Effect of optimized number of suckers and use of PGR on growth, yield and quality ofbanana(*Musa paradisiaca*L.) cv.Udhayam

Abstract

TheexperimentwasconductedinRandomizedBlockDesignwith10treatmentswiththreereplicationsofdifferentlevelsofIAAanddesuckering.IAAlevelsrangedbetween80and100ppm,while desuckering levels ranged between 1 to 3 suckers per plant. Treatment T_4, which consisted ofthe Mother plant + 1 sucker + IAA (80 ppm) had the best effect on height of mother plant (3.49 m),height of suckers (215.68 cm), number of days taken from stalk opening to harvest (120.44 days),number of leaves per plant (11.57), leaf area (32.39 m^2), leaf area index (7.34), firmness of finger atripening stage (4.33 kg/cm^2), moisture content of finger at ripening stage (78.84 %), total solublesolid (TSS) (16.26° Brix), total chlorophyll content (SPAD-502 value, 60.05), number of hands perstalk (10.88), number of fingers per hand (14.14) , finger length (15.09 cm), finger girth(4.31 cm),stalk weight (22.62 kg), yield (51.27 t/ha). From the economics point of view, Treatment T_4 MotherPlant+1 sucker + IAA (80ppm)had highest B:Cratio 3.89.

Keywords:Banana, IAA,Desuckering,Growth, Yield,Quality,Economics.

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Theabstractconsistsofanintroductionwhichincludesthebackgroundandobjectives,methods,results andconclusionsofthestudy

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1. INTRODUCTION

Comment [S3]: itisbettertoshowpreviousresearchrelatedtotheuseofPGRmainlyonbanana plants, so that it looks like thenovelty of the research conducted

The banana, *Musa paradisiaca*L., is a fruit that grows in humid tropical and subtropicalregions and is a member of the family Musaceae and the order Zingiberales. Bananas evolvedin South-East Asia, in the jungles of Malaysia, Indonesia, and the Philippines **(Stover andSimmonds, 1987)**. Potassium, phosphorus, calcium, and magnesium are all present in largeamounts. The fruit digests quickly and has little fat or cholesterol. It is recommended forpersons with high blood pressure, arthritis, ulcers, gastroenteritis, and renal conditions since itlowerstherisk ofheart diseasewhenused consistently**(Kumar*et al.*, 2012).**

With a yield of 34.6 Mt/ha and a production of 29.13 million tonnes from 0.841 millionhectares, India is the top banana producer in the world**.** India is responsible for 25.58 percentof global production while having only 15.5% of the world's land area. They cover 5.6 millionacres and are grown in over 130 countries, producing 114 million tonnes of bananas andplantains**(Rathod*et al.*, 2021).**

Fast-growing plants like bananas need lots of food and water to maintain a year-roundcycleandensureharveststhatareprofitable.Bananaplantsstarttoproducesuckersafewweeksafter planting, which compete with the parent plant for nutrients and water and reduce yield**(Oluwafemi,2013).**Therefore,controllingsuckersinbananasisacrucialculturalpractisethatinvolves removing undesired suckers that emerge from the mother plant's base, leaving just asuitable sword sucker to produce the ratoon crop. Eliminating extra suckers that compete withthemotherplant is the goalforbetter growth and yield.**(Daniells, 1984).**

Plant growth regulators are essential for regulating the growth and development of plants**(TaizandZeiger,2010)**.Fruitsofinferiorqualityarefrequentlyproduced.Therefore,increasing fruit crop productivity and quality through foliar application or bunch feeding ofplant growth regulators would be profitable **(Nandan, 2010).** Organic chemical moleculesknownasplanthormones orregulatorsworktoinfluenceorcontrolphysiologicalprocessesinplants when used at lower quantities **(Kumari*et al.*, 2018).**These substances function in veryspecific ways. Even if plants produce the majority of them, it's still vital to artificially deliversomeofthemintherequiredquantitiesandconcentrationstoboostgrowth,quality,andoutput**(Nandan,2010).**

