Eco-friendlymanagement ofPurpleblotch (*Alternariaporri*)ofonion(*Allium cepa*L.)

ABSTRACT

Onion(*Alliumcepa*L.)isoneoftheimportantcommercialvegetablecropsgrowninIndia.Onion is attacked by many diseases, one of which is Purple blotch. This study aimed to evaluate the effectoforganicmanuresandfungicidesonPurpleblotchdiseaseofonioncausedby*Alternariaporri.* The research work was undertaken at Central Research Farm (CRF) Sam Higginbottom University of Agriculture, Technology and Sciences, SHUATS, Naini, Prayagraj during *Rabi* in 2023-24.Arandomizedblock designwitheventreatmentswasemployedincludingUntreated check T_0 (Control), T_1 (Vermicompost @100g/m^2 + *Lantana camara*@100g/m^2), T_2 (Biomix @100g/m^2 + *Lantana camara*@100g/m^2), T_3 (Cocopeat @100g/m^2 + *Lantana camara*@100g/m^2),T_4 (Vermicompost@50g/m^2+ Biomix@50g/m^2+*Lantana camara*@100g/m^2),T_5(Vermicompost @50g/m^2 + Cocopeat @50g/m^2 + Lantana camara @100g/m^2) and Treated check T_6 (Carbendazim @0.2%). The results revealed that among the organic manure T_4-Vermicompost @50g/m^2 + Biomix @50g/m^2 + *Lantana camara*@100g/m^2 minimum disease intensity(8.21%,17.82%and26.48%)at30,60and90DAT,respectivelywhilemaximum diseaseintensitywasrecordedinuntreatedT_0-Contro(12.07%,26.54%and39.17%)at30,60 and90DAT,respectively. Maximum plantheight(17.34cm,29.56cm and38.18 cm)at30, 60 and90DAT,number of leaves (4.53 per plant,4.76per plantand6.66per plant) at30,60and 90DAT,freshweightofbulb(44.96gm/m^2),bulbdiameter (5.90 cm),yield (148.30q/ha)andbenefit-costratio(1:4.2)were found in T_4- Vermicompost @50g/m^2 + Biomix @50g/m^2 Lantana camara @ 100g/m^2 when compared to treated T_6- Carbendazim and untreated check T_0- Control.

Keywords:Onion,Alternariaporri,organicmanure,fungicide,purpleblotch

INTRODUCTION

"Onion(*Alliumcepa*L.)isoneoftheimportantcommercialvegetablecrops growninIndia.It iswidely grown in differentpartsofthe countrymainlybysmallandmarginalfarmers.Onion isproducedandconsumednotonlyinIndiabutalsothroughouttheworld.Onionisclassified asavegetableandhasspecialqualitieswhichaddtasteandflavourtofood"**(Palanisamy*et al*.,2022)**.

"Onionbulbsarelowincaloriesbutrichinvitaminsandmineralsandareagoodsourceof dietaryfibre.Onionsarealsoagoodsourceofantioxidantsandsulphur-containing compoundsthatmayhavehealthbenefits.Theyhavebeenproventoassistinreducing inflammation,loweringbloodsugar,andenhancinghearthealth.However,it'simportantto notethatonionsmaycausedigestive discomfortinsome people,particularlywhenconsumed inlargeamounts"**(Singh *etal*.,2023).**

