

Biochar for Soil Nourishment- A Case Study for Tomato & Chilli

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ABSTRACT: Now a days due to use of artificial fertilizers in farming, the yield of crop is getting damaged. Soil becomes polluted and unfertilized for crop production. So, we made use of Biochar which is organic material. By using Biochar fertility of soil is improved and healthy food is produced for mankind. Biochar has been proven a renewable resource and eco-friendly material for improving soil fertility. The main objective of our study is to increase the water absorbing capacity of soil and to produce crop by organic fertilizer. In this experiment we made a comparative study between Biochar and fertilizer (that is NPK and organic manure) along with the soil (i.e bearing capacity of soil, plasticity etc). The time taken by each fertilizer for production of the crop (Chilli) and how much water is absorbed by each fertilized soil is compared.

KEYWORDS: Corncobs, Chilli, Tomato,Biochar,

I. INTRODUCTION

Biochar is an organic material produced from biomass under high temperatures of pyrolysis in the absence or depleted oxygen. It is a carbon-rich material with plenty of porous structure and functional groups. Biochar is a stable carbon (C) compound created when biomass (feedstock) is heated to temperatures between 300 and 1000°C, under low (preferably zero) oxygen concentrations. The mechanisms involving chemical and physical properties of biochar particles affecting water movement through soil, remove pollutants, alter microbial communities and reduce emissions of greenhouse gases. Preserving soil moisture is important for maintaining water balance for agricultural production, and also helps in reducing the irrigation needs of the crops. This is especially important in areas where rainwater and/or groundwater resources for irrigation are scarce or decreasing due to climate change or other causes. But due to the use of artificial fertilizer the water absorbing capacity of soil gets reduced and due to this crop production becomes less. The main objective of our project is to increase the water absorbing capacity of the soil, to produce crop by organic fertilizer and the most important the change in engineering properties if soil due to use Biochar. By using Biochar, we tried to analyse the production of the crop in short duration of time and also its maximum water absorbing capacity in comparison to other fertilizer. In this project, we made a comparative study between Biochar and fertilizer (that is NPK and organic manure). The time taken by each fertilizer for production of the crop (Chilli) and how much water is absorbed by each fertilized soil is compared.

II. LITERATURE REVIEW

1) **A Systematic Review of Biochar, with a focus on Its Stability in situ and its Promise as a climate Mitigation strategy (September 2013)** by Noel P. Gurwick, Lisa A. Moore, Charline Kelly, Patricia Elias. Background claims about the environmental benefits of charring biomass and applying the resulting "Biochar" to soil are impressive. If true, they could influence land management worldwide. Alleged benefits include increased crop yields, soil fertility, and water-holding capacity. The most widely discussed idea is that applying biochar to soil will mitigate climate change. This claim rests on the assumptions that biochar persists for 100 or 1000 of year, thus storing carbon that would otherwise decomposed.

2) **Review Paper: The Fundamentals of Biochar as a Soil Amendment Tool and Management in Agriculture Scope: An Overview for Farmers and Gardeners (December 2016) by Tawheed Md. Elhessin Shareef, Baowei Zhao.** Improving the soil and biomass with coal is estimated at the international level as a way to enhance soil productiveness, fertility and also to mitigate climate change. Biochar employed to improve land scope and impound carbon, is attracting a great deal of attention. Its characteristics of chemical, physical and biological properties, containing big surface area, CEC(cation Exchange Capacity), High water holding capacity, size of pore, volume, distribution and element of composition, affects its recognised influence, particularly on microbial communities.

3) **The Effects of Biochar and its combination with compost on Lettuce (Lactuca Sativa L.) Growth, Soil Properties, and Soil Microbial Activity and Abundance (April 2017) by Dalila Trupiano, Claudia cocozza, Silvia Baronti, Carla Amendola. Impacts of Biochar application in combination with organic fertilizer, such as compost, are not fully understood.** In this study, we tested the effects of Biochar Amendment, compost addition, and their combination on lettuce plant grown in a soil poor in nutrients; soil microbiological, chemical and physical characteristics were analysed, together with plant growth and physiology an initial screening was also done to evaluate the effect of biochar and composed toxicity, using cress plants and earthworms.

III. METHODOLOGY

1) **Material used:** Corn cobs

2) **Location of project work:** Environmental lab, Civil Department , SSBT's COET, Bambhori

3) **Procedure of Set up:**

- First of all, wash all the corn cobs obtained from the farmers with the hot water then dried under sun for 2-3 days.
- The sun-dried corn cobs are cut into the longitudinal sections.
- also some corn cobs are cut into small pieces to absorb pollutants.
- To make charcoal the small pieces of corn cobs are put into a small size can and that small can is put into a large size drum to heat it up.
- A small hole is made on the small can on the upper face.
- A fire is made up inside the large drum and place that small can having corns cobs in the middle.
- When the can starts heating up the corn cobs inside starts shivering and we can see the smoke is coming through the hole at top of the can. This helps to release the pressure and stops the can from popping.
- The charcoal is made in the presence of oxygen in order to made it efficient.