The source-sink relationship of bananas can be changed by using the right plant growthregulators,whichcouldleadtoanincreaseinproduction.Inaddition,anyimprovementincrop physiologicalefficiencyachievedthroughtheapplicationofPGRmayhaveasignificant

impact on productivity. After harvest, banana retains some nutrients and assimilates in thepseudostemandleaves,whichreducesthecrop'sabilitytotransferassimilatestosink**(Simmonds, 1966).**The use of a suitable growthregulator may be helpfultotreatthiscondition.Mosttissuesshowedresponsivenesstoauxinamountamongtheseveral plantgrowthregulators. IAA, or indole acetic acid, is the most significant auxin present in plants **(Jutta,2000).** It promotes tissue differentiation, apical dominance, and responses to pathogens, light,andgravity.Italsopromotescelldivisionandelongation**(Aloni*etal.*,2006;Tian*etal.*,2014).**

In light of the foregoing, this study was conducting to find out the optimized number ofsuckers&effectofPGRongrowth,yieldandqualityofBananaandtoestimatetheeconomicsofvari ous treatments.

2. MATERIALS AND METHODS2.1.EXPERIMENTALS ITE

The present study was carried out at the Horticulture Research Farm, Department ofHorticulture,NainiAgriculturalInstitute,SamHigginbottomUniversityofAgriculture,Technolo gyand Sciences(SHUATS), Prayagraj, during 2021-2022.

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The experimental field is located close to the Yamuna River, about 8 kilometres fromPrayagrajcity.

2.2. LAYOUTANDTREATMENT

Experiment was laid out in Randomized Block Design, with Ten Treatments replicatedthrice.Thetreatmentdetailsandtreatmentcombinationsaredisplayedin Table1.Inthecurr entstudy, uniform, healthy-bearing banana plants of the Udhayam variety were used, producedusingcomparableculturalpractices.Desuckeringwasperiodicallyperformed,leavingone, two,or three suckers per plant depending on the treatment's needs, and it involved cutting off thesuckers without damaging the parents. In order to prepare an 80 ppm IAA solution, 80 mg ofIAA was weighed, dissolved in alcohol, and then the final volume of 1 litre was made up withdistilledwater.Similarlyotherconcentrationwerealsoprepared.Aknapsacksprayerwasusedfo rthesprayingofdifferenttreatments.Thesecondspraywasrepeatedonemonthafterthefirstsprayand last spray wasdonejustbeforeflowering ofbanana.

Table1.TreatmentDetails &Treatmentcombinations

S.No.	Treatmentsymbols	Treatmentcombinations
1.	T_0	Control(waterspray)
2.	T_1	MotherPlant+1Sucker
3.	T_2	MotherPlant+2Suckers
4.	T_3	MotherPlant+3Suckers
5.	T_4	MotherPlant+ 1Sucker +IAA(80ppm)
6.	T_5	MotherPlant+ 1Sucker+IAA(100ppm)
7.	T_6	MotherPlant +2Suckers + IAA(80ppm)
8.	T_7	MotherPlant+ 2Suckers + IAA(100ppm)
9.	T_8	MotherPlant +3Suckers + IAA(80ppm)
10.	T_9	MotherPlant +3Suckers + IAA(100ppm)

2.3.DATACOLLECTIONANDANALYSIS

Growth attributes like height of mother plant (m), height of suckers (cm), number ofdays taken from stalk opening to harvest, number of leaves per plant, leaf area (m^2), leaf areaindex,photosynthesisattributelikechlorophyllcontent(SPAD-502),yieldattributeslikenumber of hands per stalk, number of fingers per hand, finger length (cm), finger girth (cm),stalk weight (kg), yield (t/ha) and quality attributes like firmness of finger at ripening stage(kg/cm^2), moisture content at ripening stage (%), Total Soluble Solid (TSS) (° Brix) wererecordedandanalysed.

