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Effect of Seed Priming on Seed Germination and Growth of Kainth

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Abstract

The experiment was conducted at Horticulture Experimental Area, Nursery, P.G. Department of Agriculture, Khalsa College, Amritsar during 2021-2022 to study the germination and growth parameters of Kainth. The experiment was laid out in Randomized Block Design replicated thrice, comprising ten treatments conc. H_2SO_4 for 5 and 10 minutes, KNO_3 (1 % and 2 %) for 24 hours, Kinetin (0.50 ppm and 0.75 ppm) for 24 hours, GA_3 (500 ppm, 1000 ppm and 1500 ppm) for 24 hours and control (untreated seeds). The results of the present study revealed that the Kainth seeds primed with GA_3 @ 1500 ppm for 24 hours has recorded the minimum days required for initiation of germination (23.66 days), 50 per cent and complete germination (27.66 days and 34.66 days respectively) and maximum germination per cent (42.33 % and 64.33 %) was also recorded with seeds primed with GA_3 @1500 ppm at 30 and 60 DAS respectively, which were statistically at par with the seeds treated with GA_3 @ 1000 ppm for 24 hours. GA_3 @ 1500 ppm treatment has also proved to be superior in the production of vigorous plant height (17.56 cm) with maximum number of shoots (14.00), stem diameter (4.27 mm), leaf number (45.00) and leaf area (39.90 mm^2) at 30, 60, 90, 120 and 150 DAS.

Keywords: Kainth; Seed Germination; Seed priming; Dormancy; Growth; Gibberellic acid

Introduction

Kainth (*Pyrus pashia* Buck and Ham) is the most widely used rootstock for pears in India, though Shiara (*Pyrus pyrifolia*) and pear root suckers are also used in some areas (Meitei, 1998). Among the rootstocks used for propagating pear cultivars in Northern India, Kainth (*Pyrus pashia* Ham.) has been approved superior for being precocious, free of root suckering, adaptable to variable soil and climatic conditions, higher yield with fruit quality (Sandhu et al., 1995). Kainth has also been reported to be resistant to blight, wooly aphid and drought. It is cheaper and highly nutritious underutilized fruit of sub-tropical region and possesses great therapeutic and medicinal value. With the move towards intensive production systems, desirable rootstocks are those that restrict tree vigour and are precocious and high yielding (Bound, 2021). Rootstocks have a significant impact on the nutrient uptake, growth, longevity, precocity, productivity and fruit quality of cultivars grafted on them (Meitei, 1998).

The Kainth stock is either propagated through seed (seedling) or hardwood cuttings or stooling (clonal) (Sandhu et al., 1995). Seeds of stone fruits do not germinate immediately after harvest and a period of after ripening is essential for certain chemical and other changes to take place in the seed and for dormant embryo to grow (Shah et al., 2013). It has been hypothesised that many fruit species seed coats or testa, contain significant amounts of germination inhibitors such benzoic acid, cinnamic acid, courmarin, naringenin, jasmonate and abscisic acid (ABA) which stop seeds from germinating. To meet the increasing demand for planting material (grafts), nurserymen must produce more rootstocks with graftable sizes in a shorter period of time (Pooja and Honnabyraiah, 2022).

The results of numerous research have demonstrated that applying pre-sowing treatments will enhance seed germination and subsequent seedling growth in a wide range of fruit species (Tania et al., 2020). Therefore, this study was undertaken to keep in mind, halopriming and hormonal priming techniques utilization to examine seed priming for improving seed germination and growth of Kainth seeds.

Material and Methods

The experiment was conducted in the Horticultural Experimental Area, Nursery, P.G. Department of Agriculture, Khalsa College, Amritsar during the year 2021-2022. The seeds required for the experiment were extracted from the healthy disease-free ripened fruits of Kainth. The experiment was laid out in Randomized Block Design replicated thrice, comprising ten treatments conc. H_2SO_4 for 5 and 10 minutes, KNO_3 (1 % and 2 %) for 24 hours, Kinetin (0.50 ppm and 0.75 ppm) for 24 hours, GA_3 (500 ppm, 1000 ppm and 1500 ppm) for 24 hours and control (untreated seeds).

Treated seeds were sown in polybags of 7 × 7 inches size and then light irrigation was done. The observations on days taken to initiation of germination, days taken to 50 per cent and complete germination and germination per cent at 30 and 60 DAS were recorded daily. The data pertaining to plant height (cm), shoot number, stem diameter (mm), leaf number and leaf area (mm^2) was recorded at 30, 60, 90, 120 and 150 DAS.

