Effect of saline water irrigation and organic amendments on the growth and quality characters of cluster bean

Abstract

The pot experiment was carried out to test the salinity tolerance level of MDU - 1 in the presence of organic manures. Apot experiment was conducted in the pot culture yard ofthe Department ofSoil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Cuddalore District,duringJanuary-May,2024.Cropwasraisedusingselectedsalinetolerant Clusterbean variety MDU -1 as test crop. The experimental soil was sandy loam in texture and taxonomically classified as *Typic Ustifluvent.*The treatments consisted of three levels of salinity *viz.*, S_1–Control (bore well water), S_2(EC-2.5 dS m^{-1}) and S_3(EC-5.0 dS m^{-1}) and four different sources of organic manures *viz.*,O_1-Humicacid (HA),O_2-FYM,O_3-Vermicompost(VC)andO_4-Compostedcoirpith(CCP). The experiment was laid out in a Factorial Completely Randomized Design (FCRD) with three replications.Theresultsofthepotexperimentclearlyindicatedtheresponseofclusterbean to saline water irrigation and soil application of different organicmanures.Among the three levels of salinity tried, the treatment S_1, irrigated through bore well water recorded the highest response in respect of growth and quality characters of ClusterbeanascomparedtosalinewaterirrigationtreatmentS_2andS_3.Allthesourcesoforganics evaluatedprovedsignificanttoincreasethegrowthandqualitycharactersofclusterbean. However, the effect was much pronounced with vermicompost applied treatments as compared to humic acid, composted coirpith and FYM. Among the various treatment combinations,applicationofvermicompost@12.5tha^{-1}throughsoilandirrigatedwith borewellwater(S_1O_3)excelledtheothertreatmentsinrespectofthegrowth,yieldand nutrientuptakebyclusterbean.However,thiswasfollowedbythetreatmentS_1O_1,whichreceivedsoil applicationofhumicacid@30kgha^{-1}andirrigatedwithborewell water.Further, the quality parameters like crude protein,crude fibre and gum content in clusterbean pods were also positively improved by the application of vermicompost @ 12.5 t ha^{-1}through soil and irrigated with bore well water (S_1O_3). However,itwasfollowedbytreatmentS_2O_3(VC+salinewaterirrigation).Hence,soil applicationofvermicompost@12.5tha^{-1}andsalinewater(EC-2.5dSm^{-1})irrigationto salinetolerantclustebeanvarietyMDU-1 wasidentifiedasbesttreatment combination for sustainable clusterbean production under saline water irrigation.

Key words : Saline water, organic amendments, Clustebean

Introduction:

Salinity is a major problem throughout the world when excess soluble salts adverselyaffectsoilbehaviourbychangingitsphysico–chemicalpropertiesandinturn haveastrongbearingontheactivityofplantgrowthespeciallyduringtheearlyseedling stage.Efforts have to be made to identify crop species which can able to tolerate increasingsoilsalinitylevels.Suchaselectionofsalinityresistancecropsisoneofthe wider objectives required primarilyto increase crop productivityon salt affected lands, therebyenhancingfoodandincomegenerationoptionforthepoorsectionofthefarming community.Themostcrucialandimportantstageinthelifecycleofspeciesgrowinginsaline environment is the period of seed germination and early development of the seeding (Ranganathan and Rajalakshmi, 2006). Salinity stress negatively impacts agricultural yieldthroughouttheworldaffectingcropproduction(Shuji *etal.*,2002). The declining availability of fresh water has become a worldwide problem, which endorses thedevelopment of alternative, secondary quality water resources for agricultural use. Nowadays, the competition forfreshwater in the development of urbanization, industry and agriculture caused the decline of fresh water forirrigation. The progressive decrease of fresh water resources is leading towards the inevitable use of saline water for irrigation purpose (Chowdary, 2014). Moreover, the continuous use ofsaline waters without amendments adversely affects the soil physico-chemical and biological properties andat the same time, it adversely affects the mineral composition, uptakeand yield of crops under most situations (Ayers and Westcot, 1985 and Oster and Jayawardene, 1998). Application of organic manures and increased rate of nutrient application for crops insuch soils hold promise in improving the fertility and productivity of crops. Several investigators reported that application of organic manures like FYM, compost and or green manuring is one of the easiest methods to mitigate the adverse-effects of use of poor quality of waters like saline or sodic water. Hence thepresent investigation was carried out to study the effect of saline water irrigation and organic amendmentson the growth, quality and nutrient uptake of clusterbean.