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3. RESULTS AND DISCUSSION3.1.GROWTHATTRIBUTES

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The height of mother plants (m) are shown in Table 2, Treatment T_4, which consistedof Mother Plant + 1 sucker + IAA (80 ppm), had significantly highest height of mother plant,which was at 3.49 m, while Treatment T_0, which consisted of control, recorded significantlylower height of mother plant, which was at 3. m. The reason being highest height of motherplant in the treatment $T_4$was due to less competition of nutrients and water among bananaplants **(Stover and Simmonds, 1987; Robinson and Nel, 1990)**. The action of IAA on cellproliferation and elongation of cells may have contributed to the taller plants **(MuthulakshmiandPandyarajan, 2013).**

The observations in terms of height of sucker (cm) are shown in Table 2, whereTreatment T_4 Mother Plant + 1 sucker + IAA (80 ppm) was highest sucker height of 152.11cm,171.26cm,193.47cm,and215.68cmwhereastreatmentT_0i.e., Controlrecordedsignificantlylowerheightofsuckerperplant79.91cm,95.75cm,111.77cm&127.79cmat

30,60,90&120daysrespectively.Theincreaseinsuckerheightwasprobablycausedbylesscompetition between the surplus suckers and the mother plant for nutrients and water **(StoverandSimmonds,1987;RobinsonandNel,1990)**.Furthermore,(**Sadak*etal*.,2013andOgwu*etal*.,2015)**hypothesisethatIAA'simpactoncellgrowthandelongationmayhavecontributedtotheincreased sucker height.

Table 3, displays the findings of the observations made about the number of daysbetween stalk opening and harvest. In comparison to Treatment T_0, which included control,Treatment $T_4$was effective in terms of lower number of days taken from stalk opening toharvest, which was 120.44 days. Treatment T_0 recorded significantly highest number of daystaken from stalk opening to harvest, which was 134.66 days. The shorter time from stalkopening to harvest and enhanced desuckering intensity may be attributable to the increasedlight exposure of leaf surfaces and decrease in suckers, which increased the metabolism of theplantsandacceleratedphysiologicalmaturationandblooming.Accordingto (**Chattopadhyay*etal*., 1980).**

Table 3, displays the findings of the observations made on the number of leaves perplant.Themostsuccessfultreatment,T_4recordedthelargestnumberofleavesperplant11.57,whereasTreatmentT_0,whichcontainedcontrol,recordedlowestnumberofleavesperplant8.A banana crop should yield a sufficient number of leaves to capture solar energy and createenough photosynthates to produce biomass. The number of leaves per plant increased as lesssuckers were permitted to grow alongside mother plants across all observational periods.(**Robinson and Nel 1989),** who noted that plants with a single sucker had more functioningleaves since there was less competition among them for soil moisture, nutrients, and lightintensity **(Gogoi*et al*., 2015),** Similar results were reported by (**Sentelhas*et al*., 1987),** whoclaimedthatIAAspraying enhancedthe number of leaves perplant.

Table 3, displays the findings of the observations about leaf area (m^2). In comparisonto Treatment T_0, Treatment T_4 was highest leaf area which was 32.39 m^2, whereas TreatmentT_0 recorded significantly lower leaf area 11.21 m^2. These findings can be attributed to IAA'srole in promoting plant growth and development by promoting a variety of processes, such ascell division and tissue growth, phototropism and gravitropism, apical dominance, lateral rootinitiation,differentiationofvasculartissues,embryogenesis,senescence,andripening**(Naeem*etal*., 2004).**

Table3,displaysthefindingsoftheobservationsmadeonleafareaindex.IncomparisontoTreatmentT_0,whichincludedcontrol,TreatmentT_4wasgreatestleafareaindex,which was 7.34. Treatment T_0recorded significantly lower leaf area index, which was 2.54.Leafareaindexisfrequentlyusedasameasureofplantgrowth. Increaseintheleafareaindexis therefore confirmation that the phytohormones utilized in the trials are successful. Thesefindingsaresupported bytheseresults**(Muthulakshmiand Pandyarajan, 2013).**

3.2. PHOTOSYNTHESISANDYIELDATTRIBUTES

The results for total chlorophyll content (SPAD-502) are shown in Table 4, TreatmentT_4Mother Plant + 1 sucker + IAA (80 ppm) was the best among all other treatment thistreatment recorded significantly highest total chlorophyll content (SPAD-502 value, 60.05),whiletreatmentT_0,Control,recordedsignificantlylowesttotalchlorophyllcontent(SPAD-502value, 48.14). According to **Damian *et al.*, (2002),** IAA application caused the gibberellinbiosynthetic gene to express itself more actively and generated new wall polysaccharides toenable longer-lasting development. Certain enzymes involved in the manufacture of cell wallpolysaccharides and cell wall loosening are stimulated by auxin. Auxin starts a signalingcascade that produces secondary messengers that directly activate pre-existing H+-ATPases,booststheexpressionofnumerousgenesinvolvedingrowthanddevelopment,andconsequentlyincreases theamount of chlorophyll.