"Indiaisthesecond-largestonion-growingcountryintheworld.Indianonionsarefamous for theirpungencyandareavailablearoundtheyear.Onionisatemperatecropbutcanbegrown underawiderangeofclimaticconditionssuchastemperate,tropicalandsubtropicalclimates. Thebestperformancecanbeobtainedinmildweatherwithouttheextremesofcoldandheat andexcessiverainfall.Maximumonionproductiontakesplaceinmaharashtra(4905.0 thousandtons)statefollowedbyKarnataka(2592.2thousandtons),Gujarat(1514.1thousand tons.),Bihar(1082.0thousandtons.),MadhyaPradesh(1021.5thousandtons.)Thereisalot ofdemandofIndianonionintheworld,thecountryhasexported15,78,016.59MToffresh oniontotheworldfortheworthofRs.2,826.50crores/378.49USDMillionduringtheyear 2020-21(APEDA,2022).InIndia,theyieldofonionisverylowascomparedtotheworld averageyieldof19.1tha-1"**(BhoiteandBackiyavathy,2022)**. "Thepurpleblotchofonioncausedby*Alternariaporri*(Ellis)Cif.isoneofthemostserious fungaldiseasesthataffectonions,causingheavyyieldlossrangingfrom2.5to87.8percent. Thepathogen*Alternariaporri*destroystheleaftissuewhichhindersthestimulusforbulb initiationanddelayinbulbingandmalnutrition.Insevereattackonflowering,onioncan completelygirdleflowerstalkswithnecrotictissue,causingtheircollapseandtotallossof seedproductioncapacity"**(Agale*etal*.,2014)**."Thediseaseusuallyaffectstheleavesand bulbsof aplant, reducingtheir yieldbyupto97%"**(Dare*tal*.2020)**. Conidiawereformedinlargequantitiesonclustersofconidiophoresinolderareas. Bull's-eye-shapedbrownlesionswithreddish-purpleedgeswerealsoobserved.Infectedleavesand stemsdieafterturningayellowish-whitecolour.Blightsymptomsontheinjectedplantbecame apparentin4to5days**(Agale*etal*.,2014**).*Alternariaporri*isolatesrecordedthe morphologicalcharacters viz.,conidiallength,width,beaklengthandnumberofsepta.The conidialdimensionswereobservedtobe141.28±1.31µm×22.92±0.14µmandabeak lengthof43.61±0.91µmwith3to12transverseseptaand0to5longitudinalsepta**(Shahnaz *etal*.,2013).**

Theorganicmanure(Biomix,vermicompost),iseco-friendly,economicallyviableand ecologicallysoundthatalsoplayedasignificantroleinsoilbiology,chemistryandphysics. Interestingly,eachhuman, livestockandcropsproduceapproximately38billionmetrictonsof organicwasteworldwide,whichmaybeanefficientsourceoforganicmattersupplyinsoils. Accordingtoaconservativeestimation,around600to700milliontonnes(mt)ofagricultural waste(including272milliontonnesofcropresidues)areavailableinIndiaeveryyear,but mostofitremainsunutilized.Thishugequantityofwastecanbeconvertedintoanutrient-rich bio-fertilizer(vermicompost)forsustainablelandrestorationpractices.Ingeneral,agreat proportionofthe cropnutrientinputduring cultivationreturnedin theformofplantresidues.

Estimationshowedthat30-35% ofappliedNand P and70-80 %ofKremainedinthecrop residuesoffoodcrops**(Suthar*etal*.,2009).**

ForthemanagementofPurpleblotchOnion,nowadaysincreasinguseofchemicals tremendouslyinagriculturehasresultedingrowingconcernaboutbothpublichealthand environmentalhazardsthusemphasisisnowontheuseofindigenoussourcesforthe managementoftheplantdiseasewhichislesscostlyanddoesn'taffectpublichealthand environment.Manyfungicideshavebeentestedinonionsagainst purple blotchdiseaseand outofthesemancozeb,propiconazole,azoxystrobinandthiophanatemethylwerefound effectiveinmanagingthedisease**(Singh*etal*.,2018)**.

MATERIALSANDMETHODS

Theexperimentwascarriedoutintheresearchfieldofthe DepartmentofPlantPathology locatedatCentralResearchFarm,SamHigginbottomUniversityofAgriculture,Technology andSciences,duringthe*Rabi*seasonof2023-24.Thefieldexperimentwaslaidoutina RandomizedBlockDesignwithseventreatmentshavingthreereplications.

FieldPreparation

Thefieldhavinggoodorganicmatterwaswellpulverizedsothatitwouldhaveagooddrainage facility.Thefield islevelled,andcleaned,stubblesareremoved,andpreviouscropresidues andweedsareremoved.Soilclodswerebrokendownandplotsweremarkedasperthe layout afterwhichthefieldisdividedintosub-plotsaccordingtotreatments.

Applicationofsoilamendment

The applicationofsoilamendmentwasdonebeforethetransplantingofthe plants.Thesoil amendmentsvermicompost,biomix,cocopeat and*Lantanacamara*wereappliedinthefield.

