Original Research Article

INFLUENCES OF DIFFERENT SOWING DATES WITH APPLICATION OF GA_3 ONGERMINATION AND GROWTH OF CAPE GOOSEBERRY (*Physalisperuviana L.)* INSUBTROPICALCONDITIONPRAYAGRAJ.

ABSTRACT

The present investigation was carried out to ~~find~~ influences of different sowing dates withapplication of GA_3 on ~~G~~germination, growth, ~~Y~~yield and ~~Q~~quality attributes of Cape gooseberry(*PhysalisPeruviana* L.) in subtropical condition Prayagraj. The experiment was conducted ina Complete Randomized Design with three replications during August-March (2022-23) atHorticultural Research Farm, Department of Horticulture, Naini Agricultural Institute, SamHigginbottom University of Agriculture, Technology and Sciences Prayagraj Uttar PradeshIndia. ~~The data were recorded from four randomly selected plants from each replication of thetreatmentsforeighteencharacters~~. The10treatments~~were~~comprisedoffivedatesofsowing i.e.T_1:20August2022withseedtreatmentfromGA_3@100ppm,T_2:20Augustwithoutseedtreatment from GA_3, T_3: 5 September 2022 with seed treatment from GA_3 @ 100ppm, T_4: 5SeptemberwithoutseedtreatmentfromGA_3,T_5:20September2022withseedtreatmentfromGA_3 @100ppm,T_6:20September2022withoutseedtreatmentfromGA_3.T_7:5October2022with seed treatment from GA_3 @100ppm, T_8: 5 October 2022 without seed treatment fromGA_3, T_9: 20 October 2022 with seed treatment from GA_3 @100ppm, T_{10}: 20 October 2022without seed treatment from GA_3. From all the above treatments the highest percentage ofgermination was recorded from T_7: 93.33% followed by T_8: 90% and T_{10}: 91.66% andvegetative growth of seedling was higher in T_7 followed by T_8 and T_9. All the treatments ~~are~~sowninnurserythroughseedpropagationafterthattransplantedinmainfieldlevelforobserveger mination parameters and vegetative growth of Cape gooseberry influenced by differentsowingdates.

INTRODUCTION

CAPE GOOSEBERRY (*Physalisperuviana* L.) is an annual fruit crop that is widely grown inmany tropical and subtropical regions around the world. The genus Physalis (bladder) of thefamilySolanaceaeincludesannualandperennialherbswithglobularfruitsenclosedininflatedcal yx that becomes papery on maturity and resembles a Chinese lantern. Various Physalisspecies have been subjected to far too much confusion in literature and commerce. Capegooseberry is a well-known species that produces superior fruit (*Physalisperuviana* L.). InHawaii, it is known as Poha or Poha berry, in South Africa as Golden berry, and in India asRashbhari, Makoi, Tepari, Husk cherry, and Peruvian ground cherry. Cape gooseberry's nameis most likely derived from the name “Cape of God Hope’’ of Southern Africa where it wascommerciallygrown.

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The fruits are yellow-orange berries that are 2 to 3.5 cm in diameter, very juicy, aromatic, andhaveadistinctbitter-sweetflavor.Thesmallfruits,whichresembletomatoesinshapebuthavea sweeter taste, better aroma, and a higher pectin content, remain enclosed by the largeaccresence epicalyx. It can, however, be grown as a perennial crop in some areas withfavourable climatic conditions. Fruits are eaten fresh and can be used in the fruit processingindustry to make syrup, sauce, recipes, puddings, chutneys, ice cream, and fruit salads due totheirgood natural flavour.