The observations regarding the number of hands per stalk are shown in Table 4, whereTreatment T_4Mother Plant + 1 sucker + IAA (80 ppm) was found to be the significantlyeffectiveintermsofhighestnumberofhandsperstalkof10.88,as comparedtoTreatmentT_0,whichrecordedsignificantlylowestnumberofhandsperstalkof6.64.Intreatmentswithmorenumberofplants,thenumberofhandsperstalkmayhaveincreasedbecauseoflesscompetitionforphotosynthatesandnutrientsbetweenthemotherplantandmorefollowers(**Nambiar*e tal.*,1979)**.

Treatment T_4 Mother Plant + 1 Sucker + IAA (80 ppm) recorded considerably highestnumber of fingers per hand of 14.14, whereas Treatment T_0, recorded significantly lowestnumber of fingers per hand of 9.10. The increased in the number of fingers per hand wasprobably brought about by less competition for nutrients and water between the mother plantandthe extrasuckers(**Robinson and Nel 1990)**.

Table 4, displays the observations for finger length (cm), with treatment T_4MotherPlant + 1 Sucker + IAA (80 ppm) had significantly highest finger length of 15.09 cm, whiletreatment T_0, recorded significantly lowest finger length 11.1 cm. According to the results ofthe experiment, desuckering and effective management methods, which are essential for producing more bananas, that caused to increase in finger length of banana. In general, plants that had extra suckers removed outperformed those that had outgrowths left on the mother plants, which is the standard farming method(**Mahdi *etal.*, 2014)**.

Table4,displaystheobservationsforfingergirth(cm),withtreatmentT_4MotherPlant + 1 Sucker + IAA (80 ppm) was highest finger girth of 4.31 cm, while treatment T_0, recordedsignificantly lowest finger girth 2.7 cm. This is explained by the fact that removed the suckerwith the mother plant drastically increased finger girth and finger length, which are importantfactorsin stalk weight/size (**Robinson and Nel 1990)**.

TheresultsarepresentedinTable4,intermsofStalkweight(Kg),whereTreatmentT_4Mother Plant + 1 sucker + IAA (80 ppm) was found to be the significantly effective in termsof highest stalk weight of 22.62 kg, whereas Treatment T_0, recorded significantly lowest stalkweight9.6kg.Theexperiment'sfindingssuggestthattheincreaseinbunchproductionmaybedue to desuckering and suitable management techniques, which are crucial for increased stalkyieldandyieldsofbanana.Plantsthathadextrasuckersremovedgenerallyoutperformedthosew hose outgrowths were kept on the mother plants, which is the conventional farming practice.Similarresults werefound by(**Mahdi*et al.*, 2004).**

The observations regarding Yield (t/ha) are shown in Table 4, where Treatment T_4Mother Plant + 1 sucker + IAA (80 ppm) was found to be the significantly effective in termsof highest yield 51.27 t/ha, while Treatment T_0, recorded significantly lowest yield 21.76 t/ha.Theresultsoftheexperimentindicatethatdesuckeringandappropriatemanagementpractices,w hichareessentialforincreasingstalkyieldandbananayields,accordingtostandardagricultural methods, plants whose outgrowths were left on the mother plants outperformedthosewhoseadditional suckers were removed(**Mahdi*et al.*, 2004)**.