Transplantingofseedlings:

Theexperimentalplotwaslaidoutasperrandomizedblockdesignandnecessarymarking ofthehillswasdone fortransplantingtheseedling.Thehealthy seedlingsofabout25-30days oldhavinguniformsizewereusedfortransplanting.Propercareshouldbetakenwhile transplantingtheseedlings.Transplantingwasdoneinarowmanually.Thespacingadopted was50cm x 15cmi.e.,rowtorowspacingwas50cm andplanttoplant was15cm.

Isolationandidentificationofpathogen:

Theleaveswerecollectedfrominfectedonionplantsbearingcharacteristicsymptomsof purpleblotch.The leaveswerethoroughlywashedunderrunning tapwater.Thesymptoms onleavesaftermountingontheslidewereexaminedunderamicroscopetoconfirmthe presenceof*Alternaria*sp.Theinfectedleafpartsalongwiththehealthyportionwerecutinto smallpiecesunderasepticconditionsandsurfacesterilizedwith0.1%mercurychloride ($HgCl_2$)solutionfor30secondsandwashedthreetimeswithsteriledistilled watertoremove anytracesofmercurychloride($HgCl_2$)adheredwithleafbits.Thentheywereplacedonfilter papersothatextrawatercouldbeabsorbed.Afterthat,2-3leafbitsweretransferredonPDA media**(Tuite,1969)**containedinsterilizedpetriplateswiththehelpofforceps.Toavoid bacterialcontaminationstreptomycin@100ppmwasaddedinthemediumatalukewarm stagebeforepouringPDAintoPetriplates.ThenPetriplateswerewrappedandincubatedat 27±2°CinBOD,after3daysmyceliagrowthwasobservedaroundleafbits.Withthehelpof corkborerfromthiscolonygrowthaportionfromtheperipheryhavingasinglehyphaltipwas

separatedandtransferred tootherpetriplateshavingmediumtogetpureculture and identificationofthepathogenwasrecordedbyobservingthemorphologicalfeaturesofthe colony,sporecharacteristicsandreferringtherelevantliterature**(Barnett*etal*.,1972).**

Symptomology:

Theinitialsymptomscausedby*Alternariaporri*appearedaswhitish chloroticpatchesonthe leafsurfaceandthesepatchesimmediatelyturnedbrown.Thediseaseprogressedintheform oflargezonatelesionsofpurplecolour.Themarginsofthelesionsbecamepurplishredand weresurroundedbyayellowish-brownborder(Figure1).Undertheconditionsofhigh humidity,these spots assumedblackcolourfollowedbysporulationof thecausal pathogen.In advancedstages,yellowingandwiltingoftheleavestookplace.Theleavesgraduallydied fromthe tipdownwards.Theabovesymptomsandprogressofthediseasehavealsobeen reportedbydifferentworkers**(Neergaard,1938)**.

(a)

(b)

Figure:1(a)and(b)Symptomsofapurpleblotchofonion

Morphology:

*Alternariaporri*isthelargestsectionofthe*Alternaria*specieswhichareimportant plantpathogens**(Woudenberg*etal*.,2014).**
Thecharacteristicfeatureofthegenusistheproductionofovoid,obclavateorbeaked, ellipsoidpigmentedconidia(lighttodeepbrowncolour)withrelativelythintransverseand longitudinalsepta(muriform).Thebodyoftheconidiumisoblongwithitsformalend protrudingoutandtheterminalparttaperedintoabeakandis±producedfrom budformed byconidiophores.ThepathogenAlternariahasseptate,dark-colouredmyceliumand producesshort,simple,erectconidiophoresthatbearsingleandbranchedchainsof conidiainacropetalchains.Theconidiophoresaresolitaryorfoundingroupsandare purplewhenyoungandbrownwhenold. ThecoloniesofA. porrilookvelvety orcottony inappearancewithregulartoirregularmargins,andthecolonycolourappearslightto darkolivaceouswithagreenishorbrownishtinge**(Saharan*etal*.,2003)**.

