (1947). Biochar has great water holding capacity because of the large surface area, which could promote the growth of microorganisms. Therefore, it is possible that the increased microbial activity highly rely on the easily mineralizable organic content of fresh biochars.The mineralization or oxidation of biochar itself will be influenced by the changes of microbial properties. Therefore, after biochar treatment, the improvements of microbial functional processes could decrease the emissions of gaseous nutrients, increase the retention

Biochar and Nutrients in soil

Biochar is generally regarded as relatively inert when compared to their feedstocks and the carbon of biochars tends to present in the soils for hundreds of thousands of years,depending on the feedstock and type of pyrolysis(Thies and rillig,2009).The functions of biochar are used as soil amendment which enhances plant growth and nutrient use efficiency,improved holding capacity of nutrients such as nitrogen,calcium,phosphorus and higher pH and higher moisture holding capacity.Application of biochars in the soil can increases soil pH and also increased nutrient availability(specially in low pH soil)to plants with biomass of carbon.Biochar helps conserve plant nutrients by storing them its matrix and making the nutrients available when crops need them.The total P in biochar appears to be increasing with higher pyrolysis temperature(Yin Chan and Xu,2009),suggesting that little or no P will be lost to the gas phase during pyrolysis upto 800 degree Celsius.The fate of S during pyrolysis appears to be connected to the feedstock and applied temperature. Biochar -amended soils have had documented beneficial effects on crop yields.with local soil and its amendments.Biochar improves the soil functions as the medium for a growing crop,even as both are subjected to be buffeting variability of growing seasons and climate. Biochar mitigates soil's physical deficiencies. Some soil typically loss At lower temperatures the feedstock characteristics have a large influence on biochar nutrient content. The concentrations of these key plant nutrients in biochar post-production are however strongly influenced by the pyrolysis method, particularly with respect to the highest temperature reached. Many studies indicated that the combination of biochar with soils could improve soil structure ,increase porosity,decrease bulk density, and enhance aggregation and water retention.(Baiamonte et al.2015). Biochar is hygroscopic so ,it is desirable soil material in many locations due to its ability to attract and retain water. This is possible because of its porous structure and high surface area. As a result, nutrients ,phosphorus and agrochemicals are retained for plant benefit.Plants are therefore healthier, and less fertilizer leaches into surface or groundwater.Organic matter and inorganic salt, such as humic-like and fluvic-like substances and available N, P, and K, can serve as fertilizer and be assimilated by plants and microorganisms.

Factors affecting nutrient content and availability in biochars

Nutrient contents in biochars were determined greatly by feedstock source and pyrolytic temperature. For example, N losses began at about 400 °C, then half of the N was lost as volatilizes at about 750 °C in three woody and four herbaceous biochars (Lang et al. 2005). Moreover, the contents of available N (water-soluble) in biochars decreased from 39 to 8 mg kg^{-1} with the increase of pyrolysis temperatures from 350 to 600 °C, which could be attributed to the loss of total N and the heterocyclization of N during pyrolysis (Zheng et al. 2013). Contrasted to total N content in biochars, total P content significantly increased from 0.12 to 0.17 % with the increase of temperature from 300 to 600 °C (Zheng et al. 2013), which was attributed to the loss of carbon and relatively stable P in plant biomass in response to heating (Page et al. 1982). However, the available P in the biochars produced at lower temperature was much higher than the high-temperature biochars. Additionally, the total K content increased from 3.7 % at 300 °C to 5.02 % at 600 °C, while the available K (water-soluble) content increased with the increase of pyrolysis temperature (37 % at 300 °C and 47 % at 600 °C) (Zheng et al. 2013).Additionally, biochars produced from different feedstocks present various nutrient elements composition. For instance, swine manure biochar produced at 400 °C contained large amounts of N (3.2 %) and P (6.1 %) (Tsai et al. 2012), while *Arundo donax* biochar produced at 400 °C had little N (0.69 %)

and P (0.13 %) constituents (Zheng et al. 2013). Moreover, the ash content in the biochars made at 350 °C of poultry litter (30.7 %) (Cantrell et al. 2012) was much higher than that produced from pine wood chip at 350 °C (1.5 %) (Spokas et al. 2011).The pH of the soil is an important factor affecting nutrient availability of biochar (Silber et al. 2010). The release of PO_4^{3-} and NH_4^+ were pH-dependent while the release of K^+ and NO_3^- was not (Zheng et al. 2013). Furthermore, at pH 2–7, the content of PO_4^{3-} and NH_4^+ released from the biochars would be decreased with the increase of pH values, whereas that of K^+remained relatively stable (Zheng et al. 2013). Similarly, the initial Ca and Mg release from corn straw biochar was also pH-dependent, exhibiting an increase in released quantities as pH decreased from 8.9 to 4.5 (Silber et al. 2010).The influence of application time on nutrient release from biochars should be considered. Zheng et al. (2013) set a series of time gradient to explore the relationship between time and water-soluble nutrients. Relatively, lower pyrolysis temperature and pH may increase the availability of N and P, while higher pyrolysis temperature may increase the availability of K.