3.3. QUALITYATTRIBUTES

The results for firmness of finger at ripening stage (kg/cm^2) are shown in Table 5, whereTreatment T_4 Mother Plant + 1 sucker + IAA (80 ppm) had significantly highest firmness offinger at ripening stage which was at 4.43 kg/cm^2, while Treatment T_0 recorded significantlylowestfirmnesswhichwasat3.23kg/cm^2.Theforegoingfindingscouldbeexplainedbyt

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fact that IAA reduced the fruit's ABA content and elevated the concentration of ethylene,causingthe fruit to softenand turn colour**(Nana, 2019).**

Table 5, displays the observations related to moisture content of finger at ripening stage(%). Treatment T_4 Mother Plant + 1 Sucker + IAA (80 ppm) had highest moisture content offingeratripeningstagewhichwasat78.84%,whileTreatmentT_0recordedsignificantlylowestmoisturecontentoffingerat73.21%.Themotherplantandextrasuckerswerelesscompetitiveto each other for nutrients and water, which is what most likely led to increase in bananamoisture content (%). These results are in agreement with those of (**Stover and Simmonds,1987),**as well as (**Robinson and Nel 1990).**

InTable5,whichsummarizestheobservationsrelatedtoTSS(°Brix),TreatmentT_4MotherPlant +1sucker+IAA(80ppm)wasfoundtobeintermsofhighestTSSwhichwas at(16.26 °Brix),whileTreatmentT_0recordedsignificantlylowestTSSwhichwasat(12.28°Brix).TSSconcentration in the fruits was raised by IAA foliar spray. Similar outcomes were reported by(**Prajapati*etal.*,2015)**,inwhichauxinadministrationintheformoffoliarsprayenhancedthegrowthandcaliberofavarietyofcrops.Accordingtoreports,IAAencouragesGAbiosynthesisandpreventsofGAinaction, which increases fruits TSS content.

3.4. ECONOMICS

The economics of treatments is an important goal in determining the best treatments thatimprove income and are acceptable. Table 6, shows the cost of cultivation, gross returns, netreturns, and B:C ratio as affected by various treatments. Because of the variable application ofPGRs and different numbers of suckers, the cost of cultivation varied from (Rs 1,57,012 to1,57,237/ha).TreatmentT_4,hadhighestgrossreturns(Rs7,69,050/ha)whencomparedtotheother treatments the highest net returns (Rs 6,11,858 /ha) was recorded in treatment T_4withB:Cratio of (3.89).

Table2:Effectofoptimizednumberofsuckersanduseof PGRonHeightofmotherplant(m),Height ofsuckers(cm)of banana (*Musa paradisiaca*L.) cv. Udhayam

S. No.	Treatment symbols	Treatmentcombinations	Height* ofmotherplant (m)	Heightofsuckers(cm)			
				30 DAYS	60 DAYS	90 DAYS	120 DAYS
1.	T_0	Control(waterspray)	3.03	79.91	95.75	111.77	127.79
2.	T_1	MotherPlant+1sucker	3.42	140.96	151.72	172.73	193.74
3.	T_2	MotherPlant+2sucker	3.27	116.14	133.18	152.72	172.26
4.	T_3	MotherPlant+3 sucker	3.10	90.99	106.83	125.07	143.31
5.	T_4	MotherPlant+1sucker+ IAA(80ppm)	3.49	152.11	171.26	193.47	215.68
6.	T_5	MotherPlant+1sucker+ IAA(100ppm)	3.47	148.36	167.51	189.72	211.93
7.	T_6	MotherPlant+2sucker+ IAA(80ppm)	3.37	132.73	150.48	171.02	191.56
8.	T_7	MotherPlant+2sucker+ IAA(100ppm)	3.31	124.01	141.76	162.30	182.43
9.	T_8	MotherPlant+3sucker+ IAA(80ppm)	3.21	107.73	123.77	143.31	162.85
10.	T_9	MotherPlant+3sucker+ IAA(100ppm)	3.17	99.36	115.43	133.67	151.91
		F-Test	**S**	**S**	**S**	**S**	**S**
		S.E(d)=	**0.01**	**3.80**	**3.57**	**3.23**	**3.15**
		CD(5%)=	**0.03**	**7.98**	**7.49**	**6.78**	**6.62**
		CV=	**0.56**	**3.90**	**3.21**	**2.54**	**2.20**

***at harvestingstage**

Table3:Effectofoptimizednumberofsuckersanduseof PGRongrowthattributesofbanana(*M usa paradisiaca*L.)cv. Udhayam