RESULTSANDDISCUSSION

EffectofTreatmentsonDiseaseIntensity(%)ofPurpleBlotchonOnion

Thedatapresentedinthetable1revealedthatthediseaseintensity(%)ofpurpleblotchof onionsignificantlydecreasedinT_4-Vermicompost+Biomix+*Lantanacamara*(26.48%) followedbyT_5- Vermicompost+Cocopeat+*Lantanacamara*(27.22%),T_1-Vermicompost+ *Lantana camara*(28.74%),T_2- Biomix+ *Lantanacamara*(32.39%),T_3-Cocopeat+*Lantana camara*(34.16%)ascomparedto(Treatedcheck)T_6-Carbendazim(21.45%)and(Untreated check)T_0-control(39.17%).Similarly,findingshavebeenreportedby**Suthar*etal*.(2009)**, **Akter*etal*.(2022)**,**Zacharia*etal*.(2023)**and**Prajapati*etal*. (2019)**Theprobablereason forthisresultmaybeduetotheavailabilityofhighernutrientsandhavingthehumus–like compounds,activemicro-organisms,growthhormonesandenzymes.Biomixcontains nutrientsandcomponentslikecowdung,ricehuskash,vegetablewasteandneemcake. Theyshowedthatorganic manure hassuppressiondisease-promotingactivitymatbecause ofsomebiocontrolpropertiesinthemanure.*Lantanacamara*producesvarious allelochemicalslikecarbohydrates,flavonoidsandtannins.

EffectofTreatmentsonPlantHeight(cm)

Thedatapresentedinthetable2revealedthattheplantheight(cm)ofonionsignificantly increasedintreatmentT_4-Vermicompost+Biomix+*Lantanacamara*(38.18cm)followedby T_5-Vermicompost+Cocopeat+*Lantanacamara*(35.95cm),T_1-Vermicompost+*Lantana camara*(35.00cm),T_2-Biomix+*Lantanacamara*(29.77cm),T_3-Cocopeat+*Lantanacamara* (27.64cm)ascomparedto(Treatedcheck)T_6-Carbendazim(43.78cm)and(Untreated check)T_0-Control(23.83cm).Therefore,theavailabilityof ahigherquantityofnutrientsmight be responsible for improvement in the physical properties of soil and increased activity of microbes with higher levels of organics might have helped in increasing plant height. Similar findings have been reported by **Rai *et al*. (2015).**

EffectofTreatmentsonNumberofLeavesperplant

Thedatapresentedinthetable3revealedthatthenumberofleaves(perplant)ofonion significantlyincreasedintreatmentT_4-Vermicompost+Biomix+*Lantanacamara*(6.66per plant)followedbyT_5-Vermicompost+Cocopeat+*Lantanacamara*(6.26perplant),T_1-Vermicompost+*Lantanacamara*(5.73perplant),T_2-Biomix+*Lantanacamara*(5.33per plant),T_3-Cocopeat+*Lantanacamara*(5.13perplant)as comparedto(Treatedcheck)T_6-Carbendazim(7.93perplant) and(Untreatedcheck)T_0-Control (4.06perplant).This result maybeduetotheavailabilityofvermicompost,boimixand*Lantanacamara*.Thenutrients provideallessentialnutrientstoplantsresultinginpromotedvegetativegrowthoftheplant. Similarfindingshavebeenreportedby**Solanki*etal*.(2020).**

EffectofTreatmentsonFreshWeightofBulb(g/m^2)

Thedatapresentedinthetable4revealedthatthefreshweightofbulb(g)ofonionsignificantly increasedintreatmentT_4-Vermicompost+Biomix+*Lantanacamara*(44.96g) followedby T_5-Vermicompost+Cocopeat+*Lantanacamara*(40.60g),T_1-Vermicompost+*Lantana camara*(38.76g),T_2-Biomix+*Lantanacamara*(33.30g),T_3-Cocopeat+*Lantanacamara* (32.90g) ascomparedto(Treatedcheck)T_6-Carbendazim(48.20g)and(Untreatedcheck) T_0-Control(25.96g).Thisresultcouldbeduetotheapplicationofvermicompost,biomix, *Lantanacamara*.Organic manureapplicationinthesoilenhancesthebiochemicalpotential

ofsoilandconsequentlyaffectsplantproduction.Similarfindingshavebeenreportedby **Kumar*etal*.(2019).**

EffectofTreatmentsonbulbdiameter(cm)