The Cape gooseberry is native to Peru and Chile, but it has been widely introduced intocultivation in other tropical, subtropical, and temperate regions. It is said to thrive wherevertomatoescanbegrown,anditsnutritionalvaluerivalsthatofanyothermajorfruitcrop.Berry contains18%protein,0.2%fat,and11.5%carbohydratesintheedibleportion.Italsocontains10 mg of calcium, 60 mg of phosphorus, and 18 mg of iron per 100 gram of fruit pulp, aswell as 0.1 mg of thiamine and 1.70 mg of niacin. The ripe fruits are eaten fresh and used tomakeexcellentqualityjelly,sauces,andespeciallyjam,forwhichitisknownasthe"Jamfruitof India." When dipped in chocolate or other glazes, or pricked and rolled in sugar, the fruitsarealsoappealingly sweet.

Cape gooseberry is an herbaceous, soft-wooded, erect, veining shrub. Plants have ribbed, oftenpurplish spreading branches on which velvety heart-shaped pointed leaves 6-15 cm long and4-10 cm wide appear on a regular basis. Yellow pendulous flowers with companulate hairycorollaswithpurple to brown spotsarebornin leaf axils.

The flowers are self-pollinated, but pollination can be improved by gently shaking floweringstems or spraying the plants with water after the flowers have fallen. The calyx expands,eventually forming a straw-colored husk that is much larger than the fruits it contains. Theberry is globosely, smooth, glossy, orange-yellow skin and juicy pulp containing numerousvery small yellowish seeds when it is ripe. As the fruits ripen, they start to fall to the ground.Fruits are generally harvested manually at regular intervals, which is the most expensiveoperationinCapegooseberryproduction.Itisgrownasanannualcropintheplainsofnorthe rnIndia and as a perennial crop in the hills of southern India. It is successfully grown in statessuchasUttarPradesh,WestBengal,MadhyaPradesh,Haryana,Punjab,theNillgiriHills,andot her parts of the country. It can be grown successfully up to an elevation of 1200m in NorthIndia. It grows well up to 1800m in South India. The plant prefers a sunny, frost-free locationthat is protected from strong winds. It can grow in temperatures as low as 50 degrees Celsiusand as high as 350 degrees Celsius; however, temperatures around 210 degrees Celsius areidealforagoodcrop.

The dates of sowing and plant population per unit area are critical in achieving optimal plantgrowth and high yield. According to Bhatnagar and Pandita, the correct sowing time resultedin a higher yield and improved tomato fruit quality. The success of any crop depends on avarietyoffactors,includingsoil,sowingdate, temperature,sunshinehours,andsoon.

The Cape gooseberry plant requires full sun, a warm temperature, and protection from frost,among other things. Plants can be grown as annuals in areas where frost or freezing occurs.Cape gooseberry seeds are typically easy to germinate due to their epigeal nature, thoughgermination time may be slightly longer than that of other vegetable seeds. Cape gooseberryseedsshouldbesproutedintrayswithporesthatare80-100mmdeep.Germinationinthe

groundisnotrecommendedbecauseconditionsarenotaseasilycontrolled.Useawell-drainedstandardpottingmix. Beforeplanting theseeds, makesurethepottingmix isdamp.

Because Cape gooseberry seeds are so small, watering overly dry soil can cause them todislodgefromtheirpositionandsinkdeepintosoilcracks.Seedsthatsinkdeeplyintosoilwillnotbe able to reach the soil surfaceoncegerminated.

Plant seeds in the soil 1/4 inch deep. Cover with soil and carefully water. Overwatering canpromote fungal growth, which causes seed rot. Excess water can also bury seeds deep in thesoil, preventing them from breaking the surface. When the soil surface begins to dry, applywater. Multiple seeds can be planted in a single starter container, but once seedlings appear,theyshouldbethinned out so that only oneplant remains.

Thesoilshouldbekeptconsistentlywarm,between75^{0}and85^{0}Fahrenheit.Coolsoils,evenifonly at night, will significantly delay or inhibit germination. Germination is also inhibited byhotsoilsabove95degreesFahrenheit.Onceafewtrueleaveshaveformed,theseedlingshouldbe gradually moved outside into natural light. Because seedlings should not be exposed todirect, scorching sunlight, plants may need to be hardened off through show sun exposure.Hardeningoffcanbeaccomplishedbyusingalocationwithshadedorfilteredlight,aswella sprotection from strong winds, rain, or low humidity. The time required for hardening varies,butit can take5-10 days.

