Original Research Article

Response of Enriched biochar and Vermicompost on nutrient and seed qualityby sweet corn

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ABSTRACT

Sweet corn is a short-season crop, thus it requires a balanced nutrient supply to ensure adequate crop uptake. Enriched biochar with inorganic fertilizer produces a balanced nutrient by maintaining an inorganic nutrient in the soil and enhancing crop return. The study was carried out in 2020-21 at the CRC, GBPUAT, Pantnagar, Uttarakhand, to investigate the effect of enriched biochar or vermicompost with micronutrients and inorganic nutrients on crop nutrition and seed quality. A randomized block design experiment with three replications was carried out consist eight treatments (control, 100% RDF, 75 and 100% RDF + enriched biochar @ 2t/ha, 75% RDF + enriched biochar @ 2t/ha + micronutrient mixture, 75 and 100% RDF with vermicompost @ 4t/ha, and 75% RDF with vermicompost @ 4t/ha + micronutrient mixture). Treatment 4 (100% RDF + EB@ 2t/ha) produced the maximum yield, nutrient absorption, and quality. As a consequence, a combination of enriched biochar and inorganic produced good results in sweet corn. It is advised that sweet corn be grown in a combination of inorganic and organic fertilizers.

Keywords: Enriched biochar, vermicompost, sweet corn, nutrient, Total soluble solids

1. INTRODUCTION

Sweet corn (*Zea mays* L. *saccharata*), a speciality maize, is gaining popularity in both rural and urban areas due to its high sugar content (25-30%), vitamin A, C content and energy. It is a high-yielding crop with a short growing season [3]. Green cobs are a low-cost, palatable, and digestible source of oil, carbohydrates, sugar, minerals, vitamins and protein.The milking stage, which is normally served after roasting or boiling, has a syrupy, creamy texture and is particularly pleasant. Farmers obtain green fodder in addition to green cobs for their cattle. It is the most important maize in food-processed industries and an appealing rotating crop for producers to cultivate due to its short rotation and simplicity of farming operation automation. Excessive use of inorganic or chemical fertilizers has a negative impact on the environment and makes it harder to maintain a healthy agricultural environment. The continuing use of inorganic conventional fertilizers has degraded soil health. Inorganic fertilizers are prone to loss and provide nutrients to plants for a shorter period of time, resulting in poor nutrient absorption and plant growth, as well as poorer yields. Other than soil rehabilitation, the options for nitrogen management that go beyond typicalNPK fertilizers to increase productivity and efficiency are limited [9].As a consequence, the full potential of the soil has not been achieved, and the equilibrium has been disrupted, necessitating balanced nutrient management to ensure long-term nutrient release and availability to plants, reduce losses, and boost yield levels. Integrated nutrient management (INM) for balanced fertilization is critical for achieving potential productivity, quality, and energy efficiency while also preserving soil health [4]. Vermicompost [10], poultry manure [15], and biochar [8] are examples of organic materials with potential uses for boosting nutrient content and seed quality. Biochar has the potential to improve animal waste composting operations by extending the thermophilic phase, lowering ammonia, methane, and nitrous oxide emissions, and decreasing the pH of compost material. Biochar performance is affected by the feedstock and pyrolysis conditions [13]. Corn produced with biochar composted with poultry litter reduced N_2O and CO_2 fluxes while boosting yield [14]. Enriched biochar can be more effective in conserving soil fertility than typical organic sources because it maintains high soil carbon and supports the prolonged release of macro and micronutrients [7][11]. As a result, the current study was proposed to assess the influence of enhanced biochar on nutrient uptake and quality of kernel.

2. MATERIAL AND METHODS

The study was conducted during the Kharif season of 2020 at CRC, GBPUAT, Pantnagar, Uttarakhand. The variety used is “Central Maize VL Sweetcorn-1” which has been developed by VPKAS, Almora. It is relatively early maturing 70-72 days for plains and TSS content is 15.5-16.0%. Experiment was laid on randomized block design that replicated thrice with 8 treatments are - T1:Absolute control, T2: 100% RDF, T3: 100% RDF+VC@ 4t/ha, T4: 100% RDF+EB@ 2t/ha, T5: 75% RDF+VC@ 4t/ha, T6: 75% RDF+EB@ 2t/ha, T7: 75% RDF+VC@ 4t/ha+µNM,T8: 75% RDF+EB@ 2t/ha+µNM(Micronutrient mixture).Enriched biochar was made from poultry manure and rice rusk biochar. All the data was collected after harvested straw and grain by following methods i.e., Total soluble solid (TSS) was analyzed using grains from the centre of a randomly chosen cob. The juice was extracted by rubbing the grains between two fingers, and the juice was placed on a hand refractometer, with the reading expressing total soluble solids (TSS). A modified micro-Kjeldahl technique was used to determine the nitrogen concentration [6]. Phosphorus was measured in an acid system using the Vanadomolybdo-Phosphoric acid yellow colour method and the potassium content of the digested material was estimated by flame photometer.

