Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5184

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 969-975 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Media and GA_3 on Seed Germination of Custard Apple (*Annona squamosa* L.) cv. Sindhan

M. S. Patel*, K. H. Nurbhanej, M. J. Rathod, S. V. Vyas and N. H. Bhutiya

Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

*Corresponding Author E-mail: maulik889@gmail.com

Received: 10.07.2017 | Revised: 21.07.2017 | Accepted: 22.07.2017

ABSTRACT

The present investigation entitled "Effect of media and GA_3 on seed germination of custard apple (Annona squamosa L.) cv. Sindhan" was conducted at Lalbaugh Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) during summer season of the year 2016. The treatments comprised of different growing media [M_1 - soil + cocopeat (1:1), M_2 - soil + cocopeat + sand (1:1:1), M_3 - soil + cocopeat + FYM (1:1:1), M_4 - soil + cocopeat + sand + FYM (1:1:1:1)] and different concentration of GA_3 (G_1 - GA_3 100 mg/l, G_2 - GA_3 150 mg/l, G_3 - GA_3 200 mg/l and G_4 – water soaked). The experiment was laid out in Completely Randomized Block Design Factorial concept comprising sixteen treatment combinations and replicated three times. Different growing media and concentration of GA_3 were significantly affected the seed germination parameters viz., days required for initiation of germination, seed germination (%), germination period (days), seed vigour (cm) and germination index of custard apple seeds but interaction effect of different growing media and different concentration of GA_3 on seed germination parameters were found non significant. The media consisting of soil + cocopeat + sand + FYM (1:1:1:1) had significant influence on different germination parameters like minimum days required to seed germination (20.25 days), maximum germination (80.62 %), minimum germination period (24.09 days), maximum seed vigour (2890 cm), maximum germination index (3.31) of custard apple seedling during the course of experimentation. The treatment of GA_3 200 mg/l had significant influence on different germination parameters like minimum days required for seed germination (20.25 days), highest germination (80.07 %), minimum germination period (23.63 days), highest seed vigour (2853 cm) and germination index (3.22) of custard apple seedling during course of experimentation.

***Key words*:** *Custard apple, Sindhan, Media, Gibberellic acid, cocopeat, seed vigour.*

Cite this article: Patel, M.S., Nurbhanej, K.H., Rathod, M.J., Vyas, S.V. and Bhutiya, N.H., Effect of Media and GA_3 on Seed Germination of Custard Apple (*Annona squamosa* L.) cv. Sindhan, *Int. J. Pure App. Biosci.* **5(4):** 969-975 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5184

INTRODUCTION

Annona squamosa L. (Custard apple) is a favourite table fruit of common man in Indian subcontinent. It belongs to family Annonaceae. The family Annonaceae belongs to sub-order Magnolineae, Myristicaceae and Lauraceae. The Annonaceae family includes approximately 50 genera. Three genera i.e. *Annona*, *Rollinia* and *Asimina* produce edible fruits[8]. Two generas are of commercial importance; Annona, comprising about 100 species and Rollinia, comprising about 50 species[7]. The main commercial species are *A. cherimoya* Mill, *A. squamosa L., A. muricata L., A. reticulata* and *A. glabra.* In India, the *Annona* genus seems dedicated to the Ramayana, the great Indian Epics. It is interesting to note that most of the Annona species were referred to the important personalities of Epic-Ramayana. For instance: Sitaphal (*A. squamosa* L.), Ramphal (*A. reticulata* L.), Lakshmanphal (*A. atemoya* L.) and Hanumanphal (*A. cherimoya* L.). Custard apple is native to Tropical America. It is widely distributed throughout the tropical region of Central America and West Indies. Custard apple is also known as Sharifa, ata, meoa, sitaphal and sugar apple.

It has adopted well in India where a considerable variability is found in Aravali hills and Southern India. In Andhra Pradesh, custard apple plants are found wild in Sangareddy and other areas. Custard apple plants can also be seen wild in Uttar Pradesh, Rajasthan, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Gujarat and Orissa. In Gujarat, it is cultivated in Junagadh and Bhavnagar district of Saurashtra region. The area under custard apple is also increasing in other districts like Ahmadabad, Sabarkantha, Patan, Gandhinagar and Anand.

