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Effect of presowing seed treatments on seed germination and seedling growth of charoli (*Buchanania lanzan* Spreng)

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Abstract

Charoli (*Buchanania lanzan* Spreng) is an important underutilized and indigenous fruit crop of India belonging to the family Anacardiaceae. It has great significance due to its multifarious uses and capacity to withstand adverse climatic conditions. At present it is growing under forest condition as an underexploited fruit and gives monetary rewards to tribal community of the country. During the time of fruit collection, the charoli plants which are present in the local habitats, traders and greedy merchants destroy the branches/whole tree without bothering about new plantation. This is led to the destruction of charoli plant in the forest. Therefore, there is urgent need to develop a technology for easy multiplication and regeneration of charoli and to popularize its importance among the local inhabitants/tribals. Charoli is propagated from seed which exhibits poor germination even exposed to favourable conditions may be due to morphological factor such as hard seed coat, thick testa. Such seed require special treatments like scarification, soaking in water, soaking in growth regulators etc., For improving seed germination, pre sowing seed treatments like mechanical scarification, seed soaking in GA₃, cow urine, cow dung slurry etc., are essential. Due to poor germination availability of planting materials is less. Hence, there is a need to emphasis to study pre sowing seed treatments on seed germination and seedling growth of charoli under Vidarbha conditions. Among the eight pre sowing seed treatments, treatment Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs. recorded early germination (21.09 days), maximum germination percent (72.22%), maximum vegetative growth parameters viz., seedling height (15.94 cm), more number of leaves seedling⁻¹(9.13), stem diameter (0.71 cm) and more survival percent (81.90%).

Keywords: *Buchanania lanzan*, Charoli, seed germination, physical scarification, GA₃ seed treatment

Introduction

Charoli (*Buchanania lanzan* Spreng) is an important underutilized and indigenous fruit crop of India belonging to the family Anacardiaceae. It has great significance due to its multifarious uses and capacity to withstand adverse climatic conditions. At present it is growing under forest condition as an underexploited fruit and gives monetary rewards to tribal community of the country. During the time of fruit collection, the charoli plants which are present in the local habitats, traders and greedy merchants destroy the branches/whole tree without bothering about new plantation. This is led to the destruction of charoli plant in the forest. Therefore, there is urgent need to develop a technology for easy multiplication and regeneration of charoli and to popularize its importance among the local inhabitants/tribals. Charoli is propagated from seed which exhibits poor germination even exposed to favourable conditions may be due to morphological factor such as hard seed coat, thick testa. Such seed require special treatments like scarification, soaking in water, soaking in growth regulators etc., For improving seed germination, pre sowing seed treatments like mechanical scarification, seed soaking in GA₃, cow urine, cow dung slurry etc., are essential. Due to poor germination availability of planting materials is less. Hence, there is a need to emphasis to study pre sowing seed treatments on seed germination and seedling growth of charoli under Vidarbha conditions. Looking to the fact for the multiplication of charoli crop the experiment was undertaken with the objective to find out the suitable pre sowing seed treatment for early seed and maximum germination percent, seedling growth and survival percent in charoli.

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Materials and Methods

The experiment was conducted during the year 2019-20, 2020-21, and 2021-22 at Agriculture Research Station, Sonapur-Gadchiroli under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Fresh seeds were collected from State Agriculture fruit nursery wakdi. Extraction of seeds from the fruits was done by de-pulping of fruits by washing with water followed by dried in shade. The good quality healthy seeds were selected for germination study. In each treatment 50 charoli seeds were sown directly in the poly bags at a depth 0.50 to 1.0 cm. The polybags were punched to improve the drainage and filled with potting mixture which was prepared by mixing two parts of soil, one part of sand and one part of FYM. Before sowing the seed, different seed treatment methods which were applied for germination before sowing the seed. According to the different treatments, seed treated with different conc. of gibberellic acid, physical scarification, H₂SO₄, cow dung slurry and cow urine were used as a seed treatment. In physical scarification, seeds were kept in the gunny bag and lightly beaten with wooded laddle for 5 to 10 minutes till the hard seed coats were became a slightly crack. In all eight treatments i.e. T₁: Seed soaking in GA₃ 200 ppm for 24 hrs., T₂: Seed soaking in GA₃ 300 ppm for 24 hrs., T₃: Physical scarification + seed soaking in GA₃ 200 ppm for 24 hrs., T₄: Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs, T₅: Seed soaking in Conc. H₂SO₄ for 2 min., T₆: Seed soaking in cow urine for 7 days and T₈: Control (No pre sowing seed treatment). Experiment was laid out in Completely Randomized Design with eight treatments and three replications. Seed sowing was carried during first week of June. The data on days to germination, germination percent, seedling height, seedling diameter, number of leaves, survival percent were recorded.

