Effect of seed inoculation of biofertilizer and soil application of biochar ongrowth, yield and also to evaluate the economics of different treatment combinations ofbabycorn

Abstract

Thefieldexperimentwas conducted at Crop Research Farm, Department of Agronomy, NainiAgriculture Institute, SHUATS, Prayagraj, UP, during the *Zaid* season of 2023. Theexperiment was laid out in Randomized Block Design with ten treatment combinationswhicharereplicatedthrice.Theexperimentinvolveswiththebiofertilizerslikeazospirillum(10gand20g/kgseed),azotobacter(10gand20g/kgseed)alongwithbiochar(0t/ha,10t/ha,40t/ha).Amongthevarioustreatmentcombinationsin(treatment-9)with the application of Azospirillum 10g/kg seed along with Azotobacter 10 g/kg seedand Biochar 40 t/ha significantly recorded higher plant height(117.13 cm), plant dryweight (34.33 g), cobs/plant (1.87), cob length without husk (14.58 cm), cob weightwithout husk (12.09 g)and cob yield without husk (4.70 t/ha). Maximum gross returns(2,35,000.00₹ /ha),were obtainedin(treatment-9)whereasmaximumnetreturns(1,27,001.00₹ /ha)andhigherbenefitcostratio(1.74)wasobtainedin(treatment-8)withapplicationofAzospirillum10g/kgseed alongwith Azotobacter 10g/kgseedandBiochar 10 t/ha.

Keywords:*Babycorn,Biochar,Biofertilizers,Growth,Yield*

INTRODUCTION

Maize is the third most significant cereal crop close to rice and wheat in India. Baby corn is dehuskedyoungcobofmaizecollectedwithin2-3daysofsilkrise.Babycornhashighnutrientslikevitamin Bandofvarioussupplements.Babycornisascrumptious,enhancingandnutritiousvegetable,withoutcholesterol.Itislowcalorievegetablewhichhelpsinweightheexecutives,itislikewisea lowcarb,highfiber,fatfreevegetable,andhasrichvalueofnutrientsandminerals **(Hekmatetal.,2019[7]).**Onebabycorn can measure up to an 'egg' concerning minerals. Hundred gram of baby corn contained 89.1%moisture,0.2gfat,1.9gprotein,8.2 mgstarch,0.06g ash,28.0mgcalcium,86.0mgphosphorus,and 11.0 mg of ascorbic acid **(Rakesh et al., 2017[14]).** India is the fifth-biggest producer of corn on theplanet, contributing 3% of worldwide creation across an area of around 9.18 million hectares with adevelopmentof 27.23 million tons and a typical efficiency of 2.96 t ha-1. Uttar Pradesh contributes anareaofaround 0.73 M ha with a 7.98% to the whole nation of India, which has a development of around 1.53 M t.Because of expanding mindfulness about wellbeing combined with superior income the interest of babycornis expandinginIndianmarket**(Joshietal.,2018[8]).**

Biofertilizer is a characteristic information that can be applied as a supplement to, or as a substituent ofsynthetic manure in sustainable farming **(Meena et al., 2013[11]**). Bio composts are substances thatcontainlivemicroorganismsthatcolonizetherhizosphereorwithinplantsandinvigorateplantdevelopment by expanding the stock of essential supplement accessibility and additionally animatingobjective plant development, when applied to seeds, plant surfaces, or soil **(Fitriatin et al., 2021[5]).**Mycorrhizaladvantageousinteractionexpandsingestionofcertaincomponentslikephosphorus,nitrogenand micronutrients, further develops water take-up, produces chemicals, lessens harms brought about byecological pressure, works on nature of soil total **(Marngar et al., 2017[12]).** Bio-manures assume asignificant part in the rising accessibility of nitrogen and phosphorus. Among biofertilizers Azospirillumisknowntofixairnitrogenandexpandedaround10-15%grainyieldinmaize**(Rajeshetal.,2023[17]).**Azotobacter,avigorousfree-livingsoilmicroorganismbroadlyutilizedasbiofertilizer,convertsclimaticnitrogen and delivery it as ammonium particles into the soil. They are pervasive and richly tracked downin impartial to feebly acidic soils. The oxygen consuming microbes Azotobacter chroococcum known tofix extensive amount of nitrogen in the scope of 20-40 kg of nitrogen for each hectare in the rhizospherein non-leguminous harvests **(Tejaswi et al., 2021[22]).** Azotobacter was the first and is the most widelyrecognized biofertilizer for certain plants, for example, maize, wheat, sorghum and rice which deliverssomeplantdevelopmentadvancingmetabolites,catalystsandchemicals(auxin,cytokininandgibberelin)as well as fixing air nitrogen. On a normal 20 and 22 kg of nitrogen/ha can be saved by applying ofbiofertilizersofbabycornseedpriortoplantingwithazotobacterorazospirillum,individually**(Srietal.,2023[**

21]).