Some common varieties of custard apple cultivated in Gujarat are Sindhan, Balanagar, Red Sitaphal and GJCA-1. "Sindhan" is a local variety found on large area in Girnar hills of Junagadh district in Gujarat state. Gujarat covering an area of 5081 hectares with the production of 51906 MT and productivity is 10.21 MT/ha during the year 2014-15[3].

Germination is the first stage or transitional stage of plant development; it corresponds to the passage of inert seed to seedling. Due to hard and thick seed coat, it requires about 35-40 days for germination. To get higher and proper germination, seed needs pre sowing treatments which helps in promotion of early and higher percentage of seed germination with healthy vigorous seedling. Seed germination is affected by many factors, which include type of substrate used, environmental factors such as oxygen, water, temperature and light[11].

Media is a substrate that provides the required elements and physical support to the growing plants. All soils use for media are not always perfect for the germination of seeds and subsequent growth of seedling. Media also have good water holding capacity, drainage and other physical and chemical properties. So it is desirable to provide such soil media or mixture, which fulfils the requirements for maximum seed germination and better seedling growth.

Use of suitable growing media is essential for quick growth and production of quality horticultural crops. A good growing media would provide proper anchorage or support to the plant, serves as a nutrient and water reservoir and permit gaseous exchange between roots and atmosphere. Cocopeat is considered as a good growing media component with acceptable pH, electrical conductivity and other chemical attributes[1]. Cocopeat has good physical properties, high water content, low shrinkage, low bulk density and slow biodegradation. The results of many experiments revealed that cocopeat used alone or as a component of soil medium is suitable for roses, gerbera, many potted plants and also for vegetables[6, 16].

The growth substance most commonly used for better germination and rooting for various plant parts are Auxin (IAA, IBA, NAA), Gibbrellic acid (GA_3), etc. Among these GA_3 has proved to be the best for proper germination and seedling growth as well as effectiveness varied according to species. A wide spread use of growth

regulators by nurserymen, florist and horticulturist indicates that the growth substance are valuable aid to germination of seed and seedling growth of the plants. These is a great role of various media as well as plant growth regulators particularly GA_3 for seed germination as well as survival seedlings. During seed germinations, the role of GA_3 in the induction of synthesis of α- amylase and other hydrolytic enzymes among monocots and certain dicots is well documented. GA_3 appears mainly to induce the activity of the gluconeogenic enzymes during early stages of seed germinations.

MATERIALS AND METHODS

The experiment was conducted at the Lalbaugh Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) during summer season of the year 2016. Junagadh is situated at 21.5°N latitude and 70.5°E longitude with an altitude of 60 meters above MSL on the western side at the foot hill of mountain Girnar sierra (Gujarat). Climate is typically subtropical, characterized by fairly cool and dry winter, hot and dry summer and warm and moderately humid monsoon. The rainy season commences by third week of June and ends in September. July and August are the months of heavy precipitation. Winter sets in the month of November and continues till the month of February. December and January are the coldest months of winter. Summer commence in the second fortnight of February and ends in the middle of June. April and May are the hottest months.

The treatments comprised of different four level of growing media [M_1 - soil + cocopeat (1:1), M_2 - soil + cocopeat + sand (1:1:1), M_3 - soil + cocopeat + FYM (1:1:1), M_4 - soil + cocopeat + sand + FYM (1:1:1:1)] and different concentration of GA_3 (G_1 - GA_3 100 mg/l, G_2 - GA_3 150 mg/l, G_3 - GA_3 200 mg/l and G_4 – water soaked). There were sixteen treatments combination embedded in a Completely Randomized Block Design (factorial) with three repetitions. The details of the treatments applied in the present investigation are as under:

Sr. No.	Treat. No.	Treat. Combination	Treatment details
1.	T: 1	M_1G_1	Soil + Cocopeat + (1:1) + GA_3 100 mg/l
2.	T: 2	M_1G_2	Soil + Cocopeat + (1:1) + GA_3 150 mg/l
3.	T: 3	M_1G_3	Soil + Cocopeat + (1:1) + GA_3 200 mg/l
4.	T: 4	M_1G_4	Soil + Cocopeat + (1:1) + Water soaked
5.	T: 5	M_2G_1	Soil + Cocopeat + Sand (1:1:1) + GA_3 100 mg/l
6.	T: 6	M_2G_2	Soil + Cocopeat + Sand (1:1:1) + GA_3 150 mg/l
7.	T: 7	M_2G_3	Soil + Cocopeat + Sand (1:1:1) + GA_3 200 mg/l
8.	T: 8	M_2G_4	Soil + Cocopeat + Sand (1:1:1) + Water soaked
9.	T: 9	M_3G_1	Soil + Cocopeat + FYM (1:1:1) + GA_3 100 mg/l
10.	T: 10	M_3G_2	Soil + Cocopeat + FYM (1:1:1) + GA_3 150 mg/l
11.	T: 11	M_3G_3	Soil + Cocopeat+ FYM (1:1:1) + GA_3 200 mg/l
12.	T: 12	M_3G_4	Soil + Cocopeat+ FYM (1:1:1) + Water soaked
13	T: 13	M_4G_1	Soil + Cocopeat + Sand + FYM (1:1:1:1:1) + GA_3 100 mg/l
14	T: 14	M_4G_2	Soil + Cocopeat + Sand + FYM (1:1:1:1:1) + GA_3 150 mg/l
15	T: 15	M_4G_3	Soil + Cocopeat + Sand + FYM (1:1:1:1:1) + GA_3 200 mg/l
16	T: 16	M_4G_4	Soil + Cocopeat + Sand + FYM (1:1:1:1:1) + Water soaked

Different growing media were prepared according to proportion of various soil, cocopeat, sand, farm yard manure (FYM) and filled in 15 X 20 cm black polythene bags. Whereas, Gibberellic acid solution of 100, 150 and 200 mg/l were separately prepared by dissolving 100, 150 and 200 mg GA_3. (GA_3 was completely dissolved by addition of small quantity of NaOH pellets) in 1 liter of distill water. Seeds were soaking with different concentration of GA_3 for 24 hours and after sown 1.0 cm deep in the 15 x 20 cm polythene bags filled with prepared media on 22nd April, 2016 at Lalbaugh Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). A light irrigation was given immediately after dibbling of seeds in the black polythene bags for proper establishment. Irrigations were given regularly at 7 to 8 days interval depending upon soil moisture status.

Five plants were selected at random from each treatment and tagged for recording the observations. Required observations were recorded from each repetition of different treatments and average value was calculated. The analysis of variance for experimental design was carried out for all the characters under study.

A. Seed germination parameters

a. Days taken for first germination

The days taken for germination were calculated from the date of sowing up to germination of custard apple seeds and average was calculated.

b. Seed germination (%)

Total number of germinated seeds under each treatment was counted daily, right from the first emergence of the seed up to the period of completion of seed germination. The per cent of seed germination was calculated by using following formula:

$$\text{Seed germination (\%)} = \frac{\text{Total no. of germinated seeds}}{\text{Total no. of seeds sown}} \times 100$$

c. Germination period (days)

Germination period was calculated as the difference between date on dibbling of seeds and final emergence date.

d. Seed vigour (cm)

The seedling vigour was calculated by formula i.e germination percentage multiply by seedling height at 60, 90 and 120 days after dibbling and average value was calculated.

e. Germination Index

Germination Index was calculated as described in the association of official seed analysis (1983) by the following formula:

$$\text{Germination Index} = \frac{\text{No. of germinating seeds}}{\text{Days of first count}} + \frac{\text{No. of germinating seeds}}{\text{Days of Final or last count}}$$

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed here in following heads:

Effect on seed germination parameters

The result of the present investigation (Table 1 and 2) revealed that the different growing media and concentrations of GA_3 were significantly affected the seed germination parameters *viz*., days required for initiation of germination, germination period (days), seed germination (%), seed vigour (cm) and germination index of custard apple seeds but interaction effect of different growing media and concentrations of GA_3 on seed germination parameters were found non significant.

Effect of media on seed germination parameters

Regarding different media under study, the medium consisting of soil + cocopeat + sand + FYM (1 : 1 : 1 :1) were recorded the significantly minimum days required to seed

germination (20.25), germination period (24.09 days), maximum seed germination (80.62 %), seed vigour (2890 cm) and germination index (3.31).

