Original Research Article

Effect of Farmyard Manure and Biofertilizers on productivity and profitability of Cucumber(*Cucumis Sativus*L.) cv. Pant Kheera-1

Abstract

Biofertilizersaremicrobialinoculationofplantgrowth-promotingrhizobacteria(PGPRs) which act as important components of integrated nutrient management (INM) andhavethe abilitytoreducethenutritionaldependenceofplantsoverchemicalfertilizers.Afieldexperimentwas conductedtoinvestigatetheresponseoffarmyardmanure(FYM)and biofertilizers on the productivity and profitability of cucumber (Cucumis sativus L.) cv. Pant Kheera-1.TheapplicationofFYMwasdonebythoroughlymixingitinthesoiloneweekpriortosowingand basal dose of vermicompost was incorporated in soil one week before sowing and treatedwiththreebiofertilizerssuchasAzotobacter,PSBandKSBasperthe requirementofthetreatment.The results indicated that farmyardmanureandbiofertilizerslikeAzotobacter and PSBwith different RDF doses of fertilizers significantly influenced the different growth and yieldattributes of cucumber. Application of 75 % RDF + FYM + Azotobacter + PSB + KSBrecorded significantly higher fruit setting percent (93.26%) and fruit yield. It was recorded that themaximum gross returns and net returns was recorded in with the application of 75 % RDF + FYM +Azotobacter+PSB+KSBwithB:Cratioof4.7whilemaximumB:Cratio(4.9)wasrecordedwith a application of 100%RDF.Thus,integrationoforganicmanureandbiofertilizerswith75% of RDF improved the production potential of cucumber and enhanced the netreturn.

Keywords:Biofertilizers,Cucumber,FYM,Integratednutrientmanagement,Economics, Yield.

Introduction

Cucumber(*Cucumissativus*L.)isoneoftheearlymaturingmostpopularvinevegetableofCucurbitaceaefamily(Sharma*etal*.,2016).Cucurbitsareextremelycross-

pollinated group of vegetable crops which is cultivated in tropics, subtropics and mildertemperatezonesofIndia.Cucumberrespondswelltovariousnutrients,includingmacronutrientsandmicronutrients.Thevegetablecropsgrowandproduce agoodqualitycropafterapplicationofcalcium,magnesium,sulphur,zinc,copperandboronasthesareimportantminerals for various metabolic activities in the plants (Kaur *et al*., 2018; Singh *et al*., 2018and Lallawmkima, 2018). Application of these nutrients throughdifferentsources is theprimaryneedofcrop production(Gorakh*etal*.,2021).

The use of expensive commercial fertilizers as per the requirement of the crop is notmuch affordable to the average farmers. The application of high input technologies such aschemical fertilizers,pesticides,herbicidesimprovedtheproductionbut there isgrowingconcern over the adverse effects of the use of chemicals on soil productivity and environmentquality (Lallawmkima*et al*., 2018). So, there is need of shifting towards integrated nutrientmanagement (INM) approach which is a sustainable practice and aims at maintaining the soilfertility and plant nutrient supply by incorporating all the possible sources of nutrients likeorganic manures, inorganic fertilizer, and the biological components in an integrated andjudiciousmannertogethighercropyieldwithouthamperingthesoilhealthandtheenvironment(Singh *etal*., 2018;Anmol&Singh, 2018).