S. No.	Treatment symbols	Treatmentcombinations	Number ofleaves/plant	Leaf Area (m^2)	Leaf AreaIndex	Number ofDays takenfrom stalkopening to harvest
1.	T_0	Control(waterspray)	8.00	11.21	2.54	134.66
2.	T_1	MotherPlant+1sucker	11.02	27.56	6.25	122.92
3.	T_2	MotherPlant+2sucker	9.90	20.00	4.54	127.74
4.	T_3	MotherPlant+3sucker	8.73	13.71	3.11	132.75
5.	T_4	MotherPlant+1 sucker+IAA(80ppm)	11.57	32.39	7.34	120.44
6.	T_5	MotherPlant+1sucker+IAA(100ppm)	11.38	31.15	7.06	121.24
7.	T_6	MotherPlant+2 sucker+IAA(80ppm)	10.62	24.86	5.64	123.93
8.	T_7	MotherPlant+2sucker+IAA(100ppm)	10.26	22.26	5.05	125.88
9.	T_8	MotherPlant+3 sucker+IAA(80ppm)	9.52	17.77	4.03	129.55
10.	T_9	MotherPlant+3sucker+IAA(100ppm)	9.14	15.73	3.57	131.29
		F-Test	**S**	**S**	**S**	**S**
		S.E(d) =	**0.10**	**0.53**	**0.12**	**0.75**
		CD(5%) =	**0.22**	**0.12**	**0.25**	**1.59**
		CV=	**1.27**	**3.02**	**3.02**	**0.73**

Table4:Effectofoptimizednumberofsuckersanduseof PGRonphotosynthesisandyieldattributesof banana (*Musa paradisiaca*L.)cv.Udhayam

S. No.	Treatment symbols	Treatmentcombinations	TotalChlorophyll content(SPAD-502)	Number ofhands/stalk	Number offingers/hand	Finger length (cm)	Finger girth(cm)	Stalk Weight (Kg)	Yield (t/ha)
1.	T_0	Control(waterspray)	48.14	6.64	9.10	11.10	2.70	9.60	21.76
2.	T_1	MotherPlant+1sucker	58.06	10.16	13.24	14.43	4.05	20.65	46.81
3.	T_2	MotherPlant+2sucker	54.33	8.62	11.49	13.02	3.48	16.55	37.53
4.	T_3	MotherPlant+3sucker	50.56	7.15	9.80	11.54	2.95	12.05	27.32
5.	T_4	MotherPlant+1 sucker+ IAA(80ppm)	60.05	10.88	14.14	15.09	4.31	22.62	51.27
6.	T_5	MotherPlant+1 sucker+IAA(100ppm)	59.36	10.62	13.88	14.88	4.24	22.04	49.96
7.	T_6	MotherPlant+2 sucker+ IAA(80ppm)	56.34	9.67	12.67	13.95	3.85	19.38	43.93
8.	T_7	MotherPlant+2 sucker+IAA(100ppm)	55.33	9.15	12.09	13.54	3.66	18.15	41.14
9.	T_8	MotherPlant+3 sucker+ IAA(80ppm)	53.25	8.09	10.99	12.56	3.32	15.17	34.39
10.	T_9	MotherPlant+3 sucker+IAA(100ppm)	51.94	7.58	10.38	12.13	3.13	13.51	30.63
		F-Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
		S.E(d) =	**0.58**	**0.14**	**0.21**	**0.13**	**0.04**	**0.81**	**1.83**
		CD (5%) =	**1.22**	**0.29**	**0.45**	**0.27**	**0.09**	**1.70**	**3.86**
		CV=	**1.30**	**1.93**	**2.21**	**1.17**	**1.47**	**5.85**	**5.85**

Table5:Effectofoptimizednumberofsuckersanduseof PGRonqualityattributesofbanana(*Musa paradisiaca*L.)cv. Udhayam

