Original Research Article

Comment [A1]: The distance between lines and margins should be according to the format

Studiesonvariouslevelsoforganicsourcesandmajornutrientsongrowthandyieldofsproutingbroccoli(*Brassica oleraceavar.italicaPlenck*)

ABSTRACT

AfieldexperimentwascarriedoutattheVegetableResearchFarm,ChandraShekharAzadUniversityofAgricultureandTechnology,Kanpur(U.P.)duringRabiseason2021-22.Theexperimentconsistsoftwenty-fourtreatment combinations of six sources of organic manure and four levels of majornutrients. The experiment was laid out in Factorial Randomized Block Designwith replicated three times. Palam samridhi variety of broccoli was transplantedat spacing of 45x45 cm. Results of the experimentrevealed that thegrowthcharacters of broccoli like plant height (cm), number of leaves plant^{-1}, plantspread, stem diameter and Yield attributes viz total head yield per plot(kg) andtotalheadyield(q/ha)weresignificantlyhigherunderM_6(FYM20t + Vermicompost 5 t+ Poultry manure5 tha^{-1}) source of manure which was atpar application of M_4 (Vermicompost 5 t ha^{-1}) whereas in case of major nutrientsit was significantly higher under application of (140:80:80 kg NPK ha^{-1}) but itwasatparwith(120:60:60kgNPKha^{-1})andsignificantlysuperiortorestsourcesoforganicmanure.

Comment [A2]: State the reason for the test in one line

Keywords:Sprouting Broccoli,Nutrients, growth attributes, yield

Comment [A3]: Use words that are not in the title

Introduction

In India, broccoli farming is a boon for the rural economy. It is a cool seasoncrop andcan be grown in spring season.Itis richsourceofnutrition such asiron, calcium and vitamins. The crop contains 3.3% of protin content and highcontent of vitamin A and C. (Anonymous, 2022).Broccoli (*Brassica oleracea*var. *italica* L.) is a popular vegetable which belongs to the family Cruciferae.Broccoli is derived from the Latin word *brachium* and the Italian term broccoli,both of which imply "arm" or "branch." It is often divided into three groups:white, purple, and green, with the green form being the most nutritious. Morphologically, it is similar to cauliflower, with the exception ofsecondary heads that form in the leaf axils. Humans eat the terminal head as wellas the sprouts with bud clusters. These heads are green, purple, and white incolour,andtheirwildformcanbefoundthroughouttheMediterraneanregion.It's eaten raw, half-boiled, in soup with other vegetables' juices, and cooked as asingleormixedvegetablewithpotato.InIndia,specificdataonsproutingbroccoli for area and production are unavailable. It is mostly grown in HimachalPradesh, Uttar Pradesh, Jammu and Kashmir, Nilgiri Hills, and the NorthernPlainsofIndia.Itisbecomingincreasinglypopularin India.Appropriatefertilization may ensure lucrative and high-quality crops, as well as the use of theright amount and combination of fertilizers to boost agricultural output. Despiteits relevance, broccoli nutrition management has received little attention in ourcountry. The purpose of this investigates / Research is to design growth and yieldregimensforabroccoliproductionutilizingbothorganicand majornutrients.

Comment [A4]: The introduction is very short
Add text about experimental treatments
Added new references

Materialsandmethods

An experiment was conducted at Vegetable Research Farm ofChandra ShekharAzad University ofAgricultureand Technology, Kanpur(U.P.)during *Rabi*season 2021-22. The experiment was laid out in Factorial Randomized BlockDesign with 3 replications. The soil was sandy loam with organic carbon 0.34%,availableN152.0kg/ha,phosphorus14.76kg/haandpotassium180.0kg/haat initiation of experiment. The broccoli variety Palam samridhi was used in theexperiment, which is an early -maturity variety and takes around 70 days fromtransplantingtofirstharvesting.Twenty-fourtreatmentcombinationsofsixsources of organic manure and four levels of major nutrients. Organic sources

i.e.M_1:FarmYardManure(20t/ha),M_2:Vermicompost(5t/ha),M_3:PoultryManure (5 t/ha), M_4: Farm Yard Manure + Vermicompost (20 t/ha + 5 t/ha), M_5:FarmYardManure+Poultry Manure(20t/ha+5t/ha),M_6:FarmYardManure + Vermicompost + Poultry Manure (20 t/ha + 5 t/ha + 5 t/ha) and major nutrientsi.e.F_0:Control,F_1:80 N+40P_2O_5 +40K_2O,F_2:120N+60P_2O_5+60K_2O,F_3:140 N + 80 P_2O_5 + 80 K_2O. The crop was transplanted in plots size of 1.8m X1.8m with a spacing of 45cm between rows and 45cm between plants. Organicmanureswereappliedatthetimeoffieldpreparationaspertreatment.Allremaining other recommended cultural practices were followed to raise healthycrop.