Biocharischarcoalacquiredfrombiomassintendedtobeincorporatedintosoil**(Yeboahetal.,2016[23]).**Acoupleofsignificantpotentialimpactsofbiocharonsurfacesoilinclude:soilcarbonsequestration,green-house gas releases **(Brassard et al., 2016[3])**, crop-productivity capacity, soil biome **(Lehmann et al.,2011[10]),**soilandchemicalcapacitiesandsolutionforpollutedsoils **(Pillalaetal.,2023[13])**. Inacidicsoils, liming impact of biochar improves soil microbial variety and its capability, along with expandingcationexchangecapacityandharvestwateraccessibility.Applyingofbiochartosoilfurtherdevelops soilfertility retention, for example, soil pH, CEC, absolute C, all out N, accessible P, water storage capacity,nutrientcyclingandalsoincrease inattractionof beneficialmicrobialorganisms**(Sharmaetal.,2022[20])**. Biochar can work as soil conditioner by enhancing the physical and biological attributes ofsoils,forexample,waterholdingrangeandsoilnutrientwithholdingcapacity,andfurthermoreupgradingplant development **(Rathiya et al., 2023[18])** and as valuable soil conditioner for crop better production**(Huang etal.,2013[6])**.

MATERIALANDMETHODS

The experiment on the effect of biofertilizers and biochar on growth and yield of baby corn wereconducted in *Zaid* season of 2023 at Crop Research Farm, Department of Agronomy, SHUATS,Prayagraj which is located is located at 25°39' 42"N latitude, 81°67'56" E longitude and 98 m altitudeabovethemeansealevel(MSL).Thisareaissituatedontheright sideoftheYamunaRiverbythesideofPrayagraj- Rewaroadabout12kmfromthe city.Acompositesoilsamplewascollectedatadepthof 0 to 15 cm depth. The soil with reaction of (pH 7.3), organic carbon (1.217%), available nitrogen(2748.48 kg/ha), phosphorus (45.1 kg/ha), potassium (223.5 kg/ha), Electric conductivity (0.724mm/cm). Baby com (Zea mays L.) variety G5414 were selected for sowing. Seeds were sown in linemanually on 2023. Seeds were covered with the soil immediately after sowing. The spacing adoptedwas plant to plant 10 cm and row to row 45 cm according to the treatment details and the seeds weredrilled at 3-4 cm depth. All the treatments were applied by balancing to the initial soil test values andcroprequirements tojustifythecropresponse tothesuppliednutrients.

RESULTSANDDISCUSSION

Effectofbiofertilizersandbiocharongrowth andyield ofbabycorn.1.GrowthParameters:

1.1. Plantheight

At 40 DAS, significantly higher plant height (117.13 cm) was recorded in (treatment-9) with applicationofAzospirillum10galongwith Azotobacter10g/kgseedandBiochar40t/ha,whereas(treatment7)and

(treatment-8)werefoundtobestatisticallyatparwiththe(treatment-9).Thesignificantresponseinplantheight wasrecordedwithapplicationofbiofertilizersalongwithbiocharinbabycorn.Thismightbedueto the combined effect of biofertilizers along with use of biochar that have increased thenutrientavailability to the plant. Increase in vigorous growth of internode length due to accessibility and uptakeofnutrientsthatmighthaveincreased theplantheight**(Reddyetal.2021[16]).**