Materials and Methods:

The pot experiment was carried out in department of Soil Science and Agricultural Chemistry, Annamalai University during January– May2024. The texture ofthe soil was sandy loam and taxonomically classified as Typic ustifluventwith pH-7.9, EC - 0.86dSm^{-1} and represented low status of organic carbon (4.2 g kg^{-1}). The soil hadlow in available nitrogen (174.36 kg ha^{-1}), low in available phosphorus (7.6 kg ha^{-1}) and medium in available potassium (118.3 kg ha^{-1}). The Twelve treatments consisted of three levels of saline water viz., S_1 –control (Bore well water), S_2-Saline water (EC- 2.5) and S_3-Saline water (EC- 5.0) as factor-A and four different sources of organic manures viz., O_1- Humic Acid (HA), O_2-Farm yard manure (FYM), O_3 – Vermicompost (VC) and O_4–Composted coirpith (CCP) as factor-B. The experiment was laid out in a Factorial Completely Randomized Design (FCRD) with three replications using selected saline tolerance clusterbeanvariety MDU-1 as test crop. The calculated amount of different organics viz.,Humic Acid, FYM, vermicompost and composted coir pith was applied just before sowing. A uniform NPKdose of 25:50:25 mg $Kg^{-1}$was supplied through urea, super phosphate and muriate of potash to all the pots. The entiredose of NPK were applied as basal. Various growthcomponents like plant height, number of branches $plant^{-1}$, chlorophyll content, leaf area index(LAI) and dry matter production (DMP). Quality parameters like crude protein, cudefibre,and gum content.The plant samples were collected and analyzed for the concentration of nutrients like N, P and K were estimated using the standard procedure as outlined by Jackson (1973) and uptake were calculated.

Result and Discussion:

Growth characters

Irrigation with different salinity level water and application of different organicamendmentsfavourablyinfluencedthegrowthcharactersofclusterbean.Amongthethreelevelsofsalinewaterirrigationtreatments tried, thetreatmentS_1, irrigated through bore well water recorded the highest plant height, number of branches per plant, chlorophyll content, leaf area index and Dry matter production (76.92,11.57, 50.85, 1.14 and 90.58 cm). This was followed by the salinity level S_2 and S_3saline water irrigation.Irrespective of the salinity levels, all the organic amendments evaluated significantlyimprovedthegrowth charactersofclusterbean.Applicationofvermicompost@12.5tha^{-1}(O_3)recordedthemaximumplantheight, number of branches per plant, chlorophyll content, leaf area index and Dry matter production(77.26, 10.73, 52.76, 1.17 and 92.42 cm)ofclusterbean.Thiswas followedbythetreatments(O_1), applied with humic acid @ 30 kg ha^{-1} and application of composted coirpith @ 12.5 t ha^{-1} (O_4,). The interaction effect due to different saline water irrigation and organic manuresontheplantheightwassignificant.Applicationofvermicompost@12.5tha^{-1}by soil application and bore well waterirrigation (S_1O_3) recordedthe maximum plant height, number of branches per plant, chlorophyll content, leaf area index and Dry matter production, number of branches per plant, chlorophyll content, leaf area index and Dry matter production (82.30, 12.30, 54.70, 1.25 and 96.25cm)ofclusterbean. However,thiswasfollowedbythetreatment(S_1O_1). All the growth characters *viz.*, plant height, chlorophyll, leaf area index, dry matter production and number of branches at all the growth stages of clusterbean were significantly decreased with increasing levels of salinity. The decreased growth withtheincreasingsalinitylevelwaspossiblyduetoadversesoilchemicalandphysical properties, which hindered plant growth and biomass production. These results are in harmonywiththoseobtainedbyKadam *et al.* (2007); Jamaluddin*etal.*(2016)andPatel *et al.* (2024).The results of the study clearly brought out the usefulness of all the organic amendments evaluated in improving the growth and yield of clusterbean. Among various organic amendments, the application of vermicompost accounted for a significantly superior effect in promotingallthegrowthcharactersofclusterbeanforsalinewaterirrigation.Increased growthofclusterbeanwiththeapplicationoforganicsmightbeduetotheimprovement in nutrient availability and soil property due to the decomposition products such as polysaccharides,polyurenoids,aminoacids,humicandgrowth promotingsubstances.The earlierreportofRangarajan(1991)corroboratesthepresentfindings.Arancon et al. (2004) reported that leaf area increase in vermicompost treated strawberry (Fragaria ananassaDuch.)isduetoanincreaseinmicrobialpopulationinvermicompost.(Gomes*et al.*, 2011; Xing *et al.*, 2013) who reported the chlorophyll concentrations of leaves significantly decreased by salinity stress. However, inconsistent results were reported by Jungai*et al*. (2011), Akhzari *et al*. (2012) and Chaudhary *et al*.(2021) who stated salinity stress caused increasingchlorophyll concentrations of leaves. Results of the presentstudyareconsistentwithBerovaandKaranatsidis,(2009)andSeeranganetal*.* (2019) who stated chlorophyll contents increased significantly with vermicompost application.The improved growth characters due to organic manures in saline water irrigated plants might be due to the improved nutrient availability, microbial activity, reduced soluble salts in soil-water, lowered osmotic potential of the soil water and lowerleafwaterpotentialrequiredtosustaintranspiration.Thereforeplantsspentmore energy for making osmotic adjustments as reported by Leone *et al.* (2000). Similar resultswasobservedbyAbid*etal.*(2002),Ashraf*etal.*,(2004)andAslam*etal.*,(2020).