Organic manures like panchagavya, neemcake, vermicompost or FYM or which isbulky in nature is a good source of nutrients and build up organic matter in soil as it has beenformed by decomposing cattle dung, farm waste, cattle urine and plant waste (Rohith *et al*., 2022). Further, biologicalfertilizers like biofertilizers arethe substances made up of the living cells of beneficialmicroorganismswhichhavecapabilitytoconvertunavailableformofnutrientintotheavailable form in the soil (Ramandeep *et al*., 2018; Lallawmkima*et al*., 2018). Biofertilizersare microbial inoculation of plant growth promoting rhizobacteria (PGPRs) which act asimportant component of integrated nutrient management (INM) and have ability to reduce thenutritionaldependenceofplantsoverchemicalfertilizers.Amongstbio-fertilizers,*Azotobacter*, PSB, Rhizobium strains play an important role in harvesting the atmosphericnitrogenthroughitsfixationintheroots(Kumar*etal*.,2018;Singh*etal*.,2018).Itisgivena primary importance in non-symbiotic and associative nitrogen fixation and was recognized toplay a unique role in nitrogen economy of many crops. Several authors have worked on theeconomics of vegetable cultivation under different cropping model with integrated approachofnutrientmanagementthroughorganicsourcesaswellasbiofertilizers(Singh*etal*.,2014;

Singh *et al*., 2015; Singh *et al*., 2016, Singh *et al*., 2018)

Providing nutrients through different sources and inclusion of drip irrigation practiceshave also been reported to enhance the nutrient use efficiency as drip irrigation makes thefertigation feasible which ensures proper availability of nutrients to plants (Bahadur *et al*., 2021), organic sources are responsible for ensuring slow and long-termrelease of nutrients, biofertilizers ensure the mobilization of nutrients from soil complex andavailability of growth promoting factors; thus, ensure the improvement in soil and plantnutrientstatusforhighproductivity,qualityandeconomicalvegetableproduction.Considering all these aspects, a research study was carried out to study the effect of integrated applicationofFYMandbiofertilizerwithrecommendeddoseoffertilizersonproductivity and profitability ofcucumber.

MaterialsandMethodology

A field experiment was conducted at the CRC Farm of the Division of Horticulture,ITM University Gwalior (M.P.). The climate of this place is bestowed with hot and dry earlysummersfollowedbyhotandhumidmonsoonseasonandcoldanddrywinters.Thesoiloftheexperimental field was sandy clay loam in texture, slightly alkaline (pH 7.73) in reaction, lowin organic carbon (4.3 g/kg) and available nitrogen (196.6 kg/ha) but medium in availablephosphorus(15.85kg/ha)andpotassium(229.6kg/ha)withelectricalconductivityinthesafe rrange.

TheexperimentwaslaidoutintheRandomizedBlockDesignwithten100 % RDF, FYM, 75 % RDF + FYM + *Azotobacter* + PSB, 75%RDF+FYM+*Azotobacter*+KSB,75%RDF+FYM+PSB+KSB,75%RDF+FYM + *Azotobacter*+PSB+KSB,50%RDF+FYM +*Azotobacter*+PSB,50%RDF+FYM+*Azotobacter*+KSB,50%RDF +FYM+PSB+KSBand50% RDF + FYM + *Azotobacter* + PSB + KSB) which were replicated thrice. FYM was applied bythoroughlymixingitinthesoiloneweekpriortosowingandbasaldoseofvermicompostwasincorporated in soil one week before sowing and treated with three biofertilizers such as*Azotobacter*,PSB andKSB as per requirementofthetreatment.

The observation on yieldandrelatedattributeslikefruitlength(cm),fruitgirth(cm),average fruit weight (g), number of fruits per vine, fruit yield per plant (g), fruit yield perhectare (q) were recorded at harvest and economic analysis was carried out and analysis of variance was performed todetermine the effect of FYM and biofertilizers on growth and productivity of

cucumber.Theinterpretation of treatments effects was made based on critical difference at 5 % probabilitylevel.