The increasing seed germination parameters might be due to beneficial effect of medium combination in improving physical, biological and chemical properties of media. Soil provides natural support to plant, cocopeat given warm condition, high water holding capacity and FYM as a source of organic manure provided better nutrition to the germinating seedlings[10]. The well decomposed FYM may preserve soil humidity, increase nutrient content and improve soil structure which increase water absorption and maintains the cell turgidity, cell elongation and increase respiration at optimum level, leading to favourable for seed sprouting. Organic matter may also improve nutrient availability and improve phosphorus absorption[12]. All these factors are favorable for seed germination and ultimate by increase seed germination per cent [5, 14, 17, 13, 2, 4, 20].

Effect of gibberellic acid on seed germination parameters

The results pertaining to seed germination parameters were also significantly influenced by varying GA_3 concentrations. The minimum days required for seed germination (20.25), germination period (23.63 days), maximum seed germination (80.07 %), seed vigour (2853 cm) and germination index (3.22).

The increasing seed germination parameters might be due to the involvement of GA_3 in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption. GA_3 acts as a directly on embryo relieving them from dormancy through promoting protein synthesis and elongation of coleoptiles and leaves and also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially amylase, which favours the seed germination[19]. GA_3 also stimulates seed germination by formation of a-amylase enzymes which converts insoluble starch into soluble sugars and it also initiates the radical growth by removing some metabolic blocks[9, 13, 2, 15, 18].

Table 1: Effect of different growing media and GA_3 levels on days to germination, germination period and germination (%) of custard apple cv. Sindhan

Treatment	Days to germination	Germination period (days)	Seed germination (%)
Media (M)			
M_1- Soil + Cocopeat(1 : 1)	23.50	27.96	75.86
M_2- Soil + Cocopeat + Sand (1 : 1 : 1)	22.33	25.10	77.38
M_3- Soil + Cocopeat + FYM (1 : 1 : 1)	21.50	25.30	78.84
M_4- Soil + Cocopeat + Sand + FYM (1 : 1 : 1 :1)	20.25	24.09	80.62
S. Em±	0.18	0.37	1.09
C.D. at 5%	0.53	1.06	3.13
Gibbrellic acid (G)			
G_1- GA_3 100 mg/l	21.42	24.84	78.76
G_2- GA_3 150 mg/l	20.75	24.72	79.80
G_3- GA_3 200 mg/l	20.25	23.63	80.07
G_4- Water soaked	25.17	29.26	74.07
S. Em±	0.18	0.37	1.09
C.D. at 5%	0.53	1.06	3.13
Interaction (M x G**)**			
C.D. at 5%	NS	NS	NS
C.V. %	2.93	4.99	4.82

Table 2: Effect of different growing media and GA_3 levels on seed vigour and germination index of custard apple cv. Sindhan

Treatment	Seed vigour (cm)	Germination index
Media (M)		
M_1- Soil + Cocopeat(1 : 1)	2355	2.21
M_2- Soil + Cocopeat + Sand (1 : 1 : 1)	2520	2.62
M_3- Soil + Cocopeat + FYM (1 : 1 : 1)	2675	2.89
M_4- Soil + Cocopeat + Sand + FYM (1 : 1 : 1 :1)	2890	3.31
S. Em±	34.40	0.05
C.D. at 5%	99.09	0.14
Gibbrellic acid (G)		
G_1- GA_3 100 mg/l	2649	2.88
G_2- GA_3 150 mg/l	2725	3.04
G_3- GA_3 200 mg/l	2853	3.22
G_4- Water soaked	2213	1.89
S. Em±	34.40	0.05
C.D. at 5%	99.09	0.14
Interaction (M x G**)**		
C.D. at 5%	NS	NS
C.V. %	4.57	6.17

CONCLUSION

In the light of the results obtained from this investigation, it can be concluded that individually use as soil + cocopeat + sand + FYM (1:1:1:1) and GA_3 200 mg/l were found superior for seed germination of custard apple seedling cv. Sindhan.

