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Influence of Biochar on Yield and Yield Attributes of Sweet Corn

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ABSTRACT

A field experiment was conducted in field number 28 of northern block, Agricultural college farm, Bapatla, Andhra Pradesh to study the influence of biochar on soil properties and yield of maize (sugar cane-var. sugar 75) during *kharif* season of 2014-15. The experimental soil was clay loam in texture, slightly alkaline reaction, low in organic carbon, low in available nitrogen, medium in available phosphorus and high in available potassium. All the micronutrients were sufficient in the soil with values above their critical limits. The treatments comprised of control (no fertilizers) (T_1), RDF (T_2), RDF+Azophos (T_3), 75% RDF+biochar @ 5 t ha^{-1} (T_4),75% RDF+biochar @ 5 t ha^{-1}+Azophos (T_5), 75% RDF+FYM @ 5 t ha^{-1} (T_6), 75% RDF+FYM @ 5 t ha^{-1}+ Azophos (T_7) were replicated thrice in randomised block design (RBD) with three replications. Biochar, FYM and Azophos were incorporated one week before sowing. Entire phosphorus was applied as basal dose in the form of SSP, nitrogen and potassium were applied in 3 and 2 splits, respectively in the form of urea and MOP as per the treatments. Application of 75% RDF+biochar @ 5 t ha^{-1} +Azophos favoured the growth, yield and its attributes besides increasing the content, uptake and post harvest soil fertility with reference to N and P. The results further showed that combined application of 75% RDF and Azophos along with either biochar or FYM have been proved to be superior treatments for the best management of soil fertility in clay loam soils.

Key words : Azophos, Biochar, FYM, RDF and Yield.

Environmental pollution is of serious concern for all agricultural scientists, as modern agriculture in the name of yield maximization either directly or indirectly contributing green house gases and other pollutants to the atmosphere. Carbon sequestration is very important to minimize the load of oxides of carbon in atmosphere, either through increase in vegetation or by minimizing the CO_2 conversion of terrestrial carbon, particularly from agricultural fields. Biochar is a fine grained, carbon rich, porous product remaining after plant biomass has been subjected to thermo-chemical conversion process (pyrolysis) at low temperature (4 350 ^{0}C – 600 ^{0}C) in an environment with little or no oxygen. FYM is one of the oldest manure used by the farmers because of its easy availability and presence of all the essential nutrients in easily mineralizable. The present study was carried out to study the influence of biochar on yield and yield attributes of sweet corn.

MATERIALS AND METHODS

A field study entitled "Influence of biochar on soil properties and maize yield" was conducted during *kharif*, 2014 at Agricultural College Farm, Bapatla using inorganic fertilizers, biochar, FYM and Azophos. The material used and the methods followed during the course of the study are described. The experiment was conducted at Agricultural College Farm, Bapatla located in coastal region of Krishna agro climatic zone of Andhra Pradesh situated between 15° 55' N latitude and 80°30' E longitude and at an altitude of 4.29 meters above the mean sea level and about 8 km away from Bay of Bengal. Biochar, FYM and Azophos were applied to the field according to the treatments one week before sowing. Inorganic nitrogen (urea) was applied at different levels as per the treatments in 3 splits (as basal dose, at knee high and tasseling stages of crop growth). Full dose of 'P (SSP) ' was applied to all the plots as basal dose. Inorganic K (MOP) was applied in two splits (as basal and at tasseling stage of crop growth) according to the treatments (Recommended dose of fertilizers were 120-50-60 NPK kg ha^{-1}). From five randomly selected plants, the total number of cobs, number of kernels per row, number of kernels in each cob were counted and recorded. Their average was taken.

Table 1. Influence of biochar on length, width and no. of kernels per cob.