Vermicompost contains plant nutrients including N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu andB.Thehighpercentageofhumicacidsinvermicompostcontributestoplanthealth, as it promotes the synthesis of phenolic compounds such as anthocyanins and flavonoidswhichmayimprovetheplantquality(Theusnissen*etal*.,2010)and(Tharun Kumar *et al.*,2022).

Quality parameters

Thequalityparametersofclusterbean*viz.*,Crude protein, Crude fibre and gum contentweresignificantlyincreasedwith salinewaterirrigation andsoil applicationof organic manures.Among the different levels of salinity water tried, the treatment S_1, irrigated throughborewellwaterrecordedthehighestcrudeprotein (3.14percent),fibre(13.65 per cent), and gum content (19.47 per cent) of clusterbean. This was followed by the treatments S_2(EC-2.5 dS m^{-1}) and S_3(EC-5.0 dS m^{-1}) saline water irrigation.Amongthevariousorganicmanuresevaluated,applicationofvermicompost@12.5tha^{-1}(O_3)wassignificantlysuperiorinincreasingthecrudeprotein(3.24percent), crudefibre(12.73percent),andgum content (19.09percent).Thiswasfollowedbythe treatments applied with humic acid(HA) @ 30 kg ha^{-1} (O_1) and application of composted coirpith @12.5

t ha^{-1} (O_4). These treatments recorded the mean crude proteinof3.04and2.90percent,crudefibrecontent12.16and11.56percentandgum content 17.86 and 16.56 per cent, respectively.Interaction effect due to saline water irrigation and soil application of organic manuresonqualitycharactersofclusterbeanwassignificant.ApplicationofVC@12.5 t ha^{-1} through soil and borewell waterirrigation (S_1O_3) to clusterbean fruits registered the highest quality characterslikecrudeprotein(3.36percent), crudefibre(14.70per cent) and gum content(21.40 per cent). This was closely followed by the treatment (S_1O_1) which received humic acid @ 30 kg ha^{-1} and irrigated withborewellwater.Thismightbeduetoimprovednutrientenvironmentintherhizosphere aswellasitsutilizationintheplantsystem,leadingenhancedtranslocationofnutrient, vitaminsandproteinsinpods.Anotherreasonmightbeduetotheincreasedactivityof nitratereductasewhichhelpedinsynthesissustainsaminoacidproteinsasreportedby Chinaswamy and Marikulandi (1966); Lopes *et al.* (1996); Yadav and Vijayakumari (2004); Meena *et al.* (2016); Nagar *et al.* (2017). Application of organic manures through soil might have increased the nutrient availability which resulted in betteraccumulationofNcontentandhencetheincreasedproteincontentinpods.These resulted are in accordance with earlier reports of (Olaniyi *et al.*, 2010); (Nithya *et al.*,2024); Elayaraja *et al*. (2024).Irrigation with saline water to humic acid supplied with clusterbean also recorded the high protein content, crude fibre content and gum content. This might be duetothedirecteffectofhumicsubstancesdependonbiochemicalactiononcellwall, membrane or cytoplasm , mainly hormonal acting in manner similar to plant growth substances and agricultural humic substances are reputeddrought tolerance , enhance nutrientuptakeandoverallplantperformanceresultinginincreasingqualitycharacters of clusterbean. These results are in partlywith results reported byBhuvaneswari *et al*. (2020).