TheCapegooseberryismoreacceptableinmarginallandsasamonocroporinmixedcroppingwith other fruit trees due to its wide adaptability to varying soil conditions without much care(Morton,1987).

While most of the regions' available normal soils are under cultivation of major crops, someminorcrops,suchasCapegooseberry,arecriticalfortheircultivationinmarginallandsduetohor izontal increases in fruit production, as well as their inclusion in crop diversification forsustainable agriculture. Aside from the crop's genetic potential, the growing environment (i.e.soilconditions,culturalpractices)369hasasignificantimpactonplantgrowthandyield.Oneofth emostseriousissuesissoilsalinity,whichaffectsroughlyone-thirdoftheworld'sirrigatedland (Mengel et al., 2001). Its global spread is increasing on a regular basis (Schwabe et al.,2006),makingitaveryseriousproblemforcropproduction,withnegativeeffectsongermination,p lantvigour,andcropyield(MunnsandTester,2008).InIndia,salt-affectedsoilscoverapproximately 6.73 million ha(SharmaandGupta, 2010).

One of the considerations for successful crop cultivation under soil salinity conditions is cropselection.Morton(1987)claimsthatcapegooseberryisfairlyadaptabletoawiderangeofsoilcon ditions. According to Miranda et al. (2010), cape gooseberry is commonly grown inColumbia's salt-affected soils. In terms of solanacious vegetables, which are closely related tocape gooseberry, these crops respond well to applied fertilisers in terms of yield and quality.Furthermore, plant spacing or plant population per unit area may play an important role

inoptimumplantgrowthandfruityield.Oneoftheconsiderationsforsuccessfulcropcultivationunde r soil salinity conditions is crop selection. Morton (1987) claims that Cape gooseberry isfairly adaptable to a wide range of soil conditions. According to Miranda et al. (2010), Capegooseberry is commonly grown in Columbia's salt-affected soils. In terms of solanaciousvegetables, which are closely related to Cape gooseberry, these crops respond well to appliedfertilisersintermsofyieldandquality.Furthermore,plantspacingorplantpopulationperunit

areamay play an important rolein optimum plantgrowth andfruit yield.

MaterialandMethods

Thepresentinvestigationentitled"InfluencesofdifferentsowingdateswithapplicationofGA3ongermination andgrowthof Cape Gooseberry(*Physalisperuviana*)insubtropicalconditionPrayagrajwasdonetorecordtheoptimumnurserypreparationtime,germinationparT3:5September2022withseedtreatmentfromGA3ammeters,vegetative growth parameter, Yield and Quality parameters of Cape gooseberry influenced bydifferent sowing dates with application of GA_3 and withoutGA_3 . The details of the materialsused and the procedures adopted in the investigation, which was carried out at HorticulturalResearchFarm(HRF),DepartmentofHorticulture,NainiAgriculturalInstitute,SamHigginbottom University of Agriculture, Technology and Sciences (SHUATS), PrayagrajduringtheRabi seasonof2022-23.

The experiment was laid out in Complete Randomized Design with three replications. Thetreatmentscomprisedof5datesofsowingcomprising10treatments,withseedtreatmentfromGA_3 @ 100 ppm and without seed treatment i.e. T_1 20 August 2022 with seed treatment fromGA_3 @ 100, T_2: 20 August 2022 without seed treatment, T_3: 5 September 2022 with seedtreatment from GA_3@100 ppm, T_4: 5 September 2022without seedtreatment, T_5: 20September 2022 with seed treatment from GA_3 @ 100 ppm, T_6: 20 September 2022 withoutseed treatment, T_7: 5 October 2022 with seed treatment from GA_3 @ 100 ppm, T_8: 5 October2022 without seed treatment, T_9: 20 November 2022 with seed treatment from GA_3 @ 100ppm, T_{10} : 20 October 2022 without seed treatment. Sowing media will be the mixture ofvermicompost, soil and cocopeat with the ration of 4:4:2 and it will be sterelize in autoclaveforkillingmicrobesandthenaftercoolingthemedia.Portrayswassterilizedwithethanol70 %forremoving fungal contamination.

