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Efficacy of GA_3 on seed germination and seedling vigour of wood apple

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Abstract

Wood apple is an underutilised indigenous fruit tree and belongs to Rutaceae family. It is slow growing tree. Owing to its slow growth in nursery, seedlings attain graftable stage in longer duration. Therefore, an attempt was made to find out the effect of GA_3 on germination and seedling vigour at nursery of Central Horticultural Experiment Station (ICAR-CIAH), Vejalpur during June to November, 2016-17. Seeds were treated with various concentrations of GA_3 (0, 25, 50, 75, 100, 125, 150,175, 200, 225, 250 and 275mgL^{-1}) which were soaked for 48 hours under laboratory condition. Experiment was laid out in Complete Randomized Design (C.R.D) and which was replicated thrice. A total of 50 seeds were treated with GA_3 in each concentration. Results of study revealed that the different levels of GA_3 enhanced the germination and quick growth of seedling than control. Among the different concentrations of GA_3, 150 mgL^{-1} GA_3 exhibited better response in seed germination *i.e.*, 11.86, 28.54, 34.75, 10.34, 6.52 and 0.00 % at 5th, 7th, 9th, 11th 13th and 15th days after sowing, respectively. The seeds treated with 150mgL^{-1} GA_3 showed the highest germination (91.98%) among different treatments. The maximum seedling shoot length (23.94 cm), root length (24.53 cm), seedling diameter (5.21 mm), number of leaves/seedling (21.23), primary branches/seedling (4.52) and vigour index (4458.27) were recorded with $GA_3$150 mgL^{-1} after six month of sowing. Based on the observations, it may be inferred from the study that the $GA_3$150mgL^{-1} is found more effective to improve the seed germination and vegetative growth of seedling in nursery, whereas GA_3 concentration more than 150mgL^{-1} declined the seed germination but the vigour of seedling is not affected by higher concentration of GA_3 after germination.

Key words: *GA_3, Germination, Seedling Vigour Index, Wood Apple*

Introduction

The wood apple (*Feronia limonia* L.) is belongs to family Rutaceae. Wood apple has the common names like as elephant apple, monky fruit, curd fruit and kaith bel (Singh *et al.*, 2016). The original home of wood apple is south India and Srilanka (Lande *et al.*, 2010). It is subtropical fruit species which prefers dry climatic condition during flowering and fruit setting. It has very deep and penetrating root system, which makes it highly drought tolerant (Vaidayaratnam *et al.*, 1995). Generally wood apple requires 8-17 days for seed germination in normal condition (Hiwale, 2015). So far, little work has been carried out on this aspect in wood apple particularly under dry land condition. Therefore, seed treatment of wood apple with GA_3 is required to improve germination and seedling vigour and such seedlings could be attained graftable stage in short duration. Therefore, this study was conducted to find out the effect of GA_3 on seed germination and seedling growth of custard apple under hot semi arid condition.

Material and Methods

The present study was carried out at nursery unit of Central Horticultural Experiment Station (ICAR-CIAH), Vejalpur, Panchmahals during 2016-2017. The experiment was laid out in Complete Randomized Design (C.R.D) with three replications. There were twelve treatments like T_1: seed soaking in tap water for 48 hours (control), T_2: seed soaking in GA3 25 ppm for 48 hr, T_3: seed soaking in GA3 50 ppm 72 hr, T_4: seed soaking in 75 ppm GA_3 for 48 hr, T_5: seed soaking in 100 ppm GA_3 for 48 hr, T_6: seed soaking in 125 ppm GA_3 for 48 hr, T_7: seed soaking in 150 ppm GA_3 for 48 hr, T_8: seed soaking in 175 ppm GA_3 for 48 hr, T_9: seed soaking in 200 ppm GA_3 for 48 hr, T_{10}: seed soaking in 225 ppm GA_3 for 48 hr, T_{11}: seed soaking in 250 ppm GA_3 for 48 hr and T_{12}: seed soaking in 275 ppm GA_3 for 48 hr. The seeds of wood apple were collected from fully mature fruits of wood apple. Fully soaked seeds were selected and sown in 15th June 2017 at uniform distance in polythene bags. The size of polythene bag is 45 x 15cm and each polythene bag consists of 10 seed. Every polythene bag was filled with a composite media, which consists of soil, FYM and sand in ratio of 1:1:1. The percentages of germination of seeds were calculated according to the rules for seed testing (ISTA, 1996). The seedlings were allowed to grow for six months (June to November, 2017). After six months, 10 seedlings for each treatment were selected for measuring growth parameters: shoot and root length, seedling diameter and number of leaf. The data on germination and seedling growth under various treatments were statistically analyzed. Vigour index was calculated

according to Abdul-baki and Anderson (1973) as germination per cent × seedling total length (total shoot + root length). The data was analyzed by statistical significant at $p<0.05$ level. S.E. and C.D. at 5 per cent level by the procedure given by Gomez and Gomez (1984).