Result and Discussion

Days taken to initiation of germination

The seed priming had marked influence on seeds germination. Among all the treatments, the seeds treated with GA_3 @ 1500 ppm for 24 hours has recorded minimum number of days taken for initiation of germination which were statistically at par with seeds treated with GA_3 @ 1000 ppm for 24 hours. Whereas, the maximum number of days taken to initiate germination were observed in control (35.66 days). Early germination could be attributed to the fact that GA_3 plays an important role in two stages of germination, one during initial enzyme induction and the other during activation of the reserve food mobilising system, both of which aid in germination enhancement (Jha et al., 1997). The result is in agreement with the findings of Suryakanth et al. (2005) in guava, Rana et al. (2020) and Pareb et al. (2017) in papaya cv. Solo.

Table 1. Germination parameters

Treatments	Days taken to initiation of germination	Days taken to 50 per cent germination	Days taken to complete germination	Germination per cent at 30 DAS	Germination per cent at 60 DAS
H_2SO_4 (Conc. 5 min)	28.33 ± 0.98^{b}	35.00 ± 0.47^{cd}	41.66 ± 0.72^{de}	29.33 ± 0.72^{c}	43.00 ± 0.47^{cd}
H_2SO_4 (Conc. 10 min)	29.00 ± 0.47^{b}	36.00 ± 0.94^{bcd}	42.33 ± 0.72^{de}	28.66 ± 0.72^{c}	41.00 ± 0.47^{de}
KNO_3 (1 %)	28.00 ± 0.94^{bc}	35.33 ± 0.72^{cd}	43.66 ± 0.72^{cd}	30.00 ± 0.47^{c}	43.00 ± 0.47^{cd}
KNO_3 (2 %)	26.00 ± 0.47^{cd}	33.66 ± 0.72^{de}	41.00 ± 0.94^{ef}	34.33 ± 0.72^{b}	45.00 ± 0.47^{c}
Kinetin (0.50 ppm)	27.66 ± 1.18^{bc}	37.33 ± 0.72^{bc}	45.00 ± 0.47^{bc}	25.33 ± 0.72^{d}	55.00 ± 0.94^{b}
Kinetin (0.75 ppm)	27.00 ± 0.94^{bcd}	32.00 ± 0.94^{ef}	39.33 ± 0.72^{f}	27.66 ± 0.72^{cd}	57.33 ± 0.98^{b}
GA_3 (500 ppm)	28.66 ± 0.72^{b}	38.33 ± 0.72^{b}	46.66 ± 0.72^{b}	22.33 ± 0.72^{e}	39.33 ± 0.98^{e}
GA_3 (1000 ppm)	25.33 ± 0.72^{de}	30.33 ± 0.72^{fg}	35.66 ± 0.72^{g}	40.00 ± 0.72^{a}	63.00 ± 0.94^{a}
GA_3 (1500 ppm)	23.66 ± 0.72^{e}	27.66 ± 0.72^{g}	34.66 ± 0.72^{g}	42.33 ± 0.47^{a}	64.33 ± 0.72^{a}
Control	35.66 ± 0.72^{a}	46.66 ± 0.72^{a}	55.00 ± 0.47^{a}	0 ± 0.00^{f}	25.66 ± 0.98^{f}
CD ($p \leq 0.05$)	2.06	2.89	2.19	2.42	2.32

Days taken to 50 per cent and complete germination

The minimum number of days taken to 50 per cent and complete germination were recorded in seeds primed with GA_3 @ 1500 ppm for 24 hours (27.66 days and 34.66 days respectively) which were followed by GA_3 @ 1000 ppm for 24 hours. The maximum number of days taken to reach 50 per cent and complete germination were recorded in control (46.66 days and 55.00 days respectively). GA_3 primed seeds recorded minimum days for 50 per cent and complete germination might be due to the fact that gibberellic acid acts on the embryo and causes synthesis of hydrolyzing enzymes particularly amylase and protease and this hydrolyzed food is utilized for growth of embryo and thereby enhanced the germination (Paleg, 1965). The present results are affirmed by the findings of Rana et al. (2020) in papaya, Yadav et al. (2018) in custard apple and Hota et al. (2018) in jamum.