Protrayshaving2X5cavitieswithdepthof85mm.Portrayswasfilledwithmedia.Tennumberofseedswassownineachportrayinthedepthof1-1.5cmanditwillbeimmediatelyirrigatedwiththehelpofrosecaneafterseedsowingandthenportrayswillkeptinshadedarea.Optimummoisturewillbemaintaineddduringtheperiodofseedgermination.Theseedsoffirsttreatmentwere sown first fortnight of August 2022. Then after whole treatment seeds were sown in eachfortnight intervals. When seedling attends height of 15-20 cm then it will be transplanted inmainfieldwithspacingof60x50cm.Observationswillberecordedlikegerminationparameters, vegetative growth parameters of seedling, yield and quality parameters of Capegooseberry.Theseallaboveobservationswillberecordedatnurserylevelandmainfieldlevel.

Table1Treatmentdetails.

Treatments	Sowingdate	Application
T_1	Second fortnight of August (20August)	WithGA_3(100ppm)
T_2	Second fortnight of August (20August)	WithoutGA_3
T_3	FirstfortnightofSeptember (5September)	WithGA_3(100ppm)
T_4	FirstfortnightofSeptember (5September)	WithoutGA_3
T_5	SecondfortnightofSeptember (20September)	WithGA_3(100ppm)
T_6	SecondfortnightofSeptember (20September)	WithoutGA_3
T_7	FirstfortnightofOctober (5October)	WithGA_3(100ppm)
T_8	FirstfortnightofOctober (5October)	WithoutGA_3
T_9	SecondfortnightofOctober (20October)	WithGA_3(100ppm)
T_{10}	SecondfortnightofOctober (20October)	WithoutGA_3

RESULTANDDISCUSSION:

Thepresentstudiesonthe**"InfluencesofdifferentsowingdateswithapplicationofGA$_3$ongermination,growth,yieldandqualityattributesofCapeGooseberry(P*hysalisPeruviana*)undersubtropicalconditionPrayagraj"**werecarriedoutatHorticultureResearch Farm, Department of Horticulture, Naini Agricultural Institute, Sam HigginbottomUniversityofAgriculture,Technology and Sciences-Prayagraj, during theyear 2022-2023.

Theresultsobtainedduringthecourseofstudyaresummarizedasunderfollowing.

Days taken to seed germination was recorded among all treatments lowest days taken to seedgermination was T_7 twelve days are taken to 93.33% germination rate followed by T_9 91.66%at12thday,

$T_8$90%seedsat12thdayseedsarewheregerminatedwhileinT_1,T_2,T_3,T_4,T_5,T_6,:80% :73.3%:60%: 58.33%:20%: 18.33%:seedsaregerminatedat 20 days.

Germinationpercentagewasrecordedamongalltreatmentsthehighestgerminationpercentagewas found in T_7 twelve days ~~are taken to~~at93.33% germination rate followed by T_9 91.66% at12thday,$T_8$90%seedsat12thdayseeds~~are~~wheregerminatedwhileinT_1,T_2,T_3,T_4,T_5,T_6,:80% :73.3%:60%: 58.33%:20%: 18.33%:seeds ~~are~~weregerminated at20 days.

Hypocotyls length was recorded among all treatments seeds which was treated with GA_3 @100 ppm for 12 hours showed bigger hypocotyle as per without treated seeds with GA_3. T_7showedhighest length 1.49 cm followed byT_1andT_8.

Appearance of cotyledonary leaves was recorded among all treatment lowest day taken

toappearanceofcotyledonaryleaveswasT_9:8days,followedbyT_{10}:8.08days,T_7:8.33days.

While highest days taken to appearance of cotyledonary leaves was T_6: 28.16 days followedbyT_5: 27.66 days.