Thedatapresentedintable5revealedthatthebulbdiameter(cm)ofonionsignificantly increasedintreatmentT_4-Vermicompost+Biomix+*Lantanacamara*(5.90 cm)followedby T_5-Vermicompost+Cocopeat+*Lantanacamara*(5.13cm),T_1-Vermicompost+*Lantana camara*(4.50 cm), T_2-Biomix+*Lantanacamara*(4.30cm),T_3-Cocopeat+*Lantana camara* (3.30cm)ascomparedto(Treatedcheck)T_6-Carbendazim(6.76cm)and(Untreatedcheck) T_0-Control(2.70cm).Thisresultcouldbeduetotheapplicationofvermicompost,biomix, *Lantanacamara*.Organicmanureswhichprovidemajormicronutrientsresultedinincreased photosyntheticactivity,chlorophyll formation, nitrogenmetabolismandauxincontentsinthe plantsultimatelyimprovingthediameterofthebulb.Similarfindingshavebeenreportedby **Dhaker*etal*.(2017).**

EffectofTreatmentsonYieldofOnion(q/ha)

Thedatapresentedinthetable6revealedthattheyieldofonion(q/ha)significantlyincreased intreatmentT_4-Vermicompost+Biomix+*Lantanacamara*(148.30q/ha)followedbyT_5-Vermicompost+Cocopeat+*Lantanacamara*(136.16q/ha),T_1-Vermicompost+*Lantana camara*(101.20q/ha),T_2-Biomix+*Lantanacamara*(90.13q/ha),T_3-Cocopeat+*Lantana camara*(89.76q/ha)ascomparedto(Treatedcheck)T_6-Carbendazim(153.16q/ha)and (Untreatedcheck)T_0-Control(49.40q/ha).Thismightbesignificantly increasedbyorganic manure(vermicompost,biomixetc)and*Lantanacamara*.Theorganicmanure(vermicompost, biomixetc)maystimulatesoilbiologicalactivityduetotheenrichmentofsoilorganicmatter. Similarly,theadditionofvermicompostcouldhaveimprovedthephysicalandbiological propertiesofamendedsoil.Theapplicationofvermicompostcanalsoleadtoasignificant increasein soilenzymeactivitiessuchasphosphatase,B-glucosidase,anddehydrogenase **(Srivastava*et al*.,2012).**Theefficacyofthevermicompostisalsolinkedtotheearthworm's activitiesbecause,duringvermicomposting,greatermineralizationoforganicnutrientsoccurs inthedigestivetractofearthworms,whichincreasesmineralcontentinthevermicompost.In addition,earthwormssecretgrowthhormonesandenzymesthatpromoteplant growth (**Coulibaly*etal*.,2020).**

Table1.Effectoftreatmentsondiseaseintensity(%)ofpurpleblotchofonionat30,60 and90DAT

Sr.No.	Treatments	30DAT	60DAT	90DAT
T_0	Control	12.07	26.54	39.17
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	9.82	19.82	28.74
T_2	Biomix(B)+*Lantanacamara*(*LC*)	10.30	21.42	32.39
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	10.78	23.90	34.16
T_4	VC+B+*LC*	8.21	17.82	26.48
T_5	VC+C+*LC*	9.31	18.39	27.22
T_6	Carbendazim	7.07	12.93	21.45
S.Em.(+)		0.35	0.37	0.53
C.D (5%		1.00	1.16	1.73

Table2.Effectoftreatmentsonplantheight(cm)ofonionat30,60and90DAT

Sr.No.	Treatments	30DAT	60DAT	90DAT
T_0	Control	8.60	14.98	23.83
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	15.51	25.22	35.00
T_2	Biomix(B)+*Lantanacamara*(*LC*)	12.60	21.34	29.77
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	10.93	20.06	27.64
T_4	VC+B+*LC*	17.34	29.56	38.18
T_5	VC+C+*LC*	16.53	28.33	35.95
T_6	Carbendazim	22.46	34.73	43.78
S.Em.(+)		0.31	0.47	0.51
C.D (5%		1.02	1.45	0.98

Table3.Effectoftreatmentsonnumberofleavesperplantofonionat30,60and90 DAT

Sr.No.	Treatments	30DAT	60DAT	90DAT
T_0	Control	2.13	2.86	4.06
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	3.40	3.93	5.73
T_2	Biomix(B)+*Lantanacamara*(*LC*)	3.20	3.80	5.33
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	2.93	3.46	5.13
T_4	VC+B+*LC*	4.53	4.86	6.66
T_5	VC+C+*LC*	4.00	4.53	6.26
T_6	Carbendazim	5.00	6.06	7.93
S.Em.(+)		0.07	0.06	0.07
C.D (5%		0.23	0.20	0.22