NPK uptake

Irrigationofclusterbeanwithsalinewaterandorganicspositivelyincreasedthe uptake of nitrogen by both pod and stover of clusterbean.Among the different levels of salinity tried, the treatment S1, irrigated through bore well water recorded the highest mean NPK uptake of (513.07, 209.53, 324.98) and (286.42, 77.72, 155.20) mg pot^{-1}inpodandstoverrespectively.ThiswasfollowedbythetreatmentsS2(EC-2.5dS m^{-1}) and S3(EC-5.0 dS m^{-1}) saline waterirrigated plants byrecordingthe N uptakeby podandstover respectively.Among the various organics evaluated, vermicompost application @ 12.5 t ha^{-1}(O3)recordedthehighestmeanNPKuptakebypod(537.04, 225.93, 339.64mgpot^{-1})andstover(297.39, 82.80, 161.70 mgpot^{-1}).Thiswasfollowedbythetreatments,theapplicationofhumicacid@30kgha^{-1}(O1), application of CCP @ 12.5 t ha^{-1} (O4)and FYM 12.5 t ha^{-1} (O2).Regarding the interaction, the application of vermicompost @ 12.5 t ha^{-1} and irrigatedwithborewellwaterirrigation(S1O3)recordedthehighestnitrogenuptakeof(585.39, 245.33, 372.88) and (342.82, 90.69, 177.28 mg pot^{-1} in pod and stover respectively. However, it was followed bythe treatment pairs like S1O1, S2O3. The lowest nitrogen uptake by clusterbean pod and stover was noticed in the treatment S3O2 (saline water irrigation and FYM 12.5 t ha^{-1}).The addition oforganics through soil and salinewaterirrigatedplants enhanced the uptake of nutrients by clusterbean. This might be due to increased availability of nutrients, minimized soluble salt concentration due to slow and steady release of organicacidduringdecompositionoforganicmatterandimprovementoffavorablesoil conditions as created by addition of organic amendments. Similar results were earlier made by El-Missery. (2003).Further,increasedmajor(N,PandK)andmicro(Fe,Cu,ZnandMn)nutrients uptake by crops with application of organics along with salinewaterirrigationmaybe due to improvement of the soil environment which encouraged prolification of roots resultingin more absorption of waterandnutrientsfromlargerrhizosphere.Moreover, organicmanures,duringdecomposition releasenutrients, whichbecame availableto the plants and increased NPK concentration. The higher nutrients uptake with organic manure might be attributed to solubilization of native nutrients better availability of fertilizers,chelationof micronutrient complexwithintermediateorganiccompounds,their mobilizationandaccumulationofnutrientsbycropplants.Theseresultsareinparitywithresults reportedbySalwa *et al.* (2010); Grzebisz*et al.* (2010) and Chesti*et al.* (2015). Vermicompost contains higher nutrient contents compared to conventional compostandtheyaremorebalancedsothattheiruptakebyplantrootsismoreeffective for plant growth stimulation (Vinothini et al. 2016). The increase in N, P and K concentrationmightbeduetoPGPRnitrogenfixation,theenhancementofplantgrowth by mycrorrhizal colonization and enhanced uptake of phosphorous has been reported bycavender*etal*.,2003.Increasedplantuptakesmightberelatedtoincreasednutrient availabilityonthesoil(Roy*etal*.,2006)duetovermicompostapplicationthatresulted in increasing soil pH,.Physico-chemical properties.

Conclusion:

The present investigation clearly indicated that organic manure application under saline water irrigation improving growth, quality parameters and nutrient uptake ofclusterbean. From the results of the study, it was concluded that the soil application of vermicompost @ 12.5 t ha^{-1} and saline water (EC-2.5 dS m^{-1}) irrigation to saline tolerant clusterbean variety MDU-1 was significantly improved the growth and nutritional quality characters of clusterbean.

Reference:

Abid, Muhammad, S.A. Malik, Bilal, Khalid and R.A. Wajid, 2002. Response of okra to EC and SAR of irrigation water. *Int. J. Agric. Biol.,* **4(3):** 311-314.