S. No.	Treatmentsymbols	Treatmentcombinations	Firmness offinger atripening stage(Kg/cm^2)	Moisture Content offinger atripening stage(%)	TSS (°Brix)
1.	T_0	Control(waterspray)	3.23	73.21	12.28
2.	T_1	MotherPlant+1sucker	4.30	78.17	15.58
3.	T_2	MotherPlant+2sucker	4.03	76.21	14.35
4.	T_3	MotherPlant+3sucker	3.76	74.29	13.15
5.	T_4	MotherPlant+1 sucker+ IAA(80ppm)	4.43	78.84	16.26
6.	T_5	MotherPlant+1 sucker+IAA(100 ppm)	4.38	78.78	15.99
7.	T_6	MotherPlant+2 sucker+ IAA(80ppm)	4.21	77.57	15.19
8.	T_7	MotherPlant+2 sucker+IAA(100 ppm)	4.13	76.86	14.72
9.	T_8	MotherPlant+3 sucker+ IAA(80ppm)	3.94	75.61	13.98
10.	T_9	MotherPlant+3 sucker+IAA(100 ppm)	3.85	75.00	13.55
		F-Test	**S**	**S**	**S**
		S.E(d)=	**0.03**	**0.02**	**0.16**
		CD(5%) =	**0.06**	**0.06**	**0.33**
		CV=	**0.91**	**0.04**	**1.34**

Table 6: Effect of optimized number of suckers and use of PGR on Economics of banana(*Musaparadisiaca*L.)cv. Udhayam

Treatments	Cost ofcultivation(Rs/ha)	Total Yield(t/ha)	Price pertonne(Rs)	Gross return(Rs/ha)	Net Return (Rs)	B:C
Control(waterspray)	157012	21.76	15000	326400.00	169388.00	1.08
MotherPlant+1 sucker	157012	46.81	15000	702150.00	545138.00	3.47
MotherPlant+2 sucker	157012	37.53	15000	562950.00	405938.00	2.59
MotherPlant+3 sucker	157012	27.32	15000	409800.00	252788.00	1.61
MotherPlant+1 sucker +IAA(80ppm)	157192	51.27	15000	769050.00	611858.00	3.89
MotherPlant+1 sucker+IAA(100ppm)	157237	49.96	15000	749400.00	592163.00	3.77
MotherPlant+2 sucker +IAA(80ppm)	157192	43.93	15000	658950.00	501758.00	3.19
MotherPlant+2 sucker+IAA(100ppm)	157237	41.14	15000	617100.00	459863.00	2.92
MotherPlant+3 sucker +IAA(80ppm)	157192	34.39	15000	515850.00	358658.00	2.28
MotherPlant+3 sucker+IAA(100ppm)	157237	30.63	15000	459450.00	302213.00	1.92

CONCLUSION

From the present investigation it is concluded that the Treatment T_4 Mother Plant + 1sucker + IAA (80 ppm) was found to be best in terms of growth, yield and quality of banana.From the economics point of view, highest net return was found in the Treatment T_4 MotherPlant+1 sucker+ IAA (80ppm)with 6,11,858 Rs/ha andthe highest B:C ratio3.89.

REFERENCES

Comment [S7]: need to add the latest references(80%ofreferencesusedinthelast5-10years)

Aloni, R., Aloni, E., Langhans, M., &Ullrich, C. I. (2006). Role of cytokinin and auxin inshapingrootarchitecture:regulatingvasculardifferentiation,lateralrootinitiation,rootapical dominanceandroot gravitropism.*Annalsof botany*, *97*(5),883-893.

Chattopadhayay,P.K.,Chattopadhayay,S.,Maiti,S.C. andBose,T. K.(1980).Effectofplant density on growth, yield and quality of banana. Nat. sem. Banana Prod. Tech.TNAU,Coimbatore. pp.79-89.

Damian, P., Neill, O., & John, J. R. (2002).Auxin regulation of the gibberellin pathway inpea.Plant Physiology, 130(4), 1974–1982

Gogoi,B.,Khangia,B.,Baruah,K.andKhound,A.(2015).EffectofHighDensityPlantingandNutrientManagementonGrowthandYieldofBananacv.Jahaji(Musa,AAA).Int. J.Agric. InnovationsandRes.,3:1465-1469.

Jutta,L.M.(2000).Indole-3-butyricacidinplantgrowthanddevelopment.*PlantGrow. Regul.*,32(2-3):219-230.

Kumar,K.S.,Bhowmik,D.,Duraivel,S.,&Umadevi,M.(2012). Traditionalandmedicinalusesof banana.*Journalof PharmacognosyandPhytochemistry*, *1*(3), 51-63.

Kumari, S., Bakshi, P., Sharma, A., Wali, V. K., Jasrotia, A., &Kour, S. (2018). Use ofplant growth regulators for improving fruit production in sub tropicalcrops.*International Journal of Current Microbiology and Applied Sciences*, *7*(3), 659-668.