Results andDiscussion

Yieldandrelatedattributes

The data with respect to fruit length and girth revealed that maximum fruit length andgirth was observed with the application of 75 % RDF + FYM + *Azotobacter* + PSB + KSB(Table-1). It may be due to the easy accessibility of nutrients to plants through inorganicfertilizers along with better solubilization of organic manures with the action of *Azotobacter*and PSB. Integration of biological components like *Azotobacter* with inorganic fertilizers andorganicmanureshasproventoenhancetheprocessofnitrogenfixationinthesoil.Ithasfurtherresulted in the production of amino acids which are the building blocks of protein capable ofhastening the multiplication of cells manifesting maximum fruit length, girth and weight ofcucumber. This could be accountable to maximum average fruit weight and number of fruitsper vine, maximum fruit yield per plant and per hectare. Increase in average weight of fruit,due to application of organic manures and biofertilizers, might be associated with favourableaction of the microorganisms and positive effect of the manures which might have enhancedthe micronutrient availability in the soil. The similar findings were reported by Bairwa *et al.*(2009), Mohan *et al.* (2016), Thriveni *et al.* (2017), Dash *et al*.(2018),Eifediyiand Remison (2020) andSahu *etal.*(2020).

Economics

The economic analysis of cucumber cultivation after application of various treatmentsconfirms that the maximum gross returns (₹ 331149 ha^{-1}) and net returns (₹ 261249 ha^{-1}) wasestimatedwith the application of 75%RDF+FYM+*Azotobacter*+PSB+KSB) withB:Cratioof4.7while the maximum B:C ratio (4.9) was recorded with the application of 100 % RDF) (Table-2). However,the minimum gross returns (₹ 189701 ha^{-1}) and net returns (₹ 109704 ha^{-1}) and B:C ratio (2.4)was recorded with the application of FYM) which could be due to less yield and high cost of FYM.Theseresultsaresupportedbythefindingsof Prabhu*etal.*(2006),Kumar*etal.*(2017),Sharma et al., 2021, Navya*etal.*(2017**)** and Kumar *etal*. (2018).

Conclusion

The application of the farmyard manure and biofertilizers like *Azotobacter* and PSBwith different RDF doses of fertilizers significantly influenced the yieldparametersincucumber.Theapplicationof75%RDFincombinationwithFYM,*Azotobacter*,PSB and KSB recorded significantly higher fruityieldandgoodeconomicbenefits intermsofgrossandnetreturnincucumber.

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Table-1:Yieldandrelatedattributesofcucumberafterapplicationof FYMandbiofertilizers

Treatments	**Fruitlength (cm)**	**Fruitgirth (cm)**	**Average fruit weight(g)**	**Numberoffruits pervine**	**Fruit yieldper plant(g)**	**Fruit yieldperhectare (q)**
T_1	14.33	10.94	235.26	17.00	3999.37	444.33
T_2	12.14	9.11	200.10	12.19	2439.26	271.00
T_3	13.86	10.43	225.89	15.08	3407.23	378.54
T_4	13.30	9.96	212.57	14.12	3000.87	333.40
T_5	12.85	9.65	205.89	13.29	2735.72	303.94
T_6	14.47	11.09	240.26	17.72	4258.06	473.07
T_7	13.60	10.20	216.92	14.66	3180.29	353.33
T_8	13.05	9.76	208.32	13.67	2848.36	316.45
T_9	12.55	9.34	202.54	12.88	2608.82	289.84
T_{10}	14.10	10.73	230.47	16.59	3823.56	424.80
Sem(±)	0.060	0.052	1.099	0.103	34.628	3.847
CDat5%	0.177	0.156	3.265	0.305	102.889	11.431

Table-2:Economicsofcucumbercultivationafterapplication of FYM andbiofertilizers

Treatments	**Costofcultivation (₹ ha^{-1})**	**Grossreturns (₹ ha^{-1})**	**Netreturns (₹ ha^{-1})**	**B:Cratio**
T_1	63600	311031	247431	4.89
T_2	80000	189701	109701	2.37
T_3	68900	264980	196080	3.85
T_4	69100	233378	164278	3.38

T_5	69300	212757	143457	3.07
T_6	69900	331149	261249	4.74
T_7	73200	247331	174131	3.38
T_8	73400	221517	148117	3.02
T_9	73600	202888	129288	2.76
T_{10}	74200	297358	223158	4.01