Table4.Effectoftreatmentsonfreshweightofbulb(g)ofonion

Sr.No.	Treatments	Freshweightofbulb(g)
T_0	Control	25.96
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	38.76
T_2	Biomix(B)+*Lantanacamara*(*LC*)	33.30
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	32.90
T_4	VC+B+*LC*	44.96
T_5	VC+C +*LC*	40.60
T_6	Carbendazim	48.20
S.Em.(+)		0.18
C.D (5%		0.56

Table5.Effectoftreatmentsonbulbdiameter(cm)ononion

Sr.No.	Treatments	Bulbdiameter(cm)
T_0	Control	2.70
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	4.50
T_2	Biomix(B)+*Lantanacamara*(*LC*)	4.30
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	3.30
T_4	VC+B+*LC*	5.90
T_5	VC+C +*LC*	5.13
T_6	Carbendazim	6.76
S.Em.(+)		0.08
C.D (5%		0.25

Table6.Effectoftreatmentsonyieldofonion (q/ha)

Sr.No.	Treatments	Yield(q/ha)
T_0	Control	49.40
T_1	Vermicompost(VC)+*Lantanacamara*(*LC*)	101.20
T_2	Biomix(B)+*Lantanacamara*(*LC*)	90.13
T_3	Cocopeat(C)+*Lantanacamara*(*LC*)	89.76
T_4	VC+B+*LC*	148.30
T_5	VC+C +*LC*	136.16
T_6	Carbendazim	153.16
S.Em.(+)		0.41
C.D (5%		1.28

4. CONCLUSION

Fromthepresentstudy,itcanbeconcludedthatthetreatmentT_4–Vermicompost @50g/m^2 +Biomix@50g/m^2+*Lantanacamara*@100g/m^2significantlyreducedthediseaseintensity (%)ofpurpleblotchofonion,andsignificantlyincreasedplantheight(cm)ofonion,numberof leavesperplant,freshweightofbulb(g),bulbdiameter(cm),yield(q/h)andbenefit-costratio. Therefore,T_4–Vermicompost+Biomix+*Lantanacamara*ismosteffectiveagainstpurple blotchofonionwhencomparedwithothertreatmentsanduntreatedchecks.Using Vermicompost,Biomixand*Lantanacamara*maybeeconomical,long-lasting,eco-friendlyand freefromresidualsideeffectsandcanalsobe recommended tothefarmersfortheefficient managementofdisease.Thepresentinvestigationwaslimitedtoonecropseason(*Rabi*), undertheclimaticconditionsofPrayagraj (U.P.)therefore,tosubstantiatethepresentresult moresuchtrialsarerequiredforfurtherrecommendation.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etchave been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

REFERENCES

1.Agale,R.C.,Kadam,J.J.,Joshi,M.S.andBorkar,P.G.(2014).Symptomatologyofpurple blotchdiseaseofonionandexplorationoffungicides,phytoextractandbio-agentsagainst causalfungus*Alternariaporri*.History.11(31):63-69.