Appearance of true leaves are recorded among all treatment the lowest day ~~are~~werefound in T_9 :10daysfollowedbyT_{10}:11days,T_7:10.58.Whilehigherdays~~are~~weretakenbyT_6:30.16followedby T_5: 29.66 days.

Appearance of plumule among all treatments the lowest days taken to appearance of plumulewasT_7:2.83daysfollowedbyT_8:3.25days,T_9:3.41days.Whilehighestdaystakentoplumule initiationwereinT_6: 16.66 days,T_4: 15.83 days.

Leaf area of among all treatments T_7: 30.11 showed highest leaf area followed by T_8: 28.25.Whilelowestleafwasrecorded inT_6: 2.59, followedbyT_5:3.1 cm^2.

NumberofleavesamongalltreatmentsT_7:6.83leaves~~are~~wereshowedhighestleavesfollowedby T_8:6leaveswhilelowestleaveswererecordedinT_6:2.1followedbyT_5:2.45leavesperplantwererecor ded.

LengthofseedlingamongalltreatmentsthehighestseedlinglengthwasobservedinT_7:22.28cmfollo wedbyT_8:19.79.WhilelowestlengthwasrecordedinT_6:2.72cmfollowedbyT_5: 3.17cmwereobserved.

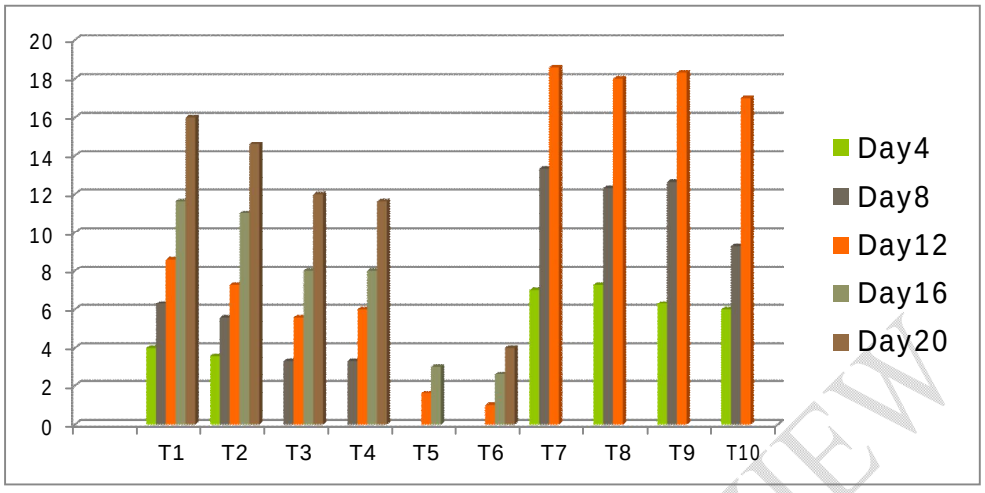
Diameterofseedling@30DASamongalltreatmentshighestdiameterwasrecordedinT_7:7.4followe d by T_8: 6.9 mm while lowest diameter was recorded in T_6: 2.08 mm followed by2.65mm.

Lengthofprimaryrootwasrecordedamongalltreatmentsthehighestprimaryrootlengthwasrecorde dInT_7:5.59cmfollowedbyT_9:4.45cm.WhilelowestlengthofseedlingwasrecordedinT_6: 2.25 followed byT_5:2.95.

