



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.03

TPI 2020; 9(9): 431-433

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www.thepharmajournal.com

Received: 21-07-2020

Accepted: 29-08-2020

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Effect of pre-sowing treatments on seed germination and seedling growth of guava

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Abstract

The results of present investigation revealed that among the different pre-sowing treatments, GA₃ @ 150 mg l⁻¹ was found to be most beneficial for improving germination percent (80.77%) and took minimum days for germination (16.73). Similar trend was observed on growth parameters such as number of leaves (7.80, 14.33, 17.93), height of seedling (7.28, 15.07, 28.18 cm), stem diameter (0.87, 2.22, 2.75 mm), primary root length (6.72 cm), number of secondary roots (26.40), fresh weight of shoot (14.21 g), dry weight of shoot (5.97 g), fresh weight of root (1.94 g), dry weight of root (1.12 g), shoot: root ratio (7.32) and survival percentage (75.00%).

Keywords: Guava, pre-sowing, GA₃, germination and growth and seedling

Introduction

Guava (*Psidium guajava* L.) is one of the most popular fruit crop grown in tropical and sub-tropical regions of India belongs to family Myrtaceae and popularly known as 'Apple of Tropics.' In India, guava occupies 265 thousand hectares of area with the production of 4054 thousand MT. It is well adapted in most states like Uttar Pradesh, Bihar, Jharkhand, Andhra Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka and Tamil Nadu. In Gujarat, it is grown in Bhavnagar, Vadodara, Kutch, Kheda, Gandhinagar, Chhotaudepur, Bharuch with 12.67 thousand hectares area with the production 169.57 thousand MT (Anonymous, 2018). The greatest bottleneck in the expansion of area under fruits is the non-availability of genuine and quality planting materials in adequate quantity from reliable nurseries. The germination of guava seeds is uncertain due to hard seed coat, (Singh, 1967) [13] which results in poor germination. Various pre-soaking treatments are very helpful to increase the germination percentage and minimize the germination period.

Material and Method

The present Investigation entitled "Effect of pre-sowing treatments on seed germination and seedling growth of guava" was conducted at Regional Horticulture Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during the year 2019-20. The experiment was laid out in a Completely Randomized Design (CRD) and repeated thrice with ten treatments comprising Control (T₁), GA₃ 150 mg l⁻¹ (T₂), KNO₃ 1% (T₃), Thiourea 500 mg l⁻¹ (T₄), Cow dung slurry 3% (T₅), Cow urine 3% (T₆), *Bijamrut* 3% (T₇), *Amritpani* 3% (T₈), *Pseudomonas fluorescens* 10 ml l⁻¹ (T₉) and Water soaking (T₁₀). Seeds were soaked for 24 hours in all treatments except control. Seeds were sown in 5" × 7" size polythene bags. For improving the drainage, holes were made in polythene bags and filled with potting mixture which was prepared by mixing one parts of red soil, one part of vermicompost, one part of sand and one part of cocopeat. The seeds were sown in polythene bags after soaking as per the treatments. The observations on the parameters listed below were recorded daily for germination parameters and after 45 days for germination percentage. For growth parameters observations were taken at 60, 90 and 120 days after sowing.

Results and Discussion

Germination attributes

The minimum days taken for germination (16.73) and maximum germination percentage of seedling (80.77%) were recorded in seeds treated with GA₃ @ 150 mg l⁻¹ for 24 hours (Table 1).

The remarkable effect of GA₃ on minimum days required for germination might be due to it acts on the embryo and causes denova synthesis of hydrolyzing enzymes particularly amylase and protease and this hydrolyzed food is utilized for growth of embryo and thereby enhanced the germination. The effect of GA₃ on higher seed germination percentage might be due to the involvement of GA₃ in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption. These results are in agreement with the findings of Vachhani *et al.* (2014) [15] in khirni; Reshma and Simi (2019) [12] in mango.

Shoot parameters

The seedling height at 60, 90 and 120 DAS (7.28, 15.07 and 28.18), maximum number of leaves per seedling at 60, 90 and 120 DAS (7.80, 14.33 and 17.93), stem diameter (0.87, 2.22 and 2.75 mm) at 60, 90 and 120 DAS was recorded when seeds treated with GA₃ @ 150 mg l⁻¹ for 24 hours (Table 1). The increased seedling height with GA₃ treatment might be due to the fact that this hormone increased osmotic uptake of nutrients, causing cell elongation and thus increasing height of the plant and stem diameter was also increased due to greater cell division and elongation at the stem portion. Similarly, the increase in number of leaves as results of GA₃ application might be due to fact that activity of GA₃ at apical meristem resulting is more system of nucleoprotein responsible for increasing leaf initiation and expansion. Present findings are supported by Vasantha *et al.* (2014) [16] in tamarind; Patil *et al.* (2018) [10] in jamun.

Root parameters and survival percentage

The primary root length (6.72 cm) at 120 DAS, number of

secondary roots/seedling (26.40) at 120 DAS and shoot: root ratio (7.32) at 120 DAS were found maximum in T₂ i.e. GA₃ @ 150 mg l⁻¹ treated seeds (Table 2). This might be due to proper level of gibberellic acid which might be resulted in rapid cell division, elongation and multiplication process in seedlings that has reflected increase in primary root length and increasing number of secondary roots. Similar results are in agreement with the findings of Pampanna and Sulikeri (2001) [7] in sapota and Kumawat *et al.* (2014) [4] in papaya.