2. Akter, U. H., Begum, F., Islam, M. R., Prinky, J. N. and Khatun, M. R. (2022). Occurrence of Purple Blotch Disease Associated with Selected Garlic Varieties and its Management Through Bio-Agent, Botanicals and Fungicides. 10(1), 13-24.
3. Barnett,H.L.andHunter,B.B.(1972).Illustratedgeneraofimperfectfungi.
4. Bhoite,V.andBackiyavathy,M.R.(2022).Effectofsourcesandlevelsofsulphuronqualityof onion (*Allium cepa*L.). International Journal of Current Microbiology Applied Science. 11(07): 206-211.
5. Coulibaly,S.S.,Ndegwa,P.M.,Soro,S.Y.,Koné,S.,Amoin,E.,Kouamé,A.E.andZoro Bi,I.A.(2020).Vermicompostapplicationrateandtimingforoptimum productivityof onion (*Allium cepa*). International Journal of Agriculture and Agricultural Research. 16: 38-52.
6. Dar, A.A.,Sharma,S.,Mahajan,R.,Mushtaq,M.,Salathia, A.,Ahamad,S. and Sharma, J.P.(2020).Overviewofpurpleblotchdiseaseandunderstandingitsmanagementthrough chemical, biological and genetic approaches. Journal of Integrative Agriculture. 19(12), 3013-3024.
7. Dhaker, B., Sharma, R. K., Chhipa, B. G. and Rathore, R. S. (2017). Effect of different organic manures on yield and quality of onion (*Allium cepa*L.). International Journal of Current Microbiology and Applied Sciences. 6(11): 3412-3417.
8. Kumar, V., Pandey, A. K., Maurya, D., Pandey, A. K., Pandey, D. K., Prakash, V. and Pandey, R. K. (2019). Effect of Organic Manure on Growth, Yield and Quality of Garlic (*Alliumsativum*L.)underHadautiRegion.InternationalJournalofCurrentMicrobiologyand Applied Sciences. 8(1): 2902-2908.
9. Neergard, P. (1938). Annual Report of the Phyto pathological Laboratory of J.E. Ohlen's Windowfrom 1st April 1937 to 31st March 1938. Copenhagen. pp. 12.
10. Palanisamy, H., Nithish, K. and Anandh, M. (2022). Constraints in the production of onion at Perambalur district of Tamil Nadu, India. International Journal of Current Microbiology Applied Science. 11(12): 7-12.
11. Prajapati,M.K.,Simon,S.andKhan,K.Z.(2019).Efficacyoforganicamendmentsagainst the purple blotch of garlic caused by *Alternariaporri*(Ellis) Cif. Journal of Pharmacognosy and Phytochemistry. 8(1): 08-10.
12. Rai, S., Rani, P., Kumar, M., Rai, A. and Shahi, S. K. (2016). Effect of integrated nutrient management on nutrient uptake and productivity of onion. Nature Environment and Pollution Technology. 15(2): 573.
13. Saharan, G.S., Mehta, N. and Sangwan, M.S. (2003). Nature and mechanism of disease resistance to *Alternaria blight* in the rapeseed-mustard system. *Annual Review of Plant Pathology.* 2: 85-128.
14. Shahnaz,E.,Razdan,V.K.,Andrabi,M.andRather,T.R.(2013).Variabilityamong*Alternariaporri*isol ates. Indian Phytopathology. 66(2): 164-167.
15. Singh, J., Prakash, S., Singh, B., Kumar, V., Kumar, S. and Singh, G. (2023). Influence of Integrated Nutrient Management (INM) on Bulb Yield and Profitability of Onion (*Alliumcepa*L.)CropinWesternUttarPradesh,India. InternationalJournal ofPlant&SoilScience. 35(18): 1158-1162.3.
16. Singh, S.K. (2018). Sustainable people, process and organization management in emerging markets. Benchmarking: An International Journal. 25(3): 774-776.
17. Solanki,S.S.,Chaurasiya,A.,Mudgal,A.,Mishra,A.andSingh,A.K.(2020).Effectofsoil applicationofsulphur,farmyardmanureandvermicompostonsoilfertility,growthandyield of garlic (*Allium sativum*L.). International Journal of Chemical Studies. 8(1): 1370-1373.
18. Srivastava,P.K.,Gupta,M.,Upadhyay,R.K.,Sharma,S.,Shikha,Singh,N.andSingh, B. (2012). Effects of combined application of vermicompost and mineral fertilizer on the growthof*Alliumcepa*L.andsoilfertility.JournalofPlantNutritionandSoilScience.175(1): 101-107.
19. Suthar,S.(2009).Impactofvermicompostandcompostedfarmyardmanureongrowthand yield of garlic (*Allium stivum*L.) field crop. International Journal of Plant Production. 3(1): 1735-6814.

20. Tuite, J. (1969). Plant Pathological Methods. Fungi and Bacteria. Burgess: Minneapolis.
21. Woudenberg, J.H.C., Truter, M., Groenewald, J.Z. and Crous, P.W. (2014). Large-spored *Alternaria* pathogens in section *Porri* disentangled. *Studies in Mycology.* 79: 1–47.
22. Zacharia, S. (2023). Biorational Approaches for Purple Blotch Disease of Garlic (*Allium sativum* L.) Incited by *Alternaria porri* (Ellis) Cif. International Journal of Environment and Climate Change. 13(10): 1612-1620.