1.2. Plantdryweight

At 40 DAS, superiorly higher plant dry weight (34.33 g) was recorded in (treatment 9) with applicationofAzospirillum10galongwithAzotobacter10g/kgseedandBiochar40t/ha,whereas(treatment8)w asfound to be statistically at par with the higher. The significant increase in plant dry weight might be duetotheroleofbiofertilizersandbiocharonenhancingsoilmoisturestatusthatcanindirectlyhelpinbettercropes tablishmentandnutrientuptake.Theapplicationofbiocharwiththeappropriatedoseinplantswillhelpincreasem icrobialactivityinthesoilandwillhaveaneffectonincreasingtheavailabilityof organicmatter in the soil. Optimal organic content in the soil helps in maintaining growth and development inplants**(Rahayuetal.2021[15];BabuandMehera,2022[1]).**

1.3. Cropgrowthrate

During30-40DAS,significantly highercropgrowthrate(29.08g/m2/day)wasrecordedwith(treatment9) with application of Azospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha,However,(treatment-7),(treatment-8)werefoundtobestatisticallyatparwiththehigher.Thesignificantincreaseincropgrowthratemightmeduetoth esynergeticeffectofbiofertilizersandbiochar mighthaveattributed the crop growth and microbial activity of biofertilizers which have enhanced the supply ofnutrientstotheplant.

1.4. Relativegrowthrate

During 30-40 DAS, the higher relative growth rate (0.0565 g/g/day) was recorded (treatment-9) withapplication of Azospirillum 10g + Azotobacter 10g/kg seed + Biochar 40 t/h and also, which was foundtobestatisticallyatparwithhigheramongalltreatments.

2. YieldParameters:

2.1. Numberofcobs/plant

Significantly maximum number of cobs/plant (1.87) was recorded with (treatment-9) with application ofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) werefoundtobestatisticallyatparwiththehigher.

2.2. Coblengthwithhusk

Significantly higher cob length with husk (22.62 cm) was recorded in (treatment-9) with application ofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) werefoundtobestatisticallyatparwiththehigher.

2.3. Coblengthwithouthusk

Significantly higher cob length with husk (14.58 cm) was recorded in (treatment-9) with application ofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) werefoundtobestatisticallyatparwiththehigher.

2.4. Cobgirthwithhusk

Significantly higher cob girth with husk (7.16 cm) was recorded in (treatment-9) with application ofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) werefoundtobestatisticallyatparwiththehigher.

2.5. Cobweightwith husk

Significantly higher cob weight with husk (41.13 g) was recorded in (treatment-9) with application ofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) and(treatment-7)were foundtobestatisticallyatparwiththe higher.

2.6. Cobweightwithouthusk

Significantlyhighercobweightwithouthusk(12.09g)wasrecordedin(treatment-9)withapplicationofAzospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8) werefoundtobestatisticallyatparwiththehigher.

2.7. Cobyield withouthusk

Significantly higher cob weight without husk (4.70 t/ha) was recorded in (treatment-9) with applicationof Azospirillum 10g along with Azotobacter 10g/kg seed and Biochar 40 t/ha, whereas (treatment -8)werefoundtobestatisticallyatparwiththe(treatment-9).

Significant increase in the yield parameter and yield of baby corn might be due the application ofbiofertilizer thathavebeenprovedbeneficialfordevelopmentofcornyieldattributingcharactersmainlyduetoavailabilityof optimum amountofnutrientsduring reproductive phaseofthe crop.(**Tejaswi*etal*.2021[22]**). Usage of biochar might have increased the organic carbon in the soil, that helps the roots ofbaby corn in nutrientuptake andrapidphotosynthesis andsupply of nutrients from source tosink.Biofertilizersincreasesthenitrogenavailabilityinthesoilthatmighthaveimprovedtheyieldofbabycorn(**BarlalandAdhikari.2013[2]**).Theincreaseintheyieldattributesandyieldofbabycornmight beduetothe synergeticeffect of biofertilizers and biochar that have enhanced water holding capacity, increasedcationexchangecapacity(CEC)andprovisionofamediumforadsorptionofplantnutrientsandimprovedconditionsforsoilmicro-organismsanddirectnutrientsfromNPK.Theriseincornyieldcouldbecrediteddue to the overall enhancement in soil chemical, physical and biological properties (**Dzomeku*et al*.2018[4];Sashi *etal*.2018[19]**).

3. Economics

3.1. Costofcultivation

Thecostofcultivationoftreatmentsvariesbetween93,007.80 ₹ /haand52,974.80₹ /ha.Maximumcost ofcultivationis recordedwithapplication ofAzotobacter 20g/kgseed+Biochar 40t/ha(₹ 1,33,007.80). Theminimum cost ofcultivation isin control(₹ 52,974.80).