Treatments	Length of the cob (cm)	Width of the cob (cm)	No. of rows per cob	No. of kermels per cob
T_1 - Control	13.81	12.56	11.97	261
T_2 - RDF	18.21	14.79	14.13	354
T_3 - RDF + Azophos	18.21	14.95	14.53	364
T_4 - 75% RDF + biochar @ 5tha^{-1}	17.53	14.51	13.74	349
T_5 - 75% RDF + biochar @ 5 t ha^{-1} + Azophos	17.87	14.66	14.03	353
T_6 - 75% RDF + FYM @ 5 t ha^{-1}	17.33	14.39	13.87	330
T_7 - 75% RDF + FYM @ 5 t ha^{-1} + Azophos	17.31	14.61	13.93	340
SEm±	0.77	0.48	0.45	15
CD @ 0.05	2.38	1.48	1.39	45
CV (%)	7.79	5.81	5.67	8

Table 2. Influence of biochar on test weight and yield (kg ha^{-1}) of sweet corn.

Treatments	Test weight (g), fresh	Test weight (g), dry	Harvest	
			Grain yield	Stover yield
T_1 - Control	23.71	6.46	2109	3570
T_2 - RDF	36.26	8.67	2588	4608
T_3 - RDF + Azophos	38.22	9.17	2600	4668
T_4 - 75% RDF + biochar @ 5tha^{-1}	35.74	8.00	2459	4248
T_5 - 75% RDF + biochar @ 5 t ha^{-1} + Azophos	35.47	8.51	2464	4268
T_6 - 75% RDF + FYM @ 5 t ha^{-1}	35.59	8.10	2426	4174
T_7 - 75% RDF + FYM @ 5 t ha^{-1} + Azophos	36.51	8.32	2453	4243
SEm±	1.23	0.44	75	190
CD @ 0.05	3.80	1.36	231	584
CV (%)	6.20	9.39	5	8

RESULTS AND DISCUSSION

Length and width of the cob

The highest length of the cob was observed in the treatments supplied with RDF and RDF + Azophos (18.21 cm), where as lowest was noticed in control (13.81 cm). Width of the cob ranged from 12.56 cm (control) to 14.95 cm (RDF + Azophos). Length and width of the cob in the treatments supplied with organics and inorganics were at par with each other and significantly superior to control. Aritola *et al*., 2012 reported that the integrated application of biochar and mineral nitrogen resulted in lengthy ears which was at par with mineral nitrogen application. Timely availability of nutrients mainly nitrogen from organic source (biochar and FYM) might have increased the length of the cob.

Number of rows and kernels per cob

The highest no. of rows and kernels per cob was observed in the treatment supplied with 100% RDF + Azophos and was on par with all other treatments which were significantly superior to control. Number of rows per cob ranged from 11.97 (control) to 14.53 (RDF + Azophos), while no. of kernels per cob ranged from 261(control) to 364 (RDF + Azophos). Integrated application of biochar and mineral nitrogen resulted in more number of rows and grains per cob which was at par with mineral nitrogen application. The possible explanation include, improved uptake of nitrogen by maize through enhancing the organic matter decomposition (Aritola *et al*., 2012).

Test weight

The test weight (fresh and dry weight) of sweet corn presented in table 1 indicated a significant influence of imposed treatments. The greater values were recorded in treatment RDF + Azophos and was on par with remaining treatments. Lowest value was noticed in control. Similar results were observed by Aritola *et al*., 2012. They reported that test weight of sweet corn grown in the soils supplied with biochar + mineral fertilizer was at par with the treatments supplied with FYM + mineral fertilizer and mineral fertilizer alone.

Grain yield

Grain yield ranged from 2109 to 2600 kg ha^{-1}. The highest grain yield of 2600 kg ha^{-1} was recorded with the application of RDF + Azophos (T_3) followed by T_2 and were on par with remaining treatments, while significantly lowest grain yield of 2109 kg ha^{-1} was obtained in control (T_1). The performance of integrated treatments similar to that of sole inorganics might be due to a better and continuous availability of nutrients to the plants up to cob development which ultimately increased the grain yield. Addition of biochar along with NPK improves nitrogen availability to plants (Gokila and Baskar., 2015).

Stover yield

The results indicated that stover yield ranged from 3570 to 4668 kg ha^{-1}. The greater stover yield was observed in the treatments T_2 and T_3 (4608, 4668 kg ha^{-1}, respectively) and were on par with the remaining treatments which were supplied with organics. The lowest grain yield was observed in control.

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