OriginalResearchArticle

Effect of different organic manure and inorganic fertilizer on growth, yield and quality of okra (*Abelmoschus esculentus* L.)

Comment [AC1]: It is suggested: Effect on the growth, yield and quality of okra (Abelmoschus esculentus L.) of different organic fertilizers and inorganic fertilizers.

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Abstract

Due to the heavy application of chemical and fertilizer, land and water bodies are getting polluted. So,toreducethedegradationofsoil,wehaveusedcombinationoforganicand inorganic sources of nutrients. The experimentwaslaid out in a randomized block designwith three replications and thirteen treatment combinations. F1 Hybrid Covi Plus was selectedfor this study.Wehavefoundthatapplicationof 75%NPKand25%of vermicompostrespectivelygave highestyield

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Comment [AC2]: The abstract is incomplete, it must present the problem and the justification of the work in detail. The methodological component does not include where the research was carried out nor the year. Replications, experimental units, variables and statistical analyzes are not mentioned. The general results are presented, but not their impact.

Keywords: Vermicompost,NPK,andYield

Comment [AC3]: The keywords are not the most appropriate, plus they must be different from the title. It is suggested to consult the international thesauri for their selection.

INTRODUCTION

Okra [*Abelmoschus esculentus* L.] known as Lady's finger, is indigenous to tropical Africa and grown throughout India in summer and rainy seasons. Okra is erect, herbaceous, annual green and belong to the family Malvaceae. The tender green fruits of okra are cooked incurryandsoup.Toalimitedextmtefindsuseincanned,dehydratedorfrozenformsforoff-seasonconsumption bythe armyat highaltitudes and export. **(Sharma et al., 2015).**The root and stem are used for clearing cane juice in preparation of 'gur'. The high iodine content of fruits helps to control of goiter disease. Okra is said to be very useful against genito-urinary disorders,andchronicdysentery.Thedryseedcontains13-22%edibleoiland20-24%protein. The oil is used in soap and cosmetic industry, while the protein is used for fortified feed preparation.Thecrushedseedisfedtocattleforhighermilkproductionandthefibreisutilized in jute textile and paper industry CITE. All parts of okra (Lady's finger) like fresh leaves, buds, flowers,pods,stemsandseedscanbeusedfordifferentpurposesandhenceitisamultipurpose crop in terms of its uses **(Gemede *et al.*, 2015).**

Comment [AC4]: Try to include more recent references.

Highapplicationrateoffertilizerand manuresarerequired forbetterfruit productionto promote vigorous growth and quality. Never the less fertilizers are expensive and should be usedefficientlyandeffectivelytoavoidwastage.Okrabeinganutrientlovingcrop,itresponds wellto added nutrients. It has beenexperimentally provedthat no single sourceoffertilizer is capable of supplying plant nutrients in adequate amount and in balanced proportion **(Ajay Varma,2000).**Therefore,tomaintainthesoilfertilityandtosupplyplantnutrientsinbalanced proportion for optimum growth, yield and quality of a crop, a combined use of inorganic, organic and biological sources of plant nutrients should be adopted CITE. This helps in better utilization of added inorganic fertilizer thus helps in reducing its level of application and reducing the deleterious effect ofharsh chemical residues that the inorganic fertilizer level in soilCITE.

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Okra is most popular in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Berlin, Saudi Arabia,Mexico andCameronLargest areaandproductionisinIndiafollowedbyNigeria.Total areaunderokrainIndiareportedtobe528.37-thousand-hectare,production6145.97thousand tonnes and productive highest in 2018-19. West Bengal is the leading state of area and production of okra, way has area 77.40 thousand hectare and production 913:32 thousand tonnes. Highest production is 17.40t ha ofAndhra Pradesh. UttarPradeshclimate is goodfor okrathat intotal22.64thousand hectareandproductionis303,05thousandtonnes in2018-19 **(NHB data, 2019).**

Applicationoforganic manuresalone(or)incombinationwithchemicalfertilizersplaya vital role in keeping the soil productivity high. The organic manure acts as a source of major and micronutrients, improvessoiltexture, increaseswater holding capacity, increasessoilmicrobial activity, reduces phosphate fixing capacity of soil, helps in slow release of nitrogen and also reduces leaching losses and improves fertilizer use efficiency. The importance of integrated nutrientmanagementinincreasingandsustainingcropproductionhasbeenamplydocumented

(Meelu, 1996). This studyaimed to find outthe effect ofOrganic and inorganic fertilizers on growth, yield and quality of okra.