REFERENCES

1. Abad, M.; Noguera, P.; Maquieira, A. and Noguera, V. Physico-chemical properties of some coconut dusts for use as a peat substitute for containerized ornamental plants. *Bioresearch Technol*., **82:** 241-245 (2002).
2. Anjanawe, S. R.; Kanpure R. N.; Kachouli B. K. and Mandloi D. S. Effect of plant growth regulators and growth media on seed germination and growth vigour of papaya. *Annals of plant and soil research* **15(1):** 31-34 (2013).
3. Anonymous. Directorate of Horticulture, Database, Gandhinagar, Gujarat (2015).
4. Bhardwaj, R. L. Effect of growing media on seed germination and seedling growth of papaya cv. Red Lady. *Indian J. Agric. Res.*, **47(2):** 163-168 (2013).
5. Chopade, Neha; Patil, B. N.; Pagar P. C. and Gawande, Ram. Effect of different pot mixtures on germination and growth of custard apple (*Annona squamosa L.*), *Journals of Soils and Crops*, **9 (1):** 69-71 (1999).
6. De Kreij, C. and Leeuven, G. J. L. Growth of pot plants in treated coir dust as compared to peat. *Commune Soil Science Plant Analysis*, **32:** 2255-2265 (2001).
7. George, A. P. Custard apple. In: P. Page (Editor), Tropical Tree Fruits for Australia. Queensland Department of Primary Industries, Brisbane. pp: 35-41 (1985).
8. George, A. P. and Nissen, R. J. Annonaceous Fruits. In: R. K. Robinson and M. J. Sadler (editors), Encyclopaedia of Food Science, Food Technology and Nutrition. Academic press. London. pp: 195-199 (1993).
9. Gillard, D. F. and Walton, D. C. Germination of *Phaseolus vulgaris* IV.

Patterns of Protein Synthesis in Excised Axes. *Plant physiology* **51:** 1147-1149 (1973).

10. Hartmann, H. T. and Kester, E. Plant propagation principles and practices. *Prentice Hall of India Private Limited*, New Delhi- 110 001 (1997).
11. Hartmann, H. T.; Kester, D. E.; Davies, F. T. and Geneve, R. L. Plant propagation, principles and practices. 7th Edition Precise Hall Publishers, New Jersey (2001).
12. Karama, A. S. and Manwan, I. Penggunaan Puuk organic padatanamanpangan. Makalahpada Lokakarya National Efisiensi Pengunaan Pupuk. Cisarua Borog, 12-13 November 1990, pp.44 (1990).
13. Kumawat, R.; Maji, S.; Govind, S. and Meena, D. C. Studies on seed germination and seedling growth of papaya (*Carica papaya L.)* cv. Coorg Honey Dew as influenced by media and chemicals. *J. Crop and Weed.* **10 (2):** 281-286 (2013).
14. Parmar, V. J.; Sitapara, H. H. and Patel, J. S. Effect of growing media, structures and sowing dates on seed germination and seedling growth of custard apple cv. Balanagar. *The Asian J. Hort. Res*. **10(2):** 282-285 (2015).
15. Patil, S. R.; Sonkamble, A. M. and Khobragade, H. M. Influence of some growth regulators on germination and growth of rangpur lime (*Citrus limonica* O.) seeds under shade net conditions. *Green Farming*. **3 (6):** 690-693 (2012).
16. Pickering, J. S. An alternative to peat. *The Garden*, **122**: 428429 (1997).
17. Prasanna, J. S. and Ray, N. R. Effect of mixture of growing media on germination and seedlings growth of different mango (*Mangifera indica* L.) cultivars under net house condition. *The Asian J. Hort. Res*. **7 (2):** 409-411 (2013).
18. Rajamanickam, C.; Anbu, S. and Balakrishnan, K. Effect of chemicals and growth regulators on seed germination in aonla (*Emblica officinalis* G.). *South Indian Hort*., **50 (1-3):** 211-214 (2002).
19. Stewart, E. R. and Freebairn, H. T. Ethylene, seed germination and epinasty. *Plant Physio*.,**44:** 955-958 (1969).
20. Yadav, R. K.; Jain, M. C. and Jhakar, R. P. Effect of media on growth and development of acid lime (*Citrus aurantifolia* Swingle) seedling with or without Azotobacter. *African Journal of Agricultural Research*, **7(48):** 6421-6424 (2012).