Table2.0Daystakentogerminationandgerminationpercentage

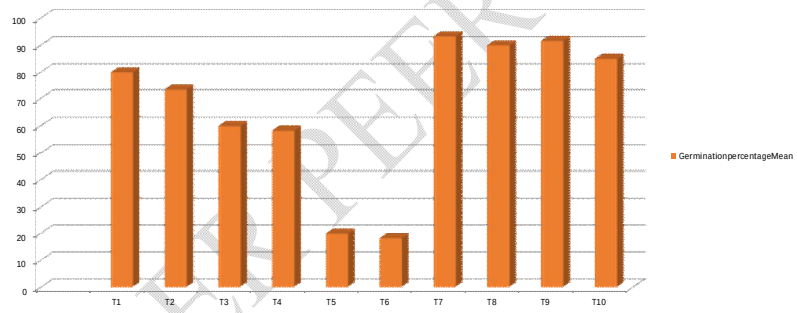
Tableno2Daystakentogerminationandgerminationpercentageinfluencedbydifferentsowingdates

Treatment	Day4	Day8	Day12	Day16	Day20	Day24	Day28	Total seed sown	% ofGermination
T1	4	6.3	8.6	11.6	16	-	-	20	80
T2	3.6	5.6	7.3	11	14.6	-	-	20	73.33333
T3	-	3.3	5.6	8	12	-	-	20	60
T4	-	3.3	6	8	11.6	-	-	20	58.33
T5	-	-	1.6	3		-	-	20	20
T6	-	-	1	2.6	4	-	-	20	18.33
T7	7	13.3	18.6	-	-	-	-	20	93.33
T8	7.3	12.3	18	-	-	-	-	20	90
T9	6.3	12.6	18.3	-	-	-	-	20	91.66
T10	6	9.3	17	-	-	-	-	20	85
F-test	s	s	s	s	s	-	-	-	S
SE(d)	0.89	0.91	0.69	0.61	1.1	-	-	-	1.02
C.V.	31.9	16.96	8.42	16.98	22.44	-	-	-	6.54
CDat5%level	1.87	1.93	1.46	1.29	2.32	-	-	-	2.09



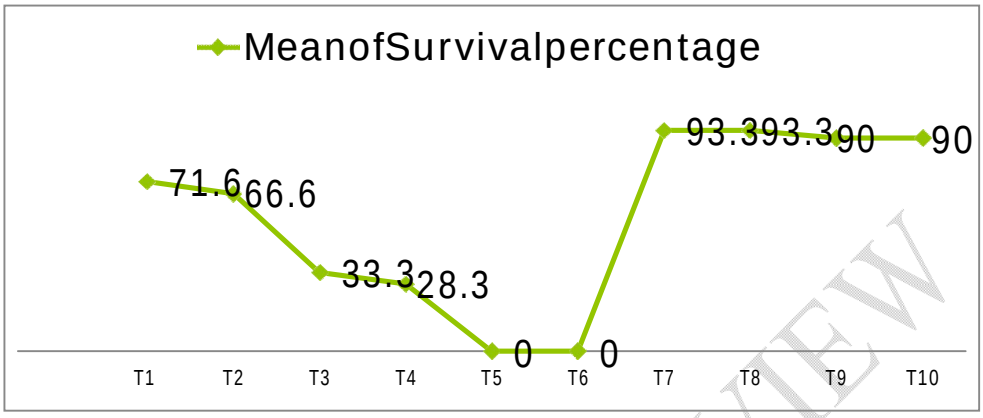
Graph 1
GraphicalrepresentationofDaystakentogermination

Graph 2 INFLUENCES OF DIFFERENT SOWING DATES WITH APPLICATION OF GA3 ONGERMINATIONOFCAPEGOOSEBERRY



GerminationPercentage

Graph 3 PerformanceofvegetativegrowthandsurvivabilityofCapegooseberryseedling.



Graphical representation of survivability percentage of cape gooseberry seedling at field.**CONCLUSION**

From the present investigation it is concluded that among 5 dates of sowing comprising 10treatments with seed treatment $GA_3$100 ppm and without seed treatment on the basis ofmeanperformanceofalltentreatmentscomprising5datesofsowingfrom 20Augustto20October. The highest rate of germination and lowest days taken to germination and alsovegetative growth and survivability in main field level was recorded from sowing date 5thOctober with seed treatment from GA_3 100 ppm. Sowing time first fortnight of October issuggested for nursery preparation for rapid germination and for good vegetative growthgoodvegetative growth.

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