MATERIALSANDMETHODS

Location:

The experiment was conducted during kharif (Rainy) season at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology& Sciences, and PRAYAGRAJ (UP) during 2022.

TheexperimentwasconductedonOkra*(AbelmoschusesculentusL.*)Var.F1KOVIPLUSwith thirteentreatment including controland three replications inRandomized Block Design.The resultoftheinvestigationconcerningtheeffectofcontrolreleasefertilizerson13treatments i.e. T0NPK(UREA,SSP,MOP)-100%(Control),T1VERMICOMPOST-100%,T2 POULTRYMANURE-100%,T3FYM-100%,T4NPK-50%+VERMICOMPOST-50%,T5 NPK-50%+POULTRYMANURE-50%,T6NPK-50%+FYM-50%,T7NPK-75% +VERMICOMPOST-25%,T8NPK-75%+POULTRYMANURE-25%,T9NPK-75% +FYM-25%,T10NPK-25%+VERMICOMPOST-75%,T11NPK-25%+POULTRY MANURE- 75%,T12 NPK- 25% +FYM- 75%.To find out the best performance in terms of growth, yield and quality.

Prayagrajissituatedatanelevationof78metersabovesealevelat25.87Northlatitudeand 81.150Elongitudes.ThisregionhasasubtropicalclimateprevailingintheSouth-Eastpartof U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, thetemperaturesometimesisaslowas20CinDecember –Januaryandveryhotsummerwith temperature reaching up to 500C in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The average rainfall is around 1013.4 (cm) with maximum concentration during July to September months with occasional showers in winters.

RESULTSANDDISCUSSION

GrowthParameters

Plantheight (cm)at 20, 40,and60DAS

The maximumplant height wasrecordedinT7treatment (11.50,69.17and118.73cm)which isreceiving75%RDF+25%vermicompost.ThiswasfollowedbyT8treatment(10.63,67.73 and116.23cm)whichisreceiving75%RDF+25%farmyardmanure.Thetreatmentreceiving pure inorganic fertilizer i.e., T1treatment recordedbetterresults (9.27, 64.57 and 107.73 cm) comparedtothosereceivingpureorganictreatments, whichrecordedlowerplant height ofall thetreatmentsT3recordedminimumplantheight(9.07,53.03and95.57cm). Similarfindings were reported by **Lakera *et al.*, (2017).**

Comment [AC5]: The introduction should end with the objective of the research plus its impact.

Comment [AC6]: No background studies are presented that justify the investigation, considering the international, national and regional context. Only outdated study is presented.

Comment [AC7]: The methodology is not reproducible. It is suggested to include the treatments in a table. Mention aspects such as: experimental units, repetitions, distribution in the field. The variables are not mentioned, as they were measured and their frequency of measurement. Statistical analyzes and programs used are not included.

Comment [AC8]: This information must go in the localization subtitle

Comment [AC9]: Comparative studies that support the research findings must show the main conclusions, how they support these results and where they were carried out to establish the context, one alone is insufficient to achieve an objective analysis of the information.

The findings give a clear indication that application of a combination of organic manure and inorganic fertilizerspromotedplant height.Thismight bedueto itspositiverole in increasing plant height in association with other essential elements. CITES.

LeafArea(cm^2)atharvesttime

The observation in term of Leaf Area (cm^2) at harvest time of Okra the results showed that maximumleafarea(cm^2)wasrecordedinT7treatment(5124.88cm^2)whichisreceiving75% RDF + 25% vermicompost. This was followed by T8 treatment (4797.07 cm^2) which is receiving75%RDF+25%farmyardmanure.Thetreatmentreceivingpureinorganicfertilizer i.e., T1 treatment recorded better results (2639.63 cm^2) compared to those receiving pure organictreatments, whichrecordedlowerleafareaofallthetreatmentsT3recordedminimum leaf area (2318.09 cm^2). Similar findings were reported by **Yadav *et al.*, (2017)**

Vermicompostcontainedmacronutrients,traceelements,organicsubstanceslikeaminoacids andplantgrowthregulators.Theseorganicfertilizershelpinthegrowthandyieldoftheplant, such as Nitrogen provides green colour to the plant and enhances vegetative growth.