Akhzari,D.,A.Sepehry, M.Pessarakli,and H.Barani.2012.Studyingtheeffectsof salinitystress on the growth of various halophytic plant species (Agropyron elongatum,KochiaprostrataandPuccinelliadistans).WorldAppliedSciences Journal 16 (7): 998-1003.

Arancon, N.Q.;Edwards, C.; Dick, R.;Dick, L. 2007VermicompostTea Production andplant growth impacts.Biocycle.v.48,p.51-52,

AshrafM.Someimportantphysiologicalselectioncriteriaforsalttolerancein plants. *Flora.* 2004;199:361–376.

AslamZ.,AhmadA.,BellitürkK.,IqbalN.,IdreesM.,RehmanW.U.,AkbarG.,Tariq M., Raza M., Riasat S., et al. 2024. Effects of vermicompost, vermi-tea and chemical fertilizer on morpho-physiological characteristics of tomato in Suleymanpasa District, Tekirdag of Turkey. Pure Appl Biol. 9(3):1920–1931Ayers, R.S., and D.W. Westcot. 1985. Water Quality for Agriculture, FAO Irrigation and Drainage Paper 29 rev 1. FAO, UN, Rome 174pp.

Berova, M., and G. Karanatsidis. 2009. Influence of bio-fertilizer, produced by Lumbricusrubellus on growth, leaf gas exchange and photosynthetic content of pepper plants (Capsicum annuum L.). Acta Horticulturae 830: 447-452.

Bhuvaneshwari, R., Nayana, N. L., Srinivasan, S., Karthikeyan, P., & Suganthi, S. (2020).Responseofhumicacidandzincfertilizationontheyieldcharactersof brinjal (Solanum melongena L.). *Plant Archives, 20*(1), 1332-1334.

Cavender, N.D., Atiyeh, R.M. and Michael, K. (2003) Vermicompost Stimulates MycorrhizalColonizationofRootsof*Sorghumbicolor*attheExpenseofPlant Growth. *Pedobiologia*, *47*, 85-89.

ChaudharyN,PuriC,JaisiPN,BasnetS.EffectofIntegratednutrientmanagementon yield and yield attributing characters of Black gram inn Lamahi, Dang. Sustainability in Food and Agriculture. 2021;1(2):106-108.

Chesti, M.H., A. Kohli, A. Mujtaba, J.A. Sofi, T. Nzir Qadri, R.J.A. Peer, M.A. Dar and I.A. Bisati, 2015. Effect of integrated application of inorganicandorganic sourcesonsoilproperties,yieldandnutrientuptakebycropsinintermediatezone of Jammu and Kashmir. *J. Indian Soc. Soil Sci.,* **63:** 88-92.

ChinaswamyKN&MariakulandiA.1966. Influenceoforganicandinorganicmanure onthefirmnessandstoragelifeoftomato.SouthIndianHorticulture,14:36-42

Chowdary,K.A.,2014.Effectofsalinewaterirrigationonsoilqualityandperformance of Jowar

Elayaraja D., R. Kamaleshwaran, and S. Vennila ,(2024). Studies on the Effect of Biofortification through Micronutrients Fortified Organics on the Soil Properties, Yield and Quality of Brinjal in Coastal Soil Environment and Ecology 42 (2) : 516—526.

El-Missery,M.M.A.,2003.Effectoforganicfertilizationonyield and quality of some vegetable crops under saline conditions. *M.Sc. Thesis,* Faculty of Agric., Ain Shams Univ., Cairo, Egypt.

Gomes, M.A.C., M.S. Suzuki, M.D. Cunha, and C.F. Tullii. 2011. Effect of salt stress on nutrient concentration, photosynthetic pigments, proline and foliar morphologyof Salvinia auriculata Aubl. Acta LimnologicaBrasiliensia 23(2): 164-176.

Grzebisz, W., R. Lukowiak, M. Biber and K. Przygocka-cyna, 2010. Effect of multi-micronutrientfertilizersappliedtofoliageonnutritionalstatusofwinteroilseed rapeanddevelopmentofyieldformingelements.*J.Elementol.,***15(3):**477-491.

Jackson,M.L.1973.Soilchemicalanalysis.PrenticeHallofIndiaPvtLtd.,NewDelhi.

(*Sorghum bicolor* L.). *M.Sc. (Ag.) Thesis,* College of Agriculture, Hyderabad.

JamalUddin,A.F.M.,S.Mutahera,H.Mehraj,K.Momenaand

A.S.M. Nahiyan, 2016. Screening of brinjal lines to high salinity levels. *J. Biosci. Agric. Res.,* **7(2):** 630-637.