3.2. Grossreturns

Maximumgrossreturns(2,35,000.00₹ /ha)were recordedin(treatment-9) Azospirillum10gandAzotobacter 10g/kg seed along with Biochar 40 t/ha and minimum gross return (78,333.33 ₹ /ha) wasrecordedincontrol.

3.3. Netreturns

Maximumnetreturns(1,27,001.00₹ /ha)wererecordedin(treatment-8)Azospirillum10gandAzotobacter 10g/kg seed along with Biochar 10 t/ha and minimum (25,358.53 ₹ /ha) was recorded incontrol.

3.4. Benefitcostratio

Higher benefit cost ratio (1.74) was recorded in (treatment-8) Azospirillum 10g and Azotobacter 10g/kgseed along with Biochar 10 t/ha and lowest (0.22) was recorded in Azospirillum 20g/kg seed + Biochar40t/ha.

CONCLUSION

It is concluded that among different treatment combinations, with the application of Azospirillum 10g+Azotobactor 10g/kg seed & Biochar 10 t/ha has recorded maximum net returns (1,27,001.00 ₹ /ha) andhigherbenefitcostratio(1.74).Italsofoundtobestatisticallyatpar withmaximumplantheight,plantdryweight,numberof cobs,cobyield.So,itisthetreatmentbestandeconomicallyprofitableforfarmers. Although the findings are based on one season. Further research is needed to confirm the findings anditsrecommendation.

Table.1Effectofbiofertilizersand biocharongrowthattributesofbabycorn

S.No	Treatments	Plant height(cm) At40DAS	Plantdry weight (g/plant) At 40DAS	Cropgrowth rate(g/m^2/day) During (30-40DAS)	Relativegrowth Rate(g/g/day) During (30-40DAS)
1.	Azospirillum20g/kgseed+Biochar0t /ha	109.13	29.61	24.61	0.0550
2.	Azospirillum20g/kgseed+Biochar 10t/ha	110.60	30.09	25.00	0.0548
3.	Azospirillum20g/kgseed+Biochar 40t/ha	111.13	30.59	25.42	0.0549
4.	Azotobacter20g/kgseed+Biochar 0t/ha	112.67	31.01	25.80	0.0550
5.	Azotobacter20g/kgseed+Biochar 10t/ha	114.07	31.74	26.44	0.0551
6.	Azotobacter20g/kgseed+Biochar 40t/ha	114.60	32.41	27.22	0.0558
7.	Azospirillum10g+Azotobactor10g/kg seed&Biochar0t/ha	115.13	32.85	27.64	0.0559
8.	Azospirillum10g+Azotobactor10g/kg seed&Biochar10t/ha	115.87	33.13	27.90	0.0560
9.	Azospirillum10g+Azotobactor10g/kg seed&Biochar40t/ha	117.13	34.33	29.08	0.0565
10.	Control(120-60-40NPKkg/ha)	107.47	29.84	24.98	0.0555
	F-Test	S	S	S	NS
	SEm(±)	0.67	0.40	0.57	0.0010
	CD(p=0.05)	2.01	1.19	1.70	-