Comment [AC10]: Keep in mind the above recommendations.

NumberofLeavesPlant^{-1}at20,40,and60DAS

The results showed that maximum Number of Leaves Plant^{-1} was recorded in T7 treatment (6.53,14.30and42.47cm)whichisreceiving75%RDF+25%vermicompost.Thiswas followed by T8 treatment (6.40, 14.23 and 41.03 cm) which is receiving 75% RDF + 25% farmyard manure.Thetreatment receivingpure inorganic fertilizer i.e.,T1treatment recorded betterresults(4.43,12.33and33.53cm)comparedtothosereceivingpureorganictreatments, which recorded lower Number of Leaves Plant-1 of all the treatments T3 recorded minimum Number ofLeavesPlant^{-1} (4.00,9.73and28.87cm). Similar findingswerereportedby**Singh et al., (2018).**

The findings give a clear indication that application of a combination of organic manure and inorganic fertilizerspromotedplant height.This might bedueto itspositiverole in increasing plant height in association with other essential elements. Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth. CITES.

Comment [AC11]: Keep in mind the above recommendations.

NumberofBranchesPlant^{-1}at20,40,and60DAS

The maximum Number ofBranches Plant^{-1} was recorded inT7 treatment (1.88, 4.07 & 6.40) whichisreceiving75% RDF+25% vermicompost.Thiswas followed byT8treatment (1.70, 3.90 & 6.20) which is receiving 75% RDF + 25% farmyard manure. The treatment receiving pureinorganicfertilizeri.e.,T1treatmentrecordedbetterresults(1.24,3.30&5.17)compared tothosereceivingpureorganictreatments, whichrecordedlower Number ofbranchesPlant-1 of all the treatments T3 recorded minimum Number of Branches Plant^{-1} (1.18, 2.63 & 4.23). Similar findings were reported by**AnburaniA. and Manivannan K. (2002).**

Comment [AC12]: The references are very old and without context.

Vermicompostcontainedmacronutrients,traceelements,organicsubstanceslikeaminoacids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. The growthand yieldsuchasshootlength,numberofleaves,numberofbranches,number~~of~~ and fruits,

lengthoffruits, weight offruits, photosyntheticpigment concentrationsuchaschlorophyll 'a', chlorophyll 'b', total chlorophyll and carotenoids was found to be maximum at concentration ofVermicompost. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth CITES-

Comment [AC13]: Expand the discussion considering the biological and agronomic aspect. The tables must be related in the text.

Table 1. Various growth parameters of okra asinfluencedby differentorganicmanure and inorganic fertilizer.

TREATMENT	TREATMENT COMBINATION	PlantHeight			Numberofleaves per plan			Leafarea (cm^2) at Harvest time	Numberof Branches per plant		
		20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS		20 DAS	40 DAS	60 DAS
T0	NPK (UREA, SSP,MOP)-100% (Control)	10.23	67.50	107.90	4.93	12.73	31.97	2388.55	1.35	3.10	5.50
T1	VERMI COMPOST-100%	9.27	64.57	107.73	4.43	12.33	33.53	2639.63	1.24	3.30	5.17
T2	POULTRY MANURE-100%	9.67	60.80	105	4.13	11.20	32.07	2561.16	1.20	3.20	4.83
T3	FYM- 100%	9.07	53.03	95.57	4.00	9.73	28.87	2318.09	1.18	2.63	4.23
T4	NPK- 50% +VERMI COMPOST-50%	10.13	65.80	107.47	5.40	12.13	37.27	3870.27	1.62	3.40	5.60
T5	NPK- 50% +POULTRY MANURE-50%	9.53	64.73	109.73	5.27	11.63	36.90	3766.51	1.55	3.23	5.50
T6	NPK- 50% +FYM-50%	9.60	66.63	109.37	5.33	12.27	35.90	3673.40	1.27	3.07	5.43
T7	NPK- 75% +VERMI COMPOST-25%	11.50	69.17	118.73	6.53	14.23	42.47	5124.88	1.88	4.07	6.40
T8	NPK- 75% +POULTRY MANURE-25%	10.63	67.73	116.23	6.40	14.30	41.03	4797.07	1.70	3.90	6.20
T9	NPK- 75% +FYM-25%	10.37	67.27	112.33	6.00	13.73	39.37	4348.05	1.41	3.73	6.17
T10	NPK- 25% +VERMI COMPOST-75%	10.03	65.07	108.20	6.10	13.20	35.97	3416.11	1.44	3.10	5.37
T11	NPK- 25% +POULTRY MANURE-75%	9.27	65.37	109.33	5.73	12.47	34.80	3183.39	1.45	2.97	5.27
T12	NPK- 25% +FYM-75%	9.37	63.80	108.33	5.23	12.90	34.57	3042.10	1.43	3.00	5.27
F-Test		**S**	**S**	**S**	**S**	**S**	**S**	S	**S**	**S**	**S**
S.Ed.±		**0.55**	**3.31**	**2.96**	**0.35**	**0.62**	**2.04**	**2.78**	**0.13**	**0.13**	**0.48**
CDat 5%		**1.13**	**6.84**	**6.10**	**0.71**	**1.28**	**4.21**	**5.75**	**0.27**	**0.64**	**0.99**
CV		**6.80**	**6.27**	**3.32**	**7.92**	**6.06**	**6.99**	**3.56**	**11.02**	**11.68**	**10.82**