Table 2. Plant height (cm)

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
H_2SO_4 (Conc. 5 min)	0.49 ± 0.04^{def}	1.56 ± 0.09^{ef}	4.06 ± 0.25^{e}	8.20 ± 0.40^{de}	11.46 ± 0.30^{ef}
H_2SO_4 (Conc. 10 min)	0.35 ± 0.02^{ef}	1.21 ± 0.11^{f}	3.20 ± 0.14^{f}	7.50 ± 0.26^{ef}	10.60 ± 0.26^{f}
KNO_3 (1 %)	0.79 ± 0.02^{cd}	1.66 ± 0.19^{def}	4.93 ± 0.19^{cd}	9.13 ± 0.52^{cd}	14.56 ± 0.40^{bc}
KNO_3 (2 %)	0.93 ± 0.04^{bc}	2.96 ± 0.21^{bc}	6.30 ± 0.38^{b}	11.00 ± 0.42^{b}	15.53 ± 0.36^{b}
Kinetin (0.50 ppm)	0.54 ± 0.02^{def}	1.44 ± 0.05^{ef}	4.66 ± 0.19^{de}	9.63 ± 0.28^{bc}	11.33 ± 0.40^{ef}
Kinetin (0.75 ppm)	0.65 ± 0.02^{cde}	2.33 ± 0.14^{cd}	5.76 ± 0.15^{bc}	10.43 ± 24^{bc}	13.60 ± 0.35^{cd}
GA_3 (500 ppm)	0.26 ± 0.02^{fg}	2.12 ± 0.19^{de}	4.06 ± 0.19^{e}	6.66 ± 0.19^{fg}	12.40 ± 0.45^{de}
GA_3 (1000 ppm)	1.20 ± 0.01^{ab}	3.66 ± 0.35^{ab}	7.26 ± 0.26^{a}	12.53 ± 0.49^{a}	16.76 ± 0.14^{a}
GA_3 (1500 ppm)	1.43 ± 0.02^{a}	4.23 ± 0.29^{a}	7.80 ± 0.14^{a}	13.46 ± 0.30^{a}	17.56 ± 0.37^{a}
Control	0.00 ± 0.00^{g}	1.20 ± 0.18^{f}	2.60 ± 0.35^{f}	5.36 ± 0.43^{g}	8.30 ± 0.21^{g}
CD ($p \leq 0.05$)	0.31	0.97	0.85	1.31	1.22

Table 3. Number of shoots

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
H_2SO_4 (Conc. 5 min)	1.00 ± 0.00^{b}	3.66 ± 0.72^{cde}	6.00 ± 0.47^{cde}	7.33 ± 0.72^{de}	9.00 ± 0.47^{de}
H_2SO_4 (Conc. 10 min)	1.00 ± 0.00^{b}	3.00 ± 0.47^{def}	5.00 ± 0.47^{def}	6.33 ± 0.98^{ef}	8.00 ± 0.47^{ef}
KNO_3 (1 %)	1.00 ± 0.00^{b}	4.33 ± 0.72^{cd}	7.00 ± 0.47^{bcd}	10.00 ± 0.47^{bc}	11.00 ± 0.47^{bcd}
KNO_3 (2 %)	1.00 ± 0.00^{b}	5.33 ± 0.72^{abc}	9.00 ± 0.47^{ab}	11.33 ± 0.27^{abc}	12.33 ± 0.72^{abc}
Kinetin (0.50 ppm)	1.00 ± 0.00^{b}	4.00 ± 0.47^{cde}	6.66 ± 0.72^{cd}	9.00 ± 0.47^{cd}	10.66 ± 0.72^{cd}
Kinetin (0.75 ppm)	1.00 ± 0.00^{b}	4.66 ± 0.72^{bcd}	7.66 ± 0.72^{bc}	9.66 ± 0.72^{bcd}	11.66 ± 0.72^{bc}
GA_3 (500 ppm)	1.00 ± 0.00^{b}	2.00 ± 0.47^{ef}	4.00 ± 0.47^{ef}	5.66 ± 0.72^{ef}	6.66 ± 0.54^{fg}
GA_3 (1000 ppm)	1.33 ± 0.27^{ab}	6.66 ± 0.72^{ab}	10.00 ± 0.94^{a}	12.00 ± 0.47^{ab}	13.00 ± 0.47^{ab}
GA_3 (1500 ppm)	1.66 ± 0.27^{a}	7.00 ± 0.47^{a}	10.66 ± 0.72^{a}	13.00 ± 0.47^{a}	14.00 ± 0.47^{a}
Control	0.00 ± 0.00^{c}	1.33 ± 0.27^{f}	3.00 ± 0.47^{f}	4.66 ± 0.72^{f}	5.66 ± 0.72^{g}
CD ($p \leq 0.05$)	0.43	2.25	2.26	2.36	2.21