Table.2Effectofbiofertilizersandbiocharonyieldattributesofbabycorn

S.No	Treatments	Number ofcobs/plant	Cob lengthwith husk(cm)	Cob lengthwithout husk(cm)	Cob girthwith husk(cm)	Cob weightwith husk(g)	Cob weightwithouthusk (g)	Cob yieldwithouthusk(t/ha)
1.	Azospirillum20g/kgseed+Biochar0t/ha	1.20	19.29	10.95	5.45	35.99	07.33	1.67
2.	Azospirillum20g/kgseed+Biochar10t/ha	1.40	20.02	11.64	5.63	36.13	10.54	2.83
3.	Azospirillum20g/kgseed+Biochar40t/ha	1.53	20.38	12.08	5.88	37.03	11.06	3.23
4.	Azotobacter20g/kgseed+Biochar0t/ha	1.40	20.98	12.49	5.99	37.40	08.19	2.23
5.	Azotobacter20g/kgseed+Biochar10t/ha	1.47	21.20	12.81	6.30	38.43	10.81	3.10
6.	Azotobacter20g/kgseed+Biochar40t/ha	1.60	21.47	13.48	6.34	39.42	11.15	3.77
7.	Azospirillum10g+Azotobactor10g/kgseed&Biochar0t/ha	1.40	21.91	13.76	6.46	40.00	08.41	2.33
8.	Azospirillum10g+Azotobactor10g/kgseed&Biochar10t/ha	1.60	22.29	14.10	6.93	40.43	11.79	4.00
9.	Azospirillum10g+Azotobactor10g/kgseed&Biochar40t/ha	1.87	22.62	14.58	7.16	41.13	12.09	4.70
10.	Control(120-60-40NPKkg/ha)	1.13	18.87	10.76	5.37	35.31	07.21	1.57
	F-Test	S	S	S	S	S	S	S
	SEm(±)	0.10	0.22	0.23	0.10	0.34	0.10	0.23
	CD(p=0.05)	0.30	0.65	0.69	0.32	1.02	0.31	0.71

Table.3Effectofbiofertilizersand biocharoneconomicsofbabycorn

S.No	Treatments	Costofcultivation(₹)	Grossreturns(₹)	Netreturns(₹)	Benefit costratio
1.	Azospirillum20g/kgseed+Biochar0t/ha	52,990.20	83,333.33	30,343.13	0.57
2.	Azospirillum20g/kgseed+Biochar10t/ha	72,990.20	1,41,666.67	68,676.47	0.94
3.	Azospirillum20g/kgseed+Biochar40t/ha	1,32,990.20	1,61,666.66	28,676.47	0.22
4.	Azotobacter20g/kgseed+Biochar 0t/ha	53,007.80	1,11,666.67	58,658.87	1.11
5.	Azotobacter20g/kgseed+Biochar10t/ha	73,007.80	1,55,000.00	81,992.20	1.12
6.	Azotobacter20g/kgseed+Biochar40t/ha	1,33,007.80	1,88,333.33	55,325.53	0.42
7.	Azospirillum10g+Azotobactor10g/kgseed&Biochar0t/ha	52,999.00	1,16,666.67	63,667.67	1.20
8.	Azospirillum10g+Azotobactor10g/kgseed&Biochar10t/ha	72,999.00	2,00,000.00	1,27,001.00	1.74
9.	Azospirillum10g+Azotobactor10g/kgseed&Biochar40t/ha	1,32,999.00	2,35,000.00	1,02,001.00	0.77

References

1. Babu,D.N.andMehera,B.InfluenceofIronandBio-FertilizeronGrowthParametersandYieldofBabyCorn (Zea mays L.) Prayagraj Condition. *International Journal of Environment and Climate Change*. 2022,**12**(10):830-836.
2. Baral,B.RandAdhikari,P.Effectof azotobacterongrowthandyieldofmaize.*SAARCJ.Agri.*2013,**11**(2):141-147.
3. Brassard,P.,Godbout,S.andRaghavan,V.Soilbiocharamendmentasaclimatechangemitigationtool:Keyparameters and mechanismsinvolved.*Journalofenvironmentalmanagement*.2016,**181**:484-497.
4. Dzomeku,I.K.,Illiasu,OandAmegbor,I.K.Effectofbiochar,ricehuskandricestrawonproductivityofmaize(zea maysL.)andsustainablesoilfertilityresortation.*JournalpfExperimentalAgricultureInternational.*2018,**20**(6):1-11.
5. Fitriatin,B.N.,Yusuf,M.I.M.,Sofyan,E.T.andNurbaity,A.Biofertilizersapplicationtoimprovegrowthofmaizeand soil nutrients.E3SWebof Conferences. 2021, **316**,03020.
6. Huang,M.,Kang,L.,Qin,H.,Jiang,L.andZou,Y.Quantifyingtheeffectofbiocharamendmentonsoilquality and cropproductionin Chinesericepaddies.*FieldCropsResearch*. 2013,**154**:172–77.
7. Hekmat,A.W.,Mohammadi,N.K.andGhosh,G.EffectofNPK,biofertilizerandzincfoliarnutritionongrowthand growthattributesofbabycorn(Zeamays L.).*InternationalJournalofChemicalStudies*. 2019,**7**(4): 2432-2436.
8. Joshi,G.,Pal,M.S. and Chilwal, A.Impactofintegratednutrient management onphysiological nutrient efficiency and economicsofbabycorn(ZeamaysL.).*JournalofPharmacognosyandPhytochemistry*.2018,**7**(5):532-534.
9. Kamara,A.,Kamara,H.S.andKamara,M.S.EffectofRiceStrawBiocharonSoilQualityandtheEarlyGrowthand BiomassYield ofTwoRiceVarieties.*Agricultural Sciences*.2015,**6**(8):798-806.
10. Lehmann,J.Biochareffectsonsoilbiota–areview.*Soilbiologyandbiochemistry*.2011,**43**(9):1812-1836.
11. Meena,M.D.,Tiwari,D.D.,Chaudhari,S.K.,Biswas,D.R.,Narjary,B.,Meena,A.L.andMeena,R.B.Effectof BiofertilizerandNutrientLevelsonYieldandNutrientUptakebymaize(ZeamaysL.).*AnnalsofAgri-Bio Research*.2013,**18**(2):176-181.
12. Marngar,E.andDawson,J.EffectofBiofertilizers,levelsofnitrogenandzincongrowthandyieldofhybridmaize (Zeamays L.).*International Journalof Current Microbiologyand AppliedSciences*. 2017, **6**(9): 3614-3622.
13. Pillala,R.,Sowmya,N.S.L.,Gajbhiye,P.andUpadhyay,H.Impactofbiocharinsustainablecropproductionandsoil healthmanagement:Areview.*ThePharmaInnovationJournal*.2023,**12**(5):569-577.
14. Rakesh,K.,Narendra,K.,Sudhir,K.,Amitesh,K.S.,Bohra,J.S.EffectofNPKSandZnFertilizationon,Growth,Yield

