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Effect of Chemical Treatments on the Germination and Subsequent Seedlings Growth of Papaya *(Carica papaya* L .*)* Seeds cv. Pusa Nanha

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Abstract—*Papaya (Carica papaya L.) is a medium sized fruit crop with a potential to produce fruits throughout the year. Due to its nature as a single stemmed tree it can be economically produced in any size of land from kitchen gardens to large plantations. Unreliable methods of picking the required sex of seedlings at planting, lack of disease- free planting materials, lack of improved varieties and devasting diseases at nurseries are difficult to contol. The goal of this research is to study the effect of chemical treatments on seed germination of papaya which will address some current production constraints especially production of disease-free papaya seedlings through subsequent testing their growth in different growing media relating to different growth regulators (GA_3).The results revealed that among the various seed treatment chemicals minimum days taken for seed germination(12.33days), maximum germination percentage (88.89%), germination index(2.90) and highest cost benefit ratio(2.57) were recorded in seeds treated with GA_3 300 ppm for 24 hrs whereas maximum root length(15.30cm) and root dry weight(0.32g) were recorded in seeds treated with GA_3 200 ppm for 24 hrs.*

Keywords*: Papaya, growing media, GA_3*

1. INTRODUCTION

Papaya (*Carica papaya* Linn.) is an important fruit crop of tropical world and has long been known as wonder fruits of the tropics. It gives higher production of fruits per hectare and income next to banana. It belongs to the family Caricaceae and is native of Tropical America (Hofmeyr, 1945). It was introduced into India in the 16th century. It is grown in almost all tropical and subtropical countries of the world and occupies a unique place amongst the fruit crops grown in India. In India it is grown in an area of 132.2 million ha with an annual production of 5381.7 MT/ha and productivity 40.7 MT/ha. In Andhra Pradesh the area is 20.65 million ha with an annual production of 1651.96 MT and productivity 80.0 MT/ ha. (NHB, 2012-13).

Propagation of papaya is only through seeds as a viable option. The germination of papaya seeds is slow, erratic and incomplete (Chacko and Singh, 1966). The seed is enclosed within a gelatinous sarcotesta (aril or outer seed coat which is formed from the outer integument).Whilst this sarcotesta is reported to prevent germination (Yahiro, 1979). The slow and asynchronous germination is attributed due to the presence of inhibitors (mainly phenolic compounds) in the sarcotesta and seed coat (chow and lin, 1991 and Reyes *et al*. 1980). In addition to inhibitor substances about 20% of papaya seeds are embryoless (Nagao and Furutani, 1986). Dormancy is also observed in seeds from which sarcotesta has been removed Therefore, freshly extracted seeds are normally cleaned to remove the sarcotesta and washed in running tap water and pre-soaked in various plant growth regulators to enhance the germination percentage and seedling vigour (Chia, 1990). In view of several treatments in improving the seed germination this study was taken up to know the role of different chemicals on seed germination and subsequent seedling vigour.

2. MATERIALS AND METHODS

An experiment was conducted at Horticultural college and Research Institute, Dr.Y.S.R Horticulture university, Ananthrajupet, Y.S.R. district of Andhra Pradesh (India) during the year 2013-2014 in a Randomized block design with three replications. Local Pusa Nanha dwarf variety were treated with chemicals and raised in 15x6 cm size polythene bag. A total of 1000 seedlings were used for this experiment. Observations were recorded at 60 days after sowing. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme(1985) and the treatment means were compared by critical difference values computed at 5% level of significance.

3. RESULTS AND DISCUSSION

3.1. Number of days taken for germination

The differences in number of days taken for germination were found to be significant (table 1). Among the various chemical treatments, the minimum days taken for germination (12.33 days) was recorded in GA_3 300 ppm for 24 hrs and maximum number of days taken for germination (30.33 days) was

recorded under control. The papaya seeds treated with GA_3 prior to sowing gave an early seed germination. This might be due to the fact that, GA_3 plays an important role in two stages of germination one at initial enzyme induction and other in activation of reserve food mobilizing system which help in enhancement of germination (Jha *et al*. 1997). The above results are conformity with Barche *et al.* (2010), Anburani and Shakila (2010) and Dhinesh Babu *et al.* (2010) in papaya.

Table 1: Effect of different seed treatment chemicals on number of days taken for germination, germination percentage, germination index, root length, root dry weight and benefit cost ratio.