Germination per cent at 30 and 60 DAS

The maximum seed germination per cent (42.33 % and 64.33 %) at 30 and 60 DAS was recorded in seeds primed with GA_3 @ 1500 ppm for 24 hours which was statistically at par with GA_3 @ 1000 ppm for 24 hours primed seeds. Whereas, the minimum germination percent (22.33 %) was observed in seeds primed with GA_3 @ 500 ppm for 24 hours followed by Kinetin @ 0.50 ppm (25.33 %). However, no seed germination initiated upto 30 DAS in control. At 60 DAS, the minimum germination per cent (25.66 %) was recorded in control. The highest germination per

cent with GA_3 primed seeds might be due to the fact that GA_3 involved in the activation of cytological enzymes which stimulates α-amylase enzyme which convert insoluble starch into soluble sugars or might have antagonized the effect of inhibitors present in seeds thus help in higher germination (Hartman and Kester 1997). These results are in conformity with Anjanawe et al. (2013) in papaya and Kalyani et al. (2014) in guava.

Table 4. Stem diameter (mm)

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
H_2SO_4 (Conc. 5 min)	0.45 ± 0.07^{de}	1.08 ± 0.07^{de}	1.96 ± 0.05^{f}	2.73 ± 0.05^{f}	3.56 ± 0.08^{g}
H_2SO_4 (Conc. 10 min)	0.37 ± 0.05^{e}	0.96 ± 0.04^{ef}	1.73 ± 0.09^{g}	2.34 ± 0.05^{g}	3.34 ± 0.06^{e}
KNO_3 (1 %)	0.63 ± 0.05^{bcd}	1.25 ± 0.05^{bc}	2.32 ± 0.06^{c}	3.16 ± 0.03^{c}	3.95 ± 0.06^{b}
KNO_3 (2 %)	0.75 ± 0.08^{bc}	1.36 ± 0.05^{b}	2.47 ± 0.07^{b}	3.24 ± 0.6^{b}	4.03 ± 0.06^{b}
Kinetin (0.50 ppm)	0.54 ± 0.05^{cde}	1.19 ± 0.06^{cd}	2.06 ± 0.05^{e}	2.95 ± 0.05^{e}	3.64 ± 0.07^{d}
Kinetin (0.75 ppm)	0.65 ± 0.05^{bcd}	1.24 ± 0.05^{bc}	2.24 ± 0.05^{d}	3.06 ± 0.05^{d}	3.76 ± 0.05^{c}
GA_3 (500 ppm)	0.47 ± 0.09^{de}	0.85 ± 0.03^{fg}	1.65 ± 0.05^{h}	2.33 ± 0.07^{g}	3.25 ± 0.06^{e}
GA_3 (1000 ppm)	0.86 ± 0.22^{b}	1.70 ± 0.01^{a}	2.56 ± 0.04^{a}	3.43 ± 0.04^{a}	4.23 ± 0.03^{a}
GA_3 (1500 ppm)	1.17 ± 0.25^{a}	1.80 ± 0.15^{a}	2.60 ± 0.09^{a}	3.48 ± 0.06^{a}	4.27 ± 0.06^{a}
Control	0.00 ± 0.00^{f}	0.75 ± 0.05^{g}	1.36 ± 0.04^{i}	2.03 ± 0.05^{h}	2.95 ± 0.06^{f}
CD ($p \leq 0.05$)	0.24	0.15	0.07	0.05	0.10

Plant height

Seed priming with GA_3 @ 1500 ppm solution for 24 hours recorded the maximum plant height (1.43 cm, 4.23 cm, 7.80 cm, 13.46 cm and 17.56 cm) at 30, 60, 90, 120 and 150 DAS respectively. The minimum plant height (0.26 cm) was recorded in seeds primed with GA_3 @ 500 ppm and no seed germination was initiated in seeds under control at 30 DAS. The untreated seeds (control) recorded the minimum plant height (1.20 cm, 2.60 cm, 5.36 cm and 8.30 cm) at 60, 90, 120 and 150 DAS respectively. The maximum plant height under GA_3 might be due to cell multiplication and cell elongation in the cambium tissue of the internodal region, since GA_3 appears to promote metabolic processes or neutralize the influence of growth inhibitors (Singh et al., 1989). The observations are in agreement with the findings of Yadav et al. (2018) in custard apple and Hota et al. (2018) in jamun.