Kadam, J.R., S.D. Bhingardeve and V.N. Walke, 2007. Effect of saline water and fertigation on the yield contributing parameters of brinjal. *Int. J. Agric. Sci.,* **3(1):** 162-164.

Leone,A.P.,M.MenetiandandG.Sorrentino,2000.Reflectancespectroscopytostudy crop response to soil salinity. *Italian J. Agro.,* **4(2):** 75-85.

Lopes AJ, Stamford NP, Eiguerired MVB, Burity NA &Ferroz EB. 1996. Effect of vermicompost,mineralnitrogen andmineralizingagentonnitrogenfixationand yield in cowpea. RevistaBrasileria-de-ciencia-do-Solo, 20: 55- 62.

Nithya, S., Sethuraman, O. S., & Sasikumar, K. (2024). Effect of vermicompost and organic fertilizer on improved growth, productivity and quality of tomato (Solanum lycopersicum) plant. *Indian J. Sci. Technol*, *17*(2), 142-148.

Nagar M, Soni AK, Sarolia DK & Saini HR. 2017. Effect of organic manures and different levels of NPK on growth and quality of bottle gourd [Lagenaria siceraria (Mol.) Standl.]. Journal of Agriculture and Ecology, 4: 44-50; http://doi.org/10.53911/JAE.2017.4206.

Olaniyi, J.O., W.B. Akanbi, O.A. Olaniran and O.T. Ilvpejv, 2010. The effect of organo-mineralandinorganicfertilizersonthegrowth,fruityieldandchemical composition of okra. J. *Animal Plant Sci*., **9:** 1135-1140.

Oster, J.D. and N.S. Jayewardene, 1998. Agriculture management of sodic soil in sodic soils distribution processes, Management and Environmental Consequences (Eds. Summer, M.F. and Nadu, R.) Oxford Uni. Press, U.K., p.125-147.

Patel, H., Parmar, V., Patel, P., &Mavdiya, V. (2024). Effect of organic fertilizers on yieldandyieldattributesofclusterbean(CyamopsistetragonolobaL.)Cv.Pusa Navbahar. *International Journal of Chemical Studies*, *6*(4), 1797-1799.

Rangarajan, T. 1991. Irrigation management on groundnut with special reference to field layout and soil amendments. M Sc(Ag) Thesis, Agriculture collage and Research Institue, TNAU. Madurai.

Ranganathan, R., and A. K. Rajalakshmi. "The effect of NaCl and Na_2SO_4salinity on germination behaviour of Avicennia officinalis L." (2006): 585-588.

Roy,R.N.,Finck,A.,Blair,G.J.andTandon,H.L.S.(2006).PlantNutritionforFood

Seerangan, G., Sha, K., &Muraleedharan, A. (2019). Effect of organic inputs and inorganic nutrients on growth and yield of Cluster bean (Cyamopsis tetragonoloba(L.)Taub. *JournalofPharmacognosyandPhytochemistry*, *8*(2S), 580-581.

Salwa,A.R.,K.A.HammadandF.Tantauy.2010.Studiesonsalinitytoleranceoftwo peanut cultivars in relation to growth, leaf water content and yield. *J. Applied Sci.* **16;**21-30.

Sharma and B.K. Dixit, 1987. Effect of nutrient application on rainfed soybean. *J. Indian Soc. Soil Sci.,* **35(3):** 452-455.

Shuji, Y., A. Ray and H. Paul Mike. 2002. Salt stress tolerance of plant. Centre for environmental stress physiology, JITCAS Working Report, 25-33.

Tharun Kumar, A., Somasundaram, E., &Thavaprakaash, N. (2022). Influence of Organic Nutrient Sources on Yield and Economics of Vegetable Cluster Bean (Cyamopsistetragonoloba(L.)Taub.)Variety–MDU1.*InternationalJournalof Environment and Climate Change*, *12*(9), 125-131.

Theunissen, J., Ndakidemi, P.A. and Laubscher, C.P. (2010) Potential of Vermicompost Produced from Plant Waste on the Growth and Nutrient Status in Vegetable Production. *International Journal of Physical Science*, *5*, 1964- 1973.

Vinothini V., Anuradha R., Senthilkumar R. 2016.Vermicompost production and nutrient analysis using *Eudrilluseugine*. World Journal of Pharmaceutical Research **5(6):** 1250–1257.