Treatments	No. of days taken for germination	Germination percentage	Germination Index	Root length(cm)	Root dry weight (g)	Benefit: cost ratio
T_1 Tap water for 12 hrs	26.67	53.33	1.15	10.62	0.14	1.15
T_2 Tap water for 24 hrs	25.33	57.77	1.18	11.25	0.16	1.18
T_3 GA_3 100 ppm for 12 hrs	19.00	68.89	1.14	13.92	0.21	1.38
T_4 GA_3 100 ppm for 24 hrs	17.00	66.66	1.56	14.44	0.23	1.45
T_5 GA_3 200 ppm for 12 hrs	16.00	76.66	1.95	15.14	0.30	1.46
T_6 GA_3 200 ppm for 24 hrs	15.67	74.44	1.92	15.30	0.32	1.81
T_7 GA_3 300 ppm for 12 hrs	14.00	80.00	1.54	14.56	0.25	2.22
T_8 GA_3 300 ppm for 24 hrs	12.33	88.89	2.90	15.09	0.28	2.58
T_9 KNO_3 1000 ppm for 12 hrs	22.33	58.89	1.37	10.43	0.12	1.44
T_{10} KNO_3 1000 ppm for 24 hrs	21.33	63.33	1.42	10.09	0.11	1.47
T_{11} KNO_3 2000 ppm for 12 hrs	22.33	66.66	1.45	10.55	0.13	1.48
T_{12} KNO_3 2000 ppm for 24 hrs	20.00	66.66	1.59	11.65	0.17	1.74
T_{13} KNO_3 3000 ppm for 12 hrs	19.67	68.89	1.45	12.70	0.18	1.76
T_{14} KNO_3 3000 ppm for 24 hrs	15.33	72.22	1.74	12.83	0.19	1.79
T_{15} Thiourea 2000 ppm for 12 hrs	20.67	68.89	1.83	10.59	0.13	1.52
T_{16} Thiourea 2000 ppm for 24 hrs	20.33	73.33	1.93	10.62	0.14	1.55
T_{17} Thiourea 3000 ppm for 12 hrs	25.00	66.66	1.41	13.87	0.22	1.83
T_{18} Thiourea 3000 ppm for 24 hrs	23.00	76.66	1.77	14.13	0.21	1.86
T_{19} Thiourea 4000 ppm for 12 hrs	27.00	71.11	1.43	14.38	0.24	2.16
T_{20} Thiourea 4000 ppm for 24 hrs	26.00	85.55	1.88	14.99	0.26	2.20
T_{21} Control	30.33	48.89	0.79	9.73	0.10	1.13
SEm±	**0.609**	**1.585**	**0.189**	**0.167**	**0.015**	
CD (P=0.05)	**1.748**	**4.546**	**0.543**	**0.480**	**0.043**	

3.2. Germination Percentage

The seed treatments significantly influenced the germination of papaya seeds (Table 1). Among the treatments maximum germination percentage (88.89%) was recorded in GA_3 300 ppm for 24 hrs and the minimum germination percentage was recorded in control (48.89%). Maximum germination percentage was recorded when seeds soaked in GA_3 might be due to the fact that GA_3 involved in the activation of cytological enzymes which stimulates α – amylase enzyme that converts insoluble starch into soluble sugars and it also initiates the radical growth by removing some metabolic blocks (Babu *et al*.2010). GA_3 also plays an important role in leaching out of the inhibitors which in turn helps in breaking the seed dormancy. Thiourea 4000 ppm for 24 hrs was found

to be the next best seed treatment in increasing germination percentage, this might be due to its deactivating capacity of certain inihibitors present in the seed. The results are conformity with the findings reported by veeraragavathatham *et al.* (1980), Pandit *et al*. (2001), Anburani and Shakila (2010), Deb *et al.* (2010) and Barche *et al*. (2010) in papaya.

3.3. Germination Index

The seed germination index was found to vary significantly among different seed treatment chemicals (table 1). The highest seed germination index was noticed in GA_3 300 ppm for 24 hrs (2.90) and the lowest germination index was recorded in control (0.79). The maximum germination index with GA_3 might be due to its influence in early germination and increased percent germination. The results are in conformity with findings of Rajamanickam and Anbu (2001) in aonla.

3.4. Root Length

There were significant differences among the seed treatments (table 1). The maximum root length was noticed in GA3 200 ppm for 24 hrs (15.30 cm) and minimum root length was recorded in control (9.73cm).The maximum root length was recorded under the GA3 treatment might be due to reason that shoot growth result in production of photosynthatates which is translocated through phloem to the root zone might be responsible for increase in root length. Similar results are obtained in accordance with the results of earlier worker Ramamoorthy (1987), Ananthakalaiselvi and Dharmalingam (1998) and Anburani and Shakila (2010) in papaya. Wittwer and Bukovac (1958) have also reported that GA at lower concentration initiate the growth of the roots whereas higher concentration has little effect on root growth.

3.5. Root Dry Weight

The differences in root dry weight were found to be significant (table 1). The highest root dry weight was noticed in GA_3 200 ppm for 24 hrs (0.32g) and minimum root dry weight was recorded in control (0.11g). The maximum root dry weight was associated in seedlings treated with GA_3 prior to sowing, which might be due to the increase in root length and more translocation of carbohydrates to roots increases the root dry weight. The above results are in conformity with Veeraragavathatham *et al*. (1980) in papaya.

3.6. Benefit cost ratio

The highest benefit cost ratio (table 2) was recorded when seeds treated with GA_3 300 ppm for 24 hrs (2.57) whereas, least benefit cost ratio was observed in control (1.12).

4. CONCLUSION

The seeds treated with GA_3 300 ppm for 24 hrs was found superior with early seed germination, maximum germination percentage, germination index and benefit cost ratio at 60 days after sowing. The root length and root dry weight of the seedlings were recorded in GA_3 200 ppm for 24 hrs.

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