Yieldparameters

Numberoffruitsperplant

The results showed that highest number of fruits per plant were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (18.73) followed by T8 treatment receiving 75% RDF+25%FYM(18.20).T9andT4treatmentsrecordedlessernumberoffruitsper plant.T3 treatment (FYM-100%)recordedminimumnumberoffruitsperplant (14.27)comparedto all other treatments. Similar results were also reported by **Rudra *et al.*, (2022)**

Application of a combination of organic manure and inorganic fertilizers promoted plant growthandyieldsuchasshootlength,numberofleaves,numberofbranches,numberoffruits, length of fruits, weight of fruits CITES.

Lengthoffruit(cm)

The results showed that highest Length of fruits (cm) were recorded with T7 treatment receiving75%RDF+25%vermicompost(12.10cm)followedbyT8treatmentreceiving75% RDF + 25% FYM (11.53 cm). T9 and T6 treatments recorded lesser length of fruits. T3 treatment(FYM-100%)recordedminimumlengthoffruitsperplant(9.03cm)comparedtoall other treatments. Similar results were also reported by **Yadav *at el.* (2017)** and **Kumar*et al*. (2018).**

Vermicompostcontainedmacronutrients,traceelements,organicsubstanceslikeaminoacids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. This combination organic manure and inorganic fertilizers help growth and yield such as shoot length,numberofleaves,numberofbranchesnumberoffruits,lengthoffruits,weightoffruits CITES.

Weightoffruit(g)

The resultsshowedthat highest Weight offruits(g) perfruit wererecorded withT7treatment receiving 75% RDF + 25% vermicompost (14.10g) followed byT8 treatment receiving 75% RDF+25%FYM(13.23g).T9andT6treatmentsrecordedlesserWeightoffruits(g)perfruit. T3treatment (FYM-100%)recorded minimumWeight offruits(9.77 g)perfruit compared to allothertreatments.Similarresultswerealsoreportedby**Ghosh*atel*.(2018)**and**Singh*etal*., (2018).**

Application of a combination of organic manure and inorganic fertilizers promoted plant growthandyieldsuchasshootlength,numberofleaves,numberofbranches,numberoffruits, length of fruits, weight of fruits CITES.

Weightoffruit/plant(g)

The results showed that highest Weight of fruits/plant (g) per fruit were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (264.18 g) followed by T8 treatment receiving 75% RDF+ 25% FYM (241.59 g).T9 andT6 treatments recorded lesser Weight of fruits (g) per fruit. T3treatment (FYM-100%) recorded minimumWeight offruits (139.37 g) per fruit compared to all other treatments. Similar results were also reported by **Ghosh *et al.* (2018)**.

Vermicompostcontainedmacronutrients,traceelements,organicsubstanceslikeaminoacids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colourtotheplantandenhancesvegetativegrowth,Phosphorusincreasestheplant'sresistance to disease, cell formation and helps in root development CITES.