Xing, W., J. Wang, H. Liu, D, Zou, and H. Zhao. 2013. Influence of natural saline- alkali stress on chlorophyll content and chloroplast ultrastructure of two contrastingrice(OryzasativaL.japonica)cultivars.AustralianJournalofCrop Science **7(2):** 289-292.

Yadav RH &Vijayakumari B. 2004. Impact of vermicompost on biochemical characters of chilli (Capsicum annum). Journal of Ecotoxicology and Environmental Monitoring, **14:** 51-56.

Table1.Effectofdifferentsalinitylevelsandorganicamendmentsontheplantheight,numberofbranchesperplantandchlorophyll content of Clusterbean.

O / S	**Plant Height(cm)**					**NumberofBranches**					**Chlorophyll(mg100g^{-1})**				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	79.40	70.90	82.30	75.10	**76.92**	11.90	10.70	12.30	11.40	**11.57**	52.40	46.90	54.70	49.40	**50.85**
S_2	72.90	65.30	76.80	69.39	**71.09**	9.90	8.90	10.20	9.50	**9.62**	51.50	45.40	53.20	48.70	**49.70**
S_3	69.10	61.80	72.70	66.20	**67.45**	9.40	8.19	9.70	8.90	**9.04**	48.30	43.10	50.40	45.90	**46.92**
Mean	**73.80**	**66.00**	**77.26**	**70.23**		**10.40**	**9.26**	**10.73**	**9.34**		**50.73**	**45.13**	**52.76**	**48.00**	
		SEd		**CD(p=0.05)**			**SEd**		**CD(p=0.05)**			**SEd**		**CD(p=0.05)**	
S		1.13		2.34			0.16		0.33			0.77		1.59	
O		1.31		2.70			0.18		0.38			0.89		1.84	
S×O		2.27		4.68			0.32		0.66			1.54		3.19	

S-Salinitylevel:S_1–BorewellWaterControl;S_2–EC-2.5dSm^{-1};S_3–EC-5.0dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@kgha^{-1};O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4–Compostedcoirpith@ 12.5tha^{-1}

Table2.Effectofdifferentsalinitylevelsandorganicamendmentsontheleaf areaindexanddrymatterproductionof Clusterbean.

O / S	Leaf Area Index					Dry Matter Production (g pot^{-1})				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	1.16	1.05	1.25	1.11	**1.14**	93.49	83.64	96.25	88.95	**90.58**
S_2	1.12	1.02	1.15	1.05	**1.08**	88.33	78.64	92.39	83.72	**85.77**
S_3	1.07	0.96	1.13	1.01	**1.04**	83.15	73.41	88.63	77.12	**80.57**
Mean	**1.11**	**1.01**	**1.17**	**1.05**		**88.32**	**78.56**	**92.42**	**83.26**	
	SEd		**CD(p=0.05)**				**SEd**		**CD(p=0.05)**	
S	0.016		0.035				1.36		2.80	
O	0.019		0.040				1.57		3.24	
S ×O	0.033		0.070				2.72		5.61	

S-Salinitylevel :S_1– Borewell WaterControl; S_2–EC-2.5 dSm^{-1};S_3–EC-5.0 dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@$kgha^{-1}$;O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4–Composted coir pith @ 12.5 t ha^{-1}

Table3.Effect ofdifferentsalinitylevelsandorganicamendmentsonthequalityparametersof Clusterbean

O / S	CrudeProtein (%)					CrudeFibre (%)					GumContent (%)				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	3.21	2.91	3.36	3.08	**3.14**	14.10	12.90	14.70	13.3	**13.65**	20.10	17.30	21.40	18.90	**19.47**
S_2	3.05	2.76	3.23	2.90	**2.98**	12.40	11.10	12.90	11.70	**12.02**	17.60	14.28	18.70	16.29	**16.71**
S_3	2.84	2.62	3.13	2.74	**2.84**	10.80	9.00	10.60	9.70	**9.82**	15.90	13.00	17.19	14.30	**15.15**
Mean	**3.04**	**2.76**	**3.24**	**2.90**		**12.16**	**10.86**	**12.73**	**11.56**		**17.86**	**14.92**	**19.09**	**16.56**	
		SEd		**CD(p=0.05)**			**SEd**		**CD(p=0.05)**			**SEd**		**CD(p=0.05)**	
S		0.046		0.096			0.192		0.397			1.278		0.573	
O		0.053		0.111			0.222		0.458			0.321		0.662	
S ×O		0.093		0.192			0.385		0.795			0.556		1.147	