4) **Procedure of Biochar:**

- Initially if we hold a flame outside the hole at top of can the smoke will immediately put it off. After a while it release a flammable gas which when exposes to flame will immediately catch on fire. When these flames go out try to reignite it again.
- When the flame won't reignite easily, it is the indication that our coal is ready now.
- Cool down the can and take the charcoal outside of can. Crush the charcoal pieces to form a powder charcoal.

5) **Material Specification:**

- (a) Water: Normal boring water with pH 7 is used for irrigating plants.
- (b) Seeds: seeds from the local market are purchased with effective germinating properties.
- (c) Soil: Black cotton soil is used. It is commonly available in the Deccan plateau of Maharashtra.
- (d) Fertilizers: N P K in the proportion of 10:26:26 is purchased from the local market.
- (e) Biochar: Biochar is prepared by pyrolysis of agriculture waste that is corn Stover; cotton plant stems are used. Pyrolysis set up is prepared using used oil cans and small tin container.

6) **Sowing of Seeds:**

1. 14 tin Tubs of dimension 9*9*16.5 cm are used for sowing seeds of chilli and tomato.
2. Two Tubs are used without mixing of biochar and fertilizer(0%).
3. Two Tubs are used with only fertilizer(NPK).
4. Ten Tubs are used with mixing of biochar in increasing percentage of 5% - 25%.
5. Then suitable number of seeds are sowed in each tub.
6. Plant are watered regularly with required water content.
7. Equal condition is maintained for each tub.
8. Regular observation for height and stem thickness, number of flowers, number of fruits are recorded.



Image.1 Chilli Plants



Image.2 Tomato Plants

7) Soil and Biochar Ratio:

Table.1 Soil & Biochar Ratio

% of Biochar	Soil in Kg	Biochar in Kg	Total
0%	7	0	7
5%	6.65	0.35	7
10%	6.3	0.7	7
15%	5.95	1.05	7
20%	5.6	1.4	7
25%	5.25	1.75	7
Fertilizer	7	0	7

IV. RESULTS & OSERVATIONS

Soil Report:

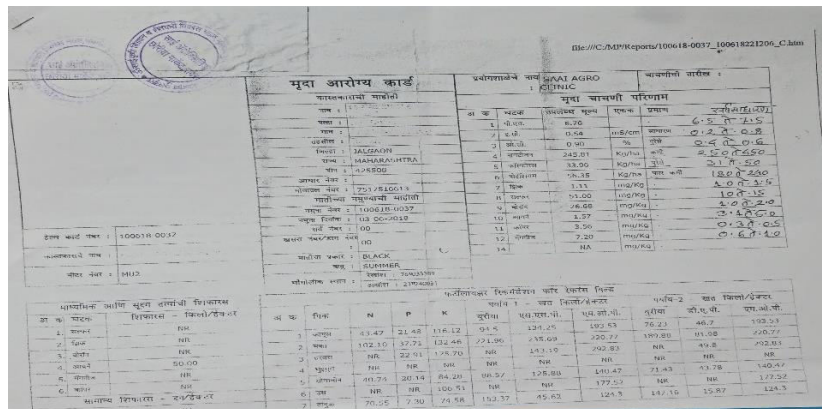


Image.3 Soil Report

Table 2. Height of Chilli and Tomato:

Biochar	0%		5%		10%		15%		20%		25%		Fertilizer	
	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato
Week 1	7.5	12	5.5	10.5	9.5	12	7.5	9	9	8	5	14	6.5	14
Week 2	7.9	17.2	7	13	9.7	17.2	8	12.9	10	12.5	5.5	16	8.1	16.5
Week 3	10	22	10	20	12	22	11	18	12	15	7	18	11	22
Week 4	13.5	23	14.5	22	16	23	13.5	19	16.5	16.5	11.5	21	15	23.5
Week 5	18	27	20	26	21	24	18	21	19	18	15	22	21	26
Week 6	25	38	28	32	25.5	28	21.5	27	23	25	23	24	27	39
Week 7	35	50	41	48	38	44	26	36	26.5	36.5	19.5	39	40	47
Week 8	48	53	54	56	51	59	29	51	34	40	25	48	57	54
Week 9	58.5	56.5	54.5	62.5	54.5	61	31	68	44	51	34	49	66	63
Week 10	60	58	66	76	58	66	33	72	50	56	40	51	72	73



Note: Height in CM.