andQuality ofBabyCorn-AReview. *InternationalJournal of CurrentMicrobiologyandAppliedScience*. 2017,**6**(3):1392-1428.

15.Rahayu,M.,Nurmalasari,A.I.andAini,N.N.Effectofvarioustypesanddosesofbiocharonhybridmaizegrowth. *EarthandEnvironmental Science*.2021, doi:10.1088/1755-1315/1016/1/012053

16.ReddyVinayKumar Reddy andSikhasingh.Responseofbiofertilizers and phosphorouslevelongrowthandyieldof wheat(TriticumaestivumL.). *ThePharma InnovationJournal*.2021,**10**(11); 293-296.

17.Rajesh,B.,Mehera,B.andKumar,P.EffectofBio-fertilizerandgibberellicacidongrowthandyieldofbabycorn. *InternationalJournal odEnvironment andClimateChange*.2023, **13**(7):602-607.

18.Rathiya,G.R.,Tiwari,A.,Samadhya,V.,Singh,A.K.andKosariya,Y.K.Effectofbiocharandcropresiduesapplication onyieldand nutrientuptakesof groundnutcrop.*ThePharma InnovationJournal*.2023, **12**(2):2355-2360.

19.Shashi, M.A.,Mannam,M.M.andRahman,M.M.Impactofricehuskbiocharongrowth,waterrelationsandyieldof maize(Zeamays L.)under drought conditions.*TheAgriculturists*. 2018,**16** (2): 93-101.

20.Sharma,J.K.,Meena,R.H.,Jat,G.andShekhawat,A.S.Effectoffertilitylevelsandbiocharonyieldofwheat.*The PharmaInnovation Journal*. 2022,**11**(7): 3590-3594.

21. Sri,S.R.S.,Debbarma,V.andReddy,S.R.K.Effectoforganicmanuresandbiofertilizersongrowthandyieldof babycorn.*InternationalJournalofPlantand SoilScience*.2023,**35**(20):436-42.

22. Tejaswi,Y.,Singh,S.andMeshram,M.R.Effectofzincandbio-fertilizersongrowth,yieldandeconomicsofbabycorn (Zeamays L.).*ThePharmaInnovation Journal*. 2021,**10**(10): 167-170.

23.Yeboah,E.,Asamoah,G.,Kofi,B.andAbunyewa,A.A.Effectofbiochartypeandrateofapplicationonmaizeyield indicesandwateruseefficiencyonanUltisol inGhana.*EnergyProcedia*. 2016,**93**:14-18.