Table 5. Leaf number

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
H_2SO_4 (Conc. 5 min)	4.66 ± 0.98^{de}	6.50 ± 0.62^{de}	17.00 ± 0.94^{ef}	25.00 ± 0.47^{ef}	32.66 ± 0.72^{de}
H_2SO_4 (Conc. 10 min)	3.33 ± 0.72^{e}	5.33 ± 0.72^{ef}	16.66 ± 0.72^{ef}	23.66 ± 0.72^{fg}	30.33 ± 0.72^{ef}
KNO_3 (1 %)	6.33 ± 0.72^{bcd}	7.66 ± 0.72^{cde}	22.33 ± 0.72^{cd}	31.66 ± 0.72^{bc}	38.66 ± 0.72^{c}
KNO_3 (2 %)	7.33 ± 0.72^{abc}	9.33 ± 0.72^{bc}	23.66 ± 0.72^{bc}	33.00 ± 0.94^{ab}	41.66 ± 0.72^{b}
Kinetin (0.50 ppm)	5.00 ± 0.47^{cde}	7.66 ± 0.72^{cde}	19.66 ± 1.18^{de}	28.00 ± 1.24^{de}	34.33 ± 0.72^{d}
Kinetin (0.75 ppm)	5.33 ± 0.72^{cde}	8.33 ± 0.72^{cd}	21.33 ± 0.72^{cd}	29.00 ± 1.24^{cd}	37.33 ± 0.47^{d}
GA_3 (500 ppm)	4.33 ± 0.72^{de}	6.33 ± 0.72^{de}	15.33 ± 0.72^{fg}	27.00 ± 0.94^{def}	29.00 ± 0.47^{fg}
GA_3 (1000 ppm)	8.66 ± 0.72^{ab}	11.33 ± 0.72^{ab}	26.66 ± 0.72^{ab}	34.33 ± 1.44^{ab}	44.66 ± 1.813^{a}
GA_3 (1500 ppm)	9.33 ± 0.72^{a}	12.33 ± 0.72^{a}	27.33 ± 0.72^{a}	36.00 ± 0.47^{a}	45.00 ± 0.94^{a}
Control	0.00 ± 0.0^{f}	3.33 ± 0.72^{f}	12.33 ± 0.72^{g}	20.66 ± 0.98^{g}	27.33 ± 0.72^{g}
CD ($p \leq 0.05$)	2.37	2.51	3.01	3.30	2.57

Stem diameter

The data obtained regarding stem diameter depicted that the seed priming with GA_3 @ 1500 ppm for 24 hours recorded the maximum stem diameter (1.17 mm, 1.80 mm, 2.60 mm, 3.48 mm and 4.27 mm respectively) at 30, 60, 90, 120 and 150 DAS which was followed by seeds primed with GA_3 @ 1000 ppm for 24 hours. The minimum stem diameter (0.37 mm) was noticed in seeds primed with conc. H_2SO_4 for 10 min at 30 DAS. There was no seed germination taken place in control at 30 DAS. At 60, 90 120 and 150 DAS, the minimum stem diameter (0.75 mm, 1.36 mm, 2.03 mm and 2.95 mm) was recorded in control. The increase in stem diameter might be due to GA_3 increase osmotic uptake of nutrient and boost the growth by increasing cell division, cell elongation and cell multiplication in the cambium tissue of the stem portion. These results are in accordance with Ramteke et al. (2015) in aonla, Parab et al. (2017) and Bhavya et al. (2017) in karonda.