Weightoffruit/plot(kg)

The results showed that highest Weight of fruit/plot (kg) were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (2.38 kg) followed byT8 treatment receiving 75% RDF+25%FYM(2.17kg).T9andT6treatmentsrecordedlesserWeightoffruit/plot(kg).T3 treatment (FYM-100%)recordedminimumWeightoffruits(1.25kg)perplotcomparedtoall other treatments.Similar results were also reported by **Singh *et al.* (2018)** and **Mishra *et al.* (2009).**

Yield(t/ha)

TheresultsshowedthathighestYield ha^{-1}wererecordedwithT7treatmentreceiving75% RDF + 25% vermicompost (19.57 t) followed by T8 treatment receiving 75% RDF + 25% FYM (17.82t).T9andT6treatmentsrecordedlesserYieldt/ha.T3treatment(FYM-100%)recorded minimumYield (10.32 t) per hector compared to all other treatments. Similar findings were reported by **Krishna *et al.*, (2002)** and **Davenda *et al.*, (2021).**

Vermicompostcontainedmacronutrients,traceelements,organicsubstanceslikeaminoacids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colourtotheplantandenhancesvegetativegrowth,Phosphorusincreasestheplant'sresistance to disease, cell formation and helps in root development and potassium provides disease resistance and makes drought tolerant plant and helps in making chlorophyll. CITES.

Comment [AC14]: Some arguments are repetitive throughout the entire discussion.

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Comment [AC15]: Consider the observations made above.

Table2.Effectofdifferentorganicmanureandinorganicfertilizeronyieldparametersofokra

Treat-ment	TREATMENT COMBINATION	No. of Fruits/Plant	Aaverage fruit length(cm)	Aaverage fruit Weight(g)	Weight of fruit/plant (g)	Weightof fruit/plot (kg)	Yield (t/ha.)
T1	NPK(UREA,SSP, MOP)- 100% (Control)	15.07	10.08	11.94	179.91	1.62	13.33
T2	VERMICOMPOST-100%	15.27	9.44	10.40	158.88	1.43	11.77
T3	POULTRY MANURE-100%	14.90	9.32	9.83	146.47	1.32	10.85
T4	FYM- 100%	14.27	9.03	9.77	139.37	1.25	10.32
T5	NPK-50%+VERMI COMPOST-50%	16.07	10.50	12.13	194.86	1.75	14.43
T6	NPK- 50% +POULTRY MANURE-50%	15.80	10.47	11.79	186.10	1.67	13.78
T7	NPK-50%+FYM-50%	16.00	11.03	11.36	181.58	1.63	13.45
T8	NPK-75%+VERMI COMPOST-25%	18.73	12.10	14.10	264.18	2.38	19.57
T9	NPK- 75% +POULTRY MANURE-25%	18.20	11.53	13.23	241.59	2.17	17.82
T10	NPK-75%+FYM-25%	17.27	11.23	12.27	211.86	1.91	15.69
T11	NPK-25%+VERMI COMPOST-75%	15.87	10.16	11.81	187.37	1.69	13.88
T12	NPK- 25% +POULTRY MANURE-75%	15.23	10.09	11.70	178.43	1.61	13.22
T13	NPK-25%+FYM-75%	15.20	10.34	11.61	176.44	1.59	13.07
F-Test		**S**	**S**	**S**	**S**	**S**	**S**
S.Ed. ±		**0.67**	**0.45**	**0.28**	**8.59**	**0.07**	**0.64**
CD at5%		**1.38**	**0.93**	**0.58**	**17.73**	**0.16**	**1.31**
CV		**5.14**	**5.32**	**2.96**	**5.59**	**5.59**	**5.59**

Diseaseincidencesandpestoccurrence

Nodiseaseswereobservedinthepresent~~experiment,~~experiment;howeverfewinsectsviz.redcottonbugs were observed during last harvesting of okra fruits.

CONCLUSION

FromthepresentinvestigationitisconcludedthatF1HybridCoviPlusokraperformedbest in treatmentT7-(75%RDF+25%vermicompost)intermsofplantheight(118.73)cm,No.of

branches(6.40),No.ofleaves(42.47),Numberoffruitsperplant(18.73),AverageFruitlength (12.10) cm, Average Fruit weight (14.10) g and yield (19.56 /ha).

Comment [AC16]: The conclusions should include the impact of the research, not just limit themselves to summarizing the main results found.

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Comment [AC17]: References are insufficient and most are outdated.

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