Resultsand Discussion:

Growthandyield attributes

Data recorded on growth and yield attributes viz; plant height, plantspread, stem diameter, number of leaves per plant as influenced by differentlevelsoforganicsourcesandmajornutrientsclearly indicatedthatincreasesignificantly by the application of organic sources of FYM 20 t/ha + Vermi-compost 5t/ha + 5t/ha Poultry manure and 140:80:80 kg NPK/ha as compared toother doses of application. Maximum number of leaves i.e. 14.15 per plant wasnoted treatment M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 tha^{-1}) which was on par with treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) and significantly superior to rest organic sources. The among organic sourcesM_6(FYM20tha^{-}+Vermicompost5tha^{-1}+Poultrymanure5tha^{-1})beingatpar with M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) produced significantly taller plantthanrestof organicsources.MinimumheightwasnotedunderM_1(FYM20 tha^{-1}) treatment. Maximum stem diameter i.e. 5.13 cm was noted treatment M_6(FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}) which was onpar with treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) and significantly superiortorest organicsources.Least diameter of stem was associated with M_1(FYM @ 20tha^{-1}).Lowest diameter of stem was associated with M_1(FYM 20 tha^{-1}). The highest plant spread of 61.20cm was obtained with M_6(FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}) which was atpar with treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) and significantlysuperior to other organic sources. However, the plant spread was recorded withM_1FYM(20tha^{-1})whichwas54.78cm.Themaximumspreadwasobtainedof60.27cmwithF_3(140+80+80kgNPK ha^{-1})whichwasatparwithF_2(120+60+60kgNPKha^{-}

Comment [A5]: The results of the soil test should be presented in the table.
Agronomic practices should be explained.
The method of measuring traits should be stated with reference.
The statistical software used should be mentioned.

Comment [A6]: This part is weak. be edited

Comment [A7]: The results of variance analysis should be presented in a separate table

Comment [A8]: In the text, the units should be based on the format

^{1})andsignificantlysuperiortooverresttreatments.However, the lowest plant spread of 54.37 cm was recorded with F_0 (0+0+0kgNPK ha^{-1}) nutrient level. The role of appropriate combination of organic sources*viz.*, FYM 210t/ha + Vermi compost 5t/ha + Poultry manure 5t/ha + Poultrymanure 5t/ha and 140 kg + 80 kg NPK/ha on increase of plant height, plantspread and stem diameter have been confirmed by Renand *et al.*, 2014, Mehdi *et al.*, 2018, Burhan and Al-Taey 2018 and Hamza and Al-Taey2020.

Comment [A9]: State the scientific reasons for each result.
About the results of other researchers, text should be added.

Comment [A10]: If the interaction effect of the treatments is significant, the results should be presented
(in the text and in the table)

Table-1:**Effectoforganicsourcesandmajornutrientsonplantgrowthparameters**

Treatments	Numberof leafPlant^{-1}	Plantheight (cm)	Diameterofstem(cm)	Plantspread
Organicsources				
M_1FYM(20tha^{-1})	12.30	48.93	4.43	54.23
M_2Vermicompost (5tha^{-1})	13.10	52.38	4.73	57.78
M_3Poultrymanure(5tha^{-1})	12.50	49.70	4.45	54.78
M_4(FYM 20tha^{-}+Vermicompost5t ha^{-1})	13.90	55.53	5.03	60.43
M_5(FYM20tha^{-}+Poultrymanure5t ha^{-1})	13.40	53.48	4.83	59.23
M_6(FYM 20tha^{-}+Vermicompost 5 t ha^{-1} + Poultrymanure5 tha^{-1})	14.15	56.68	5.13	61.20
SEm(±)	**0.26**	**1.13**	**0.09**	**1.18**
CD(P=0.05)	**0.74**	**3.23**	**0.27**	**3.36**
Majornutrients				
F_0(0+0+0kgNPK ha^{-1})Control	12.32	49.25	4.45	54.37
F_1(80+40+40 kgNPK ha^{-1})	12.90	51.38	4.63	57.55
F_2(120+60+60kgNPK ha^{-1})	13.75	54.97	4.93	59.57
F_3(140+80+80kgNPK ha^{-1})	13.93	55.52	5.03	60.27
SEm(±)	**0.21**	**0.92**	**0.08**	**0.96**
CD(P=0.05)	**0.61**	**2.63**	**0.22**	**2.74**

Marketableheadyield:

The data assembled on total marketable head yield kg plot^{-1} of broccoliwas recorded. The sources was noted on marketable headyield kg plot^{-1} ofbroccoli and maximum marketable head yield kg plot^{-1} of broccoli i.e. 6.46 kg wasobtained with M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 tha^{-} ^{1})whichwasatparwithtreatmentM_4(FYM20tha^{-}+Vermicompost5tha^{-1}) which recoded 6.33 kg plant weight and these were significantly superior toother organic sources. However, minimum marketable head yield kg plot^{-1} wasrecorded with M_1 FYM (20 tha^{-1}) which was 5.80 kg. Application of differentdoses of major nutrient showed significant effect on the marketable head yield kgplot^{-1} of broccoli. Maximum marketable head yield kg plot^{-1} of 6.40 kg wasobtainedwithF_3(140+80+80kgNPKha^{-1})whichwasatparwithF_2(120+60+60 kg NPK ha^{-1}) and significantly superior to over rest treatments.However, the lowest marketable

headyield kg plot^{-1} of 5.78 kg was recordedwith F_0 (0+0+0 kg NPK ha^{-1}) nutrient level. Marked influence of organic sourceswas noted on marketable head yield of broccoli and maximum marketable headyield of broccoli i.e. 199.36 q ha^{-1} g was obtained with M_6 (FYM 20 t ha^{-} +Vermicompost5tha^{-1}+Poultrymanure5tha^{-1})whichwasonparwithtreatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) which recoded 195.51 qyield and these were significantly superior to other organic sources. However,minimum marketableheadyield was recorded with M_1 FYM (20 tha^{-1}) whichwas178.89qha^{-1}.Applicationofdifferentdosesofmajornutrientshowedsignificanteffectonthemarketableyieldo fbroccoli.Maximummarketableyield of 197.38qha^{-1} was obtained with F_3 (140+80+80 kg NPK ha^{-1}) which wasat par with F_2 (120+60+60 kg NPK ha^{-1}) and significantly superior to over resttreatments. However, the lowest marketable yield of 177.54 q ha^{-1} was recordedwith F_0 (0+0+0kg NPK ha^{-1}) nutrient level. The production of significantlyhigher level of marketable head yield has been achieved by the cumulativecombination of average head weight size of head and head compactness. Thesignificant effect of higher level of application of FYM 210t/ha + Vermi compost5t/ha + Poultry manure 5t/ha + Poultry manure 5t/ha and 140 kg + 80 kg NPK/hainachievinghigherlevelofmarketableheadyield(190q/ha)whichmightbe obtained due to higher yield attributing characters*viz.*, average head weight,head size and head compactness. Similar observations were also recorded byBiswas*et al.*, 2021, Singh *et al.*, 2021 and Tarafder *et al.*, 2022.

Table-2:**Effectoforganicsourcesandmajornutrientsonyieldattributesof Broccoli.**

Treatments	**Marketableheadyield(kgplot^{-1})**	**Marketableheadyield(qha^{-1})**
Organicsources		
M_1FYM(20tha^{-1})	5.80	178.89
M_2Vermicompost (5tha^{-1})	6.21	191.69
M_3Poultrymanure(5tha^{-1})	5.91	182.54
M_4(FYM20t ha^{-}+Vermicompost 5t ha^{-1})	6.33	195.51
M_5(FYM20t ha^{-}+Poultrymanure 5t ha^{-1})	6.03	186.19
M_6(FYM20 t ha^{-}+Vermicompost 5tha^{-1}+Poultrymanure5t ha^{-1})	6.46	199.36
SEm(+)	**0.12**	**3.71**
CD(P=0.05)	**0.34**	**10.57**
Majornutrients		
F_0(0+0+0kgNPK ha^{-1}) Control	5.78	177.54
F_1(80+40+40 kgNPK ha^{-1})	6.01	185.42
F_2(120+60+60kgNPK ha^{-1})	6.21	191.77
F_3(140+80+80kgNPK ha^{-1})	6.40	197.38

Comment [A11]: State the scientific reasons for each result.
About the results of other researchers, text should be added.

Comment [A12]: If the interaction effect of the treatments is significant, the results should be presented
(in the text and in the table)

SEm(+)	**0.10**	**3.03**
CD(P=0.05)	**0.28**	**8.63**

Comment [A13]: Correlation between traits should be presented

Conclusion

Onthebasisofresultsobtainedfromthepresentinvestigation,itcanbeconcluded thatamong organic sources, M_6 (FYM 20 t ha^{-} + Vermicompost 5 tha^{-1} + Poultry manure 5 t ha^{-1}) and a dose of F_3 (140+80+80 kg NPK ha^{-1}) majornutrients proved to be the most suitable for commercial cultivation under Kanpur conditions.

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Comment [A14]: At least 25 references
The reference is new
Be updated according to the new text