3. RESULTS AND DISCUSSION

3.1 Total soluble solids

The data in Table 1 revealed that different treatments failed to bring significant effect on total soluble solids. However, numerically maximum (16.67) and minimum (14.67) TSS were observed under 100% RDF+EB and absolute control, respectively.A similar outcome was obtained by using biochar in a long-term experiment [1].

Table 1. Total soluble solids of sweet corn as affected by different treatments

Treatments	TSS (%)
Absolute control	14.67
100% RDF	15.33
100% RDF+VC @ 4t/ha	15.17
100% RDF+EB @ 2t/ha	16.67
75% RDF+VC @ 4t/ha	15.07
75% RDF+EB @ 2t/ha	15.33
75% RDF+VC @ 4t/ha+µNM	15.17
75% RDF+EB @ 2t/ha+µNM	15.67
SEm $\pm$	0.85
CD (0.05)	NS

3.2 N, P and K Content in Crop

The data for N, P and K content (%) in grain and stover are shown in Table 2.

3.2.1 N content in grain

Nitrogen content in grain discovered that there were no significant variations in N content in grain detected in different treatments. However, crop fertilized with 100% RDF+EB had higher N content (1.96 %) in grain than crops treated with 100% RDF and 100% RDF+VC (1.86 %). Availability of nitrogen up to maturity, as well as increased N absorption and accumulation, retained the leaf greenness till maturity. The absence of fertilizer resulted in the lowest N concentration (0.93 %).[2][5] also found that by using poultry manure and biochar N concentration increased.

3.2.2 N content in stover

An increase in N content of maize stover was seen in 100% RDF+EB, although the increase was not significant. In this investigation, the application of 100% RDF+EB (0.77 %) had more N content followed by 100% RDF+VC (0.73 %).The lowest stover nitrogen concentration was reported under absolute control (0.27 %).[2] resulted in comparable maximum nitrogen content in stover by applying 5 t ha^{-1} of poultry manure + 5 t ha^{-1} of biochar.

3.2.3 P content in grain

Grain phosphorus content in sweet corn was not affected by any of the fertilizer treatments, however, the crop treated with 100% RDF+VC had a higher P content (0.38%) in grain. The lowest nutrient content (0.18%) was observed under absolute control.

3.2.4 P content in stover

The phosphorus content of stover was significantly affected by different fertilizer treatments. The highest P content in stover has resulted was under 100% RDF+EB, followed by 100%

RDF+VC, which were significantly higher than the other remaining treatments. Similarly, biochar enriched with phosphoric acid lowered soil pH while increasing P content in plants [12].

3.2.5 K content in grain

Potassium content in grain is significantly affected by the various fertilizer treatments. Maximum K content in grain was observed under 100% RDF+EB, followed by 100% RDF+VC, both of which were at par with 75% RDF+EB+µNM. It might be related to increased potassium availability before to maturity. [5] also found that by using poultry manure and biochar K concentration increased.

3.2.6 K content in stover

None of the fertilizer treatments had an impact on the K content of the sweet corn stover.

Table 2. NPK content in grain and fodder (%) of sweet corn as influenced by different treatments

Treatments	N grain (%)	N stover (%)	P grain (%)	P stover (%)	K grain (%)	K stover (%)
Absolute control	0.93	0.27	0.18	0.09	0.20	0.63
100% RDF	1.81	0.70	0.34	0.15	0.36	1.06
100% RDF+VC @ 4t/ha	1.86	0.73	0.38	0.16	0.43	1.06
100% RDF+EB @ 2t/ha	1.96	0.77	0.37	0.17	0.42	1.09
75% RDF+VC @ 4t/ha	1.79	0.67	0.37	0.14	0.35	1.04
75% RDF+EB @ 2t/ha	1.81	0.69	0.36	0.15	0.38	1.05
75% RDF+VC @ 4t/ha+µNM	1.78	0.67	0.38	0.14	0.37	1.05
75% RDF+EB @ 2t/ha+µNM	1.81	0.70	0.36	0.15	0.40	1.06
SEm ±	0.09	0.02	0.01	0.004	0.01	0.03
CD (0.05)	NS	NS	NS	0.01	0.04	NS

4. CONCLUSION

The study's main conclusion was that adding enriched biochar with inorganic fertilizer increased the nutritional content of grain and crop while also reducing macronutrient losses by retaining it with biochar.

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