Result and discussion

The germination percentage of Wood apple seed treated with GA_3 are summarized in Table & fig (1), the differences between treatments and control were significant 5, 7, 9, 11, 13 and 15th day after sowing. Results showed that treatment of seeds with GA_3 had markedly improved germination from 51.20 to 91.98% when compare out with control 61.24%. It is clear from the Table1 that seeds treated with 150ppm GA_3, the germination percentage at 5, 7, 9, 11, 13 and 15th day after sowing was recorded as 11.86, 28.54, 34.75, 10.34, 6.52 and 0.0% respectfully, while in control it was 10.42, 18.42, 16.40, 6.52, 5.00 and 4.48 (Fig.1). The maximum and early germination percentage for wood apple seed was found in GA_3 treated seed, It may be due to GA_3 hormone increase cell size of embryo by stimulating the cell wall to release and transmit its calcium in the cytoplasm which makes favourable condition for absorption of water and cell growth and activation of hydrolytic enzyme (Taiz & Zeieger, 2002). The highest germination per cent was noted in T_7 (91.98%) followed by T_2 (72.72%), T_3 (66.10%) and T_{10} (62.42%) while lowest (61.24%) was observed in T_1 (control) at 15 days after sowing (DAS) of seeds. In Table (1) results are shown the positive effects of GA_3 150ppm treatment on shoot and root length, seedling diameter, no. of leaf/ young seedling, primary branches/seedling and vigour index of seedling, it was 23.94cm, 24.53cm, 5.21mm, 21.23, 4.52 and 4458.27, respectively. Wood apple seeds treated with 150 ppm GA_3, enhance early and quickly germination which accelerate the difference in seedling growth, it may be due to growth promotional effect of GA_3; it stimulates and accelerates cell division, increased cell elongation and enlargement or both (Hartmann *et al.*, 1990). Early germination caused by gibberellic acid which provided enough time to the plant for proper growth and development. These finding more or less similar with finding of Vanangamudi and Vanangamudi (2003) in tamarind and Swamy *et al.* (1999) noticed highest germination per cent, shoot length and root length when jamun seeds. In this study, we increase period of soaking seed because long time soaked seed gave higher germination due to maximum removal of germination inhibitor (Dzayi, 2010).

From the foregoing discussion it can be concluded that among the different treatment, T_7 (seed soaking in 150 ppm GA_3 for 48 hours) is found superior and most effective for seed germination as well as better growth of wood apple seedlings over the rest of the treatment combinations.

Table 1. Efficacy of GA_3 on seed germination and seedling vigour of wood apple (*Feronia limonia* L.)

Treatments	Total germination (%)	Seedling Shoot length (cm)	Seedling Root length (cm)	Seedling diameter (mm)	Number of leaf/seedling	Primary branches/seedling	Vigour index
T_1: Control	61.24	10.52	11.23	3.41	10.26	3.21	1331.97
T_2: GA_3 25 ppm	72.72	15.23	14.26	4.10	16.18	3.54	2144.51
T_3: GA_3 50 ppm	66.10	16.58	15.23	4.23	17.23	3.48	2102.64
T_4: GA_3 75 ppm	54.38	16.43	17.20	4.42	15.23	3.75	1828.8
T_5: GA_3 100 ppm	57.80	19.63	17.36	4.47	18.10	3.82	2138.02
T_6: GA_3 125 ppm	51.20	19.78	18.23	4.40	17.75	3.92	1946.11
T_7: GA_3 150 ppm	91.98	23.94	24.53	5.21	21.23	4.52	4458.27
T_8: GA_3 175 ppm	60.74	18.34	20.63	5.10	20.24	3.96	2367.04
T_9: GA_3 200 ppm	52.72	17.24	18.65	4.83	19.46	3.37	1892.12
T_{10}: GA_3 225 ppm	62.42	18.23	18.10	5.12	20.23	3.27	2267.72
T_{11}: GA_3 250 ppm	55.92	17.83	17.67	4.73	18.23	2.87	1985.16
T_{12}: GA_3 275 ppm	41.50	16.85	17.21	4.63	17.56	2.92	1413.49
C.D. (P=0.05)	4.32	1.52	1.21	0.35	1.87	0.27	202.65

Fig.1: Effect of GA_3 on seed germination (%) of wood apple (*Feronia limonia* L.)

Fig. 2: Annual weather data of CHES in 2016-17

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