The fresh weight of shoot and root (14.21 and 1.94 g) and dry weight of shoot and root (5.97 and 1.12 g) at 120 DAS were recorded, when seeds treated with GA₃ at 150 mg l⁻¹ (Table 2). A possible reason for this might be due to overall growth of the seedling and increased rate of photosynthesis that lead to the overall assimilation and redistribution of photosynthetic within the seedling and hence, resulted in higher fresh and dry weight. Thus, increased growth is a consequence of increased dry matter accumulation. The results are in close conformity with the findings of Patil *et al.* (2012) [10] in citrus; Patil *et al.* (2018) [10] in jamun; Vasantha *et al.* (2014) [16] and Tandon *et al.* (2019) [14] in tamarind.

The survival percentage at 120 DAS was found maximum (75.00%) when the seeds were treated with GA₃ at 150 mg l⁻¹ (Table 2). This might be due to the early germination of seeds which helps in successful acclimatization of seedlings in field conditions and GA₃ 150 mg l⁻¹ was overall performance in relation to growth parameters were good in such treatments which ultimately increased the survival percentage. The observation analogues to these findings were reported by Brijwal *et al.* (2014) [2] in guava; Patel *et al.* (2018) [8] in tamarind and Khatana *et al.* (2015) [3] in kagzi lime.

Table 1: Effect of pre-sowing seed treatments on germination and shoot parameters of guava seedlings.

Treatments	Days to germination	Germination%	Number of leaves/seedling			Seedling height (cm)			Stem diameter (mm)		
			60 days	90 days	120 days	60 days	90 days	120 days	60 days	90 days	120 days
T ₁ : Control	28.00	54.33 (47.47)	4.53	7.26	10.93	4.02	8.77	13.26	0.41	0.50	1.86
T ₂ : GA ₃ 150 mg l ⁻¹	16.73	80.77 (63.98)	7.80	14.33	17.93	7.28	15.07	28.18	0.87	2.22	2.75
T ₃ : KNO ₃ (1%)	24.33	65.00 (53.71)	7.37	13.43	17.56	6.27	13.50	24.71	0.85	2.15	2.60
T ₄ : Thiourea 500 mg l ⁻¹	23.13	58.00 (49.59)	7.07	13.10	16.63	5.10	12.07	24.44	0.56	2.14	2.42
T ₅ : Cow dung slurry (3%)	26.27	57.67 (49.39)	5.62	9.27	15.70	4.25	9.49	20.73	0.47	1.55	1.95
T ₆ : Cow urine (3%)	26.87	55.33 (48.05)	5.10	8.87	13.20	4.20	9.41	19.99	0.46	1.54	1.90
T ₇ : Bijamrut (3%)	25.47	60.00 (50.77)	6.57	11.86	16.42	4.48	9.61	23.37	0.52	1.65	2.23
T ₈ : Amritpani (3%)	24.20	62.67 (52.32)	6.40	9.50	16.07	4.36	9.52	23.04	0.51	1.59	2.15
T ₉ : <i>Pseudomonas fluorescens</i> 10 ml l ⁻¹	18.93	77.33 (61.57)	7.43	13.79	17.70	6.81	14.53	27.92	0.86	2.16	2.71
T ₁₀ : Water soaking	26.80	54.67 (47.66)	5.03	8.33	11.00	4.17	9.38	13.37	0.44	1.51	1.92
S. Em. ±	0.63	1.82	0.20	0.34	0.59	0.13	0.44	0.57	0.02	0.05	0.08
C. D. @ 5%	1.84	5.17	0.59	1.00	1.73	0.39	1.31	1.68	0.06	0.14	0.22
C. V.%	4.50	5.02	5.52	5.37	6.62	4.49	6.88	4.52	5.76	4.76	5.86

Table 2: Effect of pre-sowing seed treatments on root parameters and survival percentage of guava seedlings.

Treatments	Primary root length (cm)	No. of secondary roots	Fresh weight of shoot (g)	Dry weight of shoot (g)	Fresh weight of root (g)	Dry weight of root (g)	Shoot: root ratio	Survival%
T ₁ : Control	4.71	6.20	6.71	2.87	1.42	0.12	4.07	56.00
T ₂ : GA ₃ 150 mg l ⁻¹	6.72	26.40	14.21	5.97	1.94	1.12	7.32	75.00
T ₃ : KNO ₃ (1%)	6.49	24.53	13.23	5.75	1.87	1.06	6.78	67.67
T ₄ : Thiourea 500 mg l ⁻¹	6.43	16.00	11.76	4.52	1.77	0.93	6.64	64.67
T ₅ : Cow dung slurry (3%)	6.15	10.07	9.33	3.60	1.60	0.63	5.83	59.33
T ₆ : Cow urine (3%)	6.01	7.87	8.06	3.25	1.48	0.35	5.51	57.67
T ₇ : <i>Bijamrut</i> (3%)	6.40	12.87	10.78	4.40	1.72	0.19	6.17	63.33
T ₈ : <i>Amritpani</i> (3%)	6.30	11.73	10.06	3.85	1.65	0.77	6.11	61.00
T ₉ : <i>Pseudomonas fluorescens</i> 10 ml l ⁻¹	6.62	25.65	13.66	5.82	1.88	1.11	7.23	73.73
T ₁₀ : Water soaking	5.74	7.07	7.65	3.14	1.55	0.16	4.96	57.33
S. Em. ±	0.19	4.40	0.33	0.14	0.05	0.02	0.20	1.73
C. D. @ 5%	0.58	1.19	0.96	0.41	0.13	0.06	0.59	4.91
C. V.%	5.51	4.71	5.34	5.52	4.67	5.38	5.73	4.70

Conclusion

Based on the results of the experiment it could be concluded that the guava seeds soaked in GA₃ @ 150 mg l⁻¹ for 24 hours gave the maximum germination, vegetative growth and survival of guava seedlings.

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