Table 6. Leaf area (mm^2)

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
H_2SO_4 (Conc. 5 min)	6.43 ± 0.16^{ef}	16.00 ± 0.35^{de}	25.90 ± 0.33^{de}	30.46 ± 0.45^{e}	35.06 ± 0.33^{e}
H_2SO_4 (Conc. 10 min)	6.63 ± 0.14^{de}	15.06 ± 0.21^{e}	25.10 ± 0.43ef	29.33 ± 0.21^{f}	33.63 ± 0.21^{f}
KNO_3 (1 %)	7.63 ± 0.22^{bc}	17.96 ± 0.23^{bc}	27.40 ± 0.33^{bc}	33.56 ± 0.41^{bc}	37.63 ± 0.28^{bc}
KNO_3 (2 %)	7.66 ± 0.28b	18.60 ± 0.35^{b}	27.93 ± 0.35^{b}	33.76 ± 0.44^{b}	37.76 ± 0.19^{b}
Kinetin (0.50 ppm)	6.76 ± 0.23^{cd}	16.76 ± 0.42^{cd}	26.53 ± 0.51^{cd}	32.26 ± 0.28^{d}	36.00 ± 0.38^{d}
Kinetin (0.75 ppm)	7.30 ± 0.26^{bcd}	17.53 ± 0.53^{bc}	26.96 ± 0.37^{bc}	33.13 ± 0.25^{c}	36.86 ± 0.25^{c}
GA_3 (500 ppm)	5.86 ± 0.28^{e}	14.63 ± 0.42^{e}	24.53 ± 0.33^{f}	28.10 ± 0.23^{g}	32.23 ± 0.24^{g}
GA_3 (1000 ppm)	8.60 ± 0.30^{a}	20.10 ± 0.51^{a}	29.26 ± 0.36^{a}	35.03 ± 0.25^{a}	39.86 ± 0.35^{a}
GA_3 (1500 ppm)	8.90 ± 0.37^{a}	20.63 ± 0.50^{a}	29.43 ± 0.35^{a}	35.10 ± 0.35^{a}	39.90 ± 0.38^{a}
Control	0.00 ± 0.00^{f}	6.63 ± 0.43^{f}	15.06 ± 0.45^{g}	24.16 ± 0.38^{h}	29.60 ± 0.57^{h}
CD ($p \leq 0.05$)	0.87	1.38	0.98	0.59	0.80

Leaf number

The data pertaining to leaf number showed that seed priming with GA_3 @ 1500 ppm recorded the maximum leaf number (9.33, 12.33, 27.33, 36.00 and 45.00) which was statistically at par with seeds treated with GA_3 @ 1000 ppm for 24 hours at 30, 60, 90, 120 and 150 DAS respectively. The minimum leaf number (3.33) was recorded in conc. H_2SO_4 for 10 min at 30 DAS. At 60, 90, 120 and 150 DAS, the minimum leaf number (3.33, 12.33, 20.66 and 27.33 respectively) was recorded in control. More number of leaves might be due to the activity of GA_3 at apical meristem, resulting in more synthesis of nucleoprotein responsible for increasing leaf initiation and leaf expansion (Palepad et al., 2017). These results are in accordance with Nimbalkar et al. (2012) and Sen et al. (1990) in papaya seeds.

Leaf area

The maximum leaf area (8.90 mm^2, 20.63 mm^2, 29.43 mm^2, 35.10 mm^2 and 39.90 mm^2) was observed in seeds primed with GA_3 @ 1500 ppm solution for 24 hours which was statistically at par with seeds treated with GA_3 @ 1000 ppm for 24 hours at 30, 60, 90, 120 and 150 DAS. The minimum leaf area (5.86 mm^2) was observed in seeds primed with GA_3 @ 500 ppm for 24 hours. However, no seed germination initiated in control upto 30 DAS. At 60, 90, 120 and 150 DAS, the minimum leaf area (6.63 mm^2, 15.06 mm^2, 24.16 mm^2 and 29.60 mm^2 respectively) was recorded in control. Leaf area increment of the seedlings treated with GA_3 can be attributed to GA_3 availability at the apical meristem which might have accelerated the nucleoprotein synthesis to an increase in cell division and their multiplication which enhanced the leaf production with increased leaf area (Manthri and Bharad, 2017). The results are in line with the findings of Nimbalkar et al. (2012) in karonda and Anjanawe et al. (2013) in papaya cv. Solo.

Conclusion

The results of current study revealed that seed priming with GA_3 @ 1500 ppm and GA_3 @ 1000 ppm have shown statistically non-significant behaviour except all other treatments which were statistically significant with each other. Seed priming with GA_3 @ 1500 ppm for 24 hours proved to be superior for earlier and highest germination per cent, production of vigorous seedlings with better growth parameters like plant height, shoot number, stem diameter, leaf number and leaf area. Hence, standardization of GA_3 treatment can be used for improving seed germination and growth of Kainth. This simple intervention can help nurserymen raise vigorous Kainth rootstocks in short period of time.

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