S-Salinitylevel :S_1– Borewell WaterControl; S_2–EC-2.5 dSm^{-1};S_3–EC-5.0 dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@$kgha^{-1}$;O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4 –Composted coir pith @ 12.5 t ha^{-1}

Table4.EffectofdifferentsalinitylevelsandorganicamendmentsonthenitrogenuptakebyClusterbean

O / S	Nitrogenuptake-Fruit (mg pot^{-1})					Nitrogenuptake-Stover (mg pot^{-1})				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	537.14	437.52	585.39	492.26	**513.07**	312.12	235.43	342.82	255.34	**286.42**
S_2	485.33	387.73	535.56	430.24	**459.71**	262.83	207.64	287.26	230.92	**247.16**
S_3	427.26	342.28	490.19	387.52	**411.81**	227.54	182.20	262.10	207.26	**219.77**
Mean	**483.24**	**389.17**	**537.04**	**436.67**		**267.49**	**208.42**	**297.39**	**231.17**	

	SEd (Fruit)	CD(p=0.05) (Fruit)	SEd (Stover)	CD(p=0.05) (Stover)
S	7.62	15.73	4.20	8.67
O	8.80	18.16	4.85	10.02
S ×O	15.24	31.46	8.10	17.35

S-Salinitylevel :S_1– Borewell WaterControl; S_2–EC-2.5 dSm^{-1};S_3–EC-5.0 dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@kgha^{-1};O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4–Composted coir pith @ 12.5 t ha^{-1}

Table5.EffectofdifferentsalinitylevelsandorganicamendmentsonthePhosphorousuptakebyClusterbean

O / S	Phosphorousuptake-Fruit (mg pot^{-1})					Phosphorousuptake-Stover (mg pot^{-1})				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	222.11	180.67	245.33	190.02	**209.53**	84.54	65.26	90.69	70.42	**77.72**
S_2	201.25	160.48	227.08	180.19	**192.25**	72.13	57.70	82.28	65.11	**69.30**
S_3	177.79	140.25	205.40	162.00	**171.36**	62.88	50.38	75.44	60.88	**62.39**
Mean	**200.38**	**160.46**	**225.93**	**177.40**		**73.18**	**57.78**	**82.80**	**65.47**	
	SEd		**CD(p=0.05)**				**SEd**		**CD(p=0.05)**	
S	3.16		6.52				1.15		2.37	
O	3.65		7.53				1.32		2.27	
S ×O	6.32		13.05				2.30		4.75	

S-Salinitylevel :S_1– Borewell WaterControl; S_2–EC-2.5 dSm^{-1};S_3–EC-5.0 dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@kgha^{-1};O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4–Composted coir pith @ 12.5 t ha^{-1}

Table6.EffectofdifferentsalinitylevelsandorganicamendmentsonthePotassiumuptakebyClusterbean

O / S	Potassiumuptake-Fruit (mg pot^{-1})					Potassiumuptake-Stover (mg pot^{-1})				
	O_1	**O_2**	**O_3**	**O_4**	**Mean**	**O_1**	**O_2**	**O_3**	**O_4**	**Mean**
S_1	342.56	272.06	372.88	312.42	**324.98**	162.64	130.56	177.28	150.32	**1545.20**
S_2	312.98	240.72	342.29	272.52	**291.12**	147.18	112.12	165.72	130.44	**138.86**
S_3	272.32	220.53	303.76	245.20	**260.45**	130.55	90.93	142.11	115.01	**119.65**
Mean	**309.28**	**244.43**	**339.64**	**276.71**		**146.79**	**111.20**	**161.70**	**131.92**	
	SEd		**CD(p=0.05)**			**SEd**		**CD(p=0.05)**		
S	4.84		9.98			2.30		4.75		
O	5.58		11.53			2.66		5.49		
S ×O	9.68		19.79			4.60		9.51		

S-Salinitylevel :S_1– Borewell WaterControl; S_2–EC-2.5 dSm^{-1};S_3–EC-5.0 dSm^{-1}

O-Organicmanures:O_1–HumicAcid30@kgha^{-1};O_2–Farmyardmanure@12.5tha^{-1};O_3–Vermicompost@12.5tha^{-1}andO_4–Composted coir pith @ 12.5 t ha^{-1}