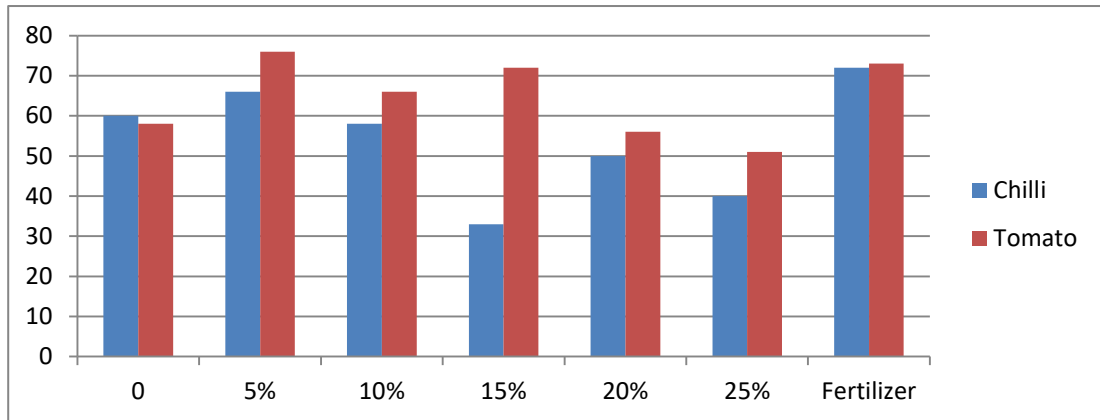


Figure.1 showing Height of Chilli & Tomato of 10th week

Number of Flowers:

Table.3 Number of Flowers(Chilli & Tomato)

Biochar	0%		5%		10%		15%		20%		25%		Fertilizer	
Plants	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato
Week 6	-	5	-	8	-	-	-	2	-	2	-	2	-	2
Week 7	2	9	5	13	4	4	-	5	-	4	2	5	5	12

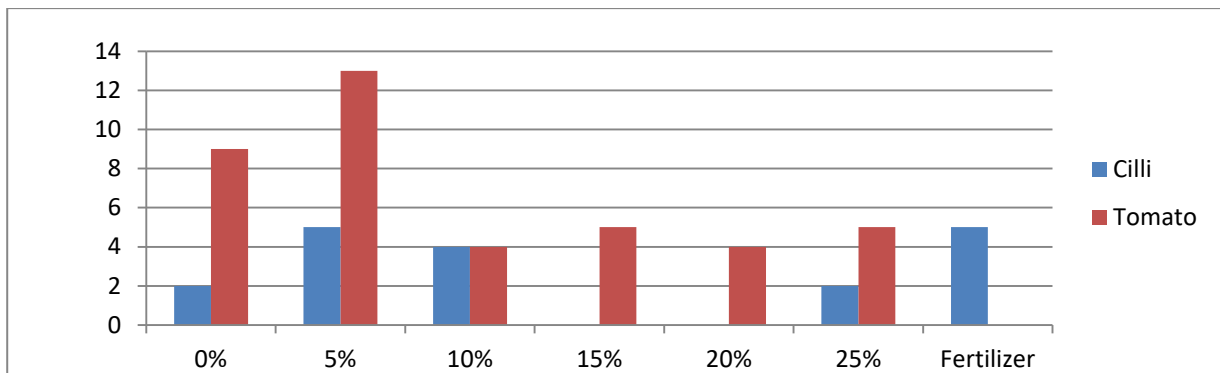


Figure.2 showing Number of Flowers of Chilli & Tomato

Number of Fruits:

Table.4 Number of Fruits(Chilli & Tomato)

Biochar	0%		5%		10%		15%		20%		25%		Fertilizer	
Plants	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato	Chilli	Tomato
Week6	-	2	2	3	-	-	-	-	-	-	-	1	1	2
Week 7	2	3	5	7	1	2	1	1	-	1	-	1	4	6

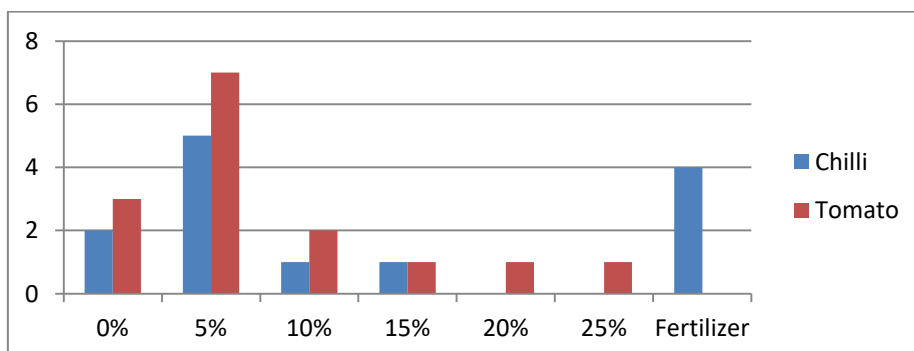


Figure.3 showing Number of Fruits if Chilli & Tomato

V. CONCLUSIONS

- 1) It is observed that Biochar is beneficial for both Chilli & Tomato.
- 2) The Corncobs used for making Biochar, contains carbon & carbon holds water for long time.
- 3) For both the Chilli & Tomato, 5% Biochar gives more growth, flower & yield to the plants as compared to other percentages of biochar used.
- 4) Farm waste is reused properly.

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