Mahdi,E.F.M.,Bakhiet,S.B.andGasim,S.(2014).GROWTHANDYIELDRESPONSES OFBANANA PLANTTO DESUCKERINGPRACTICE.International Journalof Science,Environment andTechnology,Vol.3, No1, 2014,279–285.

Muthulakshmi, S. and Pandiyarajan, V. (2013). Effect of Iaa on the Growth, Physiologicaland Biochemical Characteristics in Catharanthusroseus (L). G. Don. InternationalJournalof ScienceandResearch (IJSR),ISSN(Online): 2319-7064.

Naeem, M., Bhatti, I., Ahmad, R. H. and Ashraf, W. M. (2004).Effect of some growthhormones (GA, IAA and kinetin) on the morphology and early or delayed initiation ofbudoflentil (Lens culinarisMedik). Pak.J.Bot. 36(4): 801–809.

Nambiar, I. P. S., Balakrishnan, S. and Marykutty, K. C. (1979). Influence of desuckeringandrelationofvaryingnumbersofsuckersonplantgrowthandyieldof Robustabanana.AgricRes. J. of Kerala, 17, 248-50.

Nana,L.(2019).EffectsofIAAandABAontheImmaturePeachFruitDevelopmentProcess. HorticulturalPlantJournalVolume5,Issue4,Pages145-154

Nandan, C.P. (2010). Studies on effect of growth substances spray, bunch sleeving and ureabunchstalkfeedingonimprovementofyieldandqualityattributesofbananacv.Nanjanaguduras abale.M.Sc.Hortthesisunpub.UniversityofAgriculturalSciences,Bengaiuru.

Ogwu,M.C.,Aiwansoba,R.OandOsawaru,M.E.(2015).EffectsofIndole-3-AceticAcidon germination in lead polluted petri dish of Citrulluslanatus (Thunberg) MatsumuraandNakai,Cucurbitaceae.AcehInternationalJ.ScienceandTechnology,4(3):107-113.

Oluwafemi, A. B. (2013). Influence of number of sucker per plant on the growth, yield andyield components of Plantain (Musa sp.) in Ado-Ekiti, Nigeria. *Agricultural ScienceResearchJournals.* 3 (2):45-49.

Prajapati, S., Jamkar, T., Singh, O. P., Raypuriya, N., Mandloi, R., & Jain, P. K. (2015). Plant growth regulators in vegetable production: An overview. Plant Archives, 15(2),619–626.

Rathod,S.R.,Gavali,A.V.,&Yadav,D.B.,(2021). Trendanalysisofarea,productionandproductivityofbananainMaharashtra.*JournalofPharmacognosyandPhytochemistry*.Sp10(1): 612-614

Robinson,J.C.,andNel,D.J.(1990).Competitiveinhibitionofyieldpotentialina'Williams'banan aplantationduetoexcessivesuckergrowth.*Scientiahorticulturae,43*(3-4), 225-236.

Sadak,M.S.,Dawood,M.G.,Bakry,B.A&El-Karamany,M.F.(2013). Synergisticeffectof Indole Acetic Acid and Kinetin on performance, some biochemical constituents andyield of Faba Bean plant grown under newly reclaimed sandy soil. World Journal ofAgriculturalSciences, 9(4):335-344.

Sentelhas, P.C., Cactano. J. R.G. and Teixeira, N.T. (1987) The effect of IAA and FoliarNitrogenon wheat. Ecossitema. 12: 123-128.

Simmonds,N.W.(1966). **Bananas.**Longmans,2nd Edn.London. P.466.

Stover,R.H.(1979).Pseudostemgrowth,leafproductionandflowerinitiationinthe„GrandNaine‟banana.Bull. Trop.Agric. Services.,8:37. (Hort.Abstr. 50:9622).

Stover,R.H.andSimmonds,N.W.(1987). Bananas(3rdEdition).Longmans,London.Pp468.

Tian,H.,DeSmet,I.,&Ding,Z.(2014). Shapingarootsystem:regulatinglateralversusprimaryroot growth.*Trends in plant science*, *19*(7),426-431.