Biochar-organic carbon

Conversion of plant residues to biochar is an attractive strategy for atmospheric CO_2 emission mitigation and soil carbon (C) storage enhancement. However, our understanding of the factors controlling biochar persistence in soil is still limited, and generally based on biochar chemical recalcitrance. In addition to its chemical properties, biochar C decomposition might be limited by other factors, such as N and low molecular weight C compounds availability.Biochar effects on soil dynamics will need to be farther investigated in the field to better constrain the overall C sequestration potential of biochar.

Biochar -activity of growth

The use of biochar for the soil improvement for crop yields in agricultural fields is lately recognized. Biochar is a carbon rich product obtained from different feedstock at low temperatures.It stores carbon for long time to improve soil fertility and optimized soil pH.application of biochar not only increases crop productivity and soil cation exchange capacity but also is possible to increase soil macro and micro elements.

Enhanced crop yields

Biochar ,when added to soil,improves plant growth and enhances crop yields,increasing food production and sustainibility in areas with depleted soils,limited organic resources,insufficient water and acess to agrochemical fertilizers.Not all soils react same to biochar,and it frequently can take up to a year to see results.On poor soils with low carbon content,many studies have shown biochar can increases crop yields upto 4 times.It is important to note that not all the biochar are same.The physical and chemical properties of biochar greatly affected by the type of feedstock being heated and the conditions of the pyrolysis process.The two different chars will look the same but will behave quite differently.

4. MATERIAL AND METHODS:

4.1 Experimental site

The experiment will be conducted on Agricultural research farm, LPU, phagwara. Geographically it is situated at 31 degree 22 minutes and 31.81 seconds' north latitude and 75 degree and 23 minutes and 3.02 seconds' east longitude with an altitude of about 252 meters above the sea level which falls under the Trans-Gangetic plain region of agro-climatic zone of Punjab.

4.2.Weather and climatic conditions

Region of experimental site comes under sub tropics with cool weather in winter season, hot weather in summers and distant rainfall period in month of July, August and September. South west monsoon is the main source of rainfall. During winter season the temperature never goes below zero. Normally rice is best suited to high temperature, high humidity, prolonged sunshine and assured water supply throughout the crop growth cycle. A temperature range from 20 to 37.5^{0}C is required for optimum crop growth. .Rice required low temperature initially but high at tillering stage. 26.5 to 29.5^{0}C required for blossoming. Almost 83 to 85 percent relative humidity is favorable.

4.3Experimental details

1. Year of experimentation - 2018
2. Recommended dose of fertilizers - As per package and practice of Rice.
3. No. of treatments - 9
4. No. of replications - 3
5. No. of pots - 150
6. Collection of weeds sample - Dec-Jan

7.Date of burning of weed sample -March

8.Date of analysis of biochar in laboratory-April

9. Collection of soil - June

10. Date of sowing - 2nd fortnight of June

11. Sieving of soil and washing pots - 1st -5th July

12. Preparation of potting mixture - 6-7th July

13. Pot arrangement in field - 8th July

14. Date of sowing - 2nd fortnight of June.

13. Method of sowing - Transplanting

14. Crop and variety - Pusa Basmati 3386

15. Transplanting - July

4.4Experimental Design

This experiment is performed in Complete Randomized Design with ten treatments and three replications. This experiment is conducted to decrease the amount of recommended dose of fertilizers by minimum 50 percent. Weed biochar is used as a supplement to increase the fertilizer use efficiency.

4.5Treatment details

To	=	Control
T1	=	100% RDF
T2	=	75%RDF+4%WeedBiochar1+25%Sewage sludge
T3	=	75%RDF+6%WeedBiochar1+25%Sewage sludge
T4	=	75% RDF+4%WeedBiochar2+25%Sewage sludge
T5	=	75% RDF+6%WeedBiochar2+25%Sewage sludge
T6	=	75% RDF+4%WeedBiochar3+25%Sewage sludge
T7	=	75%RDF+6%WeedBiochar3+25%Sewage sludge
T8	=	75%RDF+4%(WeedBiochar1+Weed Biochar2+Weedbiochar3)+25%Sewage sludge
T9	=	75%RDF+6%(WeedBiochar1+WeedBiochar 2+WeedBiochar3)+25% Sewage sludge

4.6Layout

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	T1	T2
T9	T2	T1

4.7 Laboratory Analysis of Soil Samples to be conducted

Soil Physio-Chemical Analysis

Soil pH

pH will be conducted using glass electrode method by (Sparks, 1996) in a 1:2.5 ratio of soil water suspension in a pre-calibrated pH meter.

Electrical conductivity (EC)

Electrical conductivity is also measured using 1:2.5 ratio of soil water suspension in a pre-calibrated EC meter. It will be followed by conductivity meter method given by (Sparks, 1996).

Soil Texture

The method to find the composition of sand, silt and clay is by hydrometer method given by (Bouyoucos, 1962). Textural triangle given by (brady and weil, 2002) can also be used.

Organic Carbon

The determination of soil organic carbon will be based on the Walkley-Black chromic acid wet oxidation method (Allison, 1965).The procedure followed to determine Particulate Organic Carbon will be Camberdella and Elliot, given in 1992.

Available Nitrogen

The method to find the amount of available nitrogen in the soil will be kjeldahl method which is invented by Johan Kjeldahl in 1883.

Available phosphorous

Available phosphorous will be determined using Olsen's method found by Olsen et al (1954) and (Jackson, 1973)

Available potassium

The method of flame photometer given by Toth and Prince, 1949 will be followed.

4.8Agronomic Parameters evaluated

Plant Height, Tiller Numbers

The plant height and tiller numbers were measured at 25, 40, 55, 70 and 85 days after transplanting. Plant height is measured from the base to the tip of the highest leaf and tillers were individually counted.

No of leaves per plant

The number of leaves per plant was counted at 25, 40, 55, 70 and 85 days after transplanting.

Stem Girth

Stem girth was measured using a vernier caliper meter at 25, 40, 55, 70 and 85 days after transplanting.

Clum length, Panicle length and No of panicles

Clum length is measure from soil surface to the neck node (panicle base node). Panicle length is measured from the neck node (panicle base node) to the end of the panicle. Counting and recording the number of panicles except panicles shorter than the half of culm length and late emerging heads to find the no of panicles. Panicle length and no of panicle was measured at 80 and 100 days after transplanting.

4.9Yield Attributes

Seeds per panicle

Grain weight

Straw yield

4.10 COLLECTION OF SAMPLES:

Weed samples will be taken for analysis to check the soil status (pH,E C ,N, P, K and organic carbon) before conducting the experiment.

4.11 OBSERVATIONS TO BE RECORDED:

1. **PLANTS PARAMETERS:**
   - Plant weight
   - Plant height (cm)
   - Root biomass
   - No of leaves per plant
   - Leaf Area Index (LAI)
   - Number of pods
   - Number of grains/pods
   - Stem growth
2. **YIELD ATTRIBUTES:**
   - Grain yield (kg/ha)

3. **BENEFIT COST RATIO:** to be calculated

4. **STATISTICAL ANALYSIS**:Statistical analyses will be conducted after the crop harvesting ,The data obtained from all the observations shall be analyzed using the standard procedures using SPSS 16 to arrive at valid conclusions.

4.12 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

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

5.CONCLUSION

The studies indicates that different physical properties of the soil such as bulk density, total porosity, and the chemical properties such as available nitrogen, available phosphorus ,potassium, and pH and soil organic carbon of the soil were improved due to biochar compared to the control. The application of biochar into soil has a great potential for improving the soils fertility and promoting growth. Biochar choice management is flexible ,it has diverse so could not be used as feed stocks of biochars and also could not pyrolyzed at different temperatures. Biochar has well developed pore structure ,huge surface area, nutrient elements, plenty of liming and amounts of exchangeable cations because of all this properties, soil properties could be improved after biochar treatments. The improvements of soil physical, chemical and biological properties promote the productivity of plant by increasing the amount of nutrient elements, by enhancing availability of nutrient elements, reducing nutrient leaching, and mitigating gaseous nutrients losses. Biochar can be a novel and feasible fertilizer directly or indirectly, not only because of soil fertility but also due to their environmental and economic benefits. Biochar as a new soil amendments has a potential in controlling the fate of trace elements in the soil systems. However, the production of biomass resulted in variable biochars properties which have a influence on trace elements availability in soil. The addition of biochar is a solution because biochar has been shown to improve soil fertility, to promote plant growth, to increase crop yield, and to reduce contamination. The results show that addition of biochars to soil has a positive effect in growth performance and as well as in nutrient content. The results detailing the nutrient content and growth performance of paddy showed that application of biochar in soil improves the biomass production. Due to application of Biochar germination percentage, mean germination time, germination index, plant height, fresh and dry weight of the shoots and roots, number of grains/panicles, number of grains, yield of it were significantly increased. Biochar has significant potential to improve crop performance. This study examined the effect of biochar application on the yield of rice crop grown on the soil . Biochar significantly improved grain yield .Biochar was correlated to increase leaf N and accompanied with improved soil available N and biological N fixation. Biochar application also improved the availability of other soil nutrients, which appeared critical in improving rice performance. Biochar incorporation into soil has shown to improve the soil quality for crop production and sequestered organic carbon into the soil thereby mitigating climate change.

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