Results and Discussion

The pooled data of three years regarding seed germination,

vegetative growth parameters and survival percent as influenced by different pre sowing seed treatments was recorded and are presented in Table 1 to 6 for the year 2019-20, 2020-21 & 2021-22 and pooled data. However, all character studied in charoli (pooled mean) indicated that there were significant differences amongst the different pre sowing seed treatments in charoli.

Days to Seed germination (days)

The data in respect of seed germination in days is presented in Table 1. It is revealed from the table that, early seed germination was significantly influenced by different pre sowing seed treatments. Significantly early pooled germination (21.09 days) was recorded in treatment T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs followed by treatments T₃ (23.48 days), T₂ (24.55 days) and T₁ (26.01days). However, late seed germination (36.33days) was recorded in control treatment (T₈). The seed germination in Chironji is erratic due to the possession of various degrees of physical dormancy caused due to hard seed coat, which is impermeable to water and oxygen. The mechanical scarification treatment removed the seed coat there by increased the permeability of air and water through seed which favours the earliest germination. On the other hand, GA₃ (300 ppm) may be associated with triggering the de novo synthesis of hydrolytic enzymes like alpha-amylase and proteases, where it could rapidly mobilize stored endosperm reserves into simple sugars and amino acids and accelerate radicle emergence, which might be the reason for the reduced number of days to germination. Similar results were found by Sharma (2016) [17], Joshi *et al.* (2017) [5], Chauhan *et al.* (2020) [2], Sharma *et al.* (2020) [18], Homeshvari *et al.* (2022) [3], Prakash *et al.* (2025) [14] and Janbandhu *et al.* (2026) [4] in charoli, Palepad *et al.* (2017) [11] in custard apple and Lalitha *et al.* (2020) [7] in aonla.

Table 1: Days to seed germination as influenced by pre sowing seed treatments in Charoli

Treatments	Days to seed germination (days)			
	2019-20	2020-21	2021-22	Pooled mean
T ₂ : Seed soaking in GA ₃ 200 ppm for 24 hrs	25.66	26.03	26.33	26.01
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	24.33	25.99	23.33	24.55
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	23.33	24.00	23.13	23.48
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs.	21.60	22.33	19.33	21.09
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	26.33	28.00	24.33	26.22
T ₆ : Seed soaking in cow urine for 7 days	34.00	33.00	30.66	32.55
T ₇ : Seed soaking in cow dung slurry for 7 days	31.66	31.33	32.33	31.77
T ₈ : Control (No pre sowing seed treatment)	35.66	35.99	37.33	36.33
'F' test	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.68	0.45	0.68	0.71
CD at 5%	2.10	1.37	2.02	2.13

Seed germination percent

The data in respect of seed germination percent is presented in Table 2. It is revealed from the table that, seed germination percent was significantly influenced by different pre sowing seed treatments. Significantly maximum pooled seed germination percent (72.22%) was recorded in treatment T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs followed by the treatments T₃ (66.11%), T₂ (60.66%), and T₁ (57.44%). However, minimum seed germination percent (30.55%) was recorded in control treatment. The increase in germination percent might be due to Physical scarification removing the mechanical resistance of the stony endocarp. It plays a key

role in overcoming physical dormancy mechanisms and allowing unhindered embryo expansion. On the other hand, GA₃ (300 ppm) may be associated with acting as a potent physiological catalyst to alter the endogenous promoter-to-inhibitor hormonal balance, where it could overcome Absciscic Acid (ABA) mediated suppression, promote cell division and elongation in the embryonic axis and ensure that a maximal number of embryos successfully break through the seed coat that might be the reason for the increased germination percentage. Similar results were found by Shukla and Solanki (2000) [19], Narayan *et al.* (2014) [10], Sharma (2016) [17], Joshi *et al.* (2017) [5], Sadashiv *et al.* (2017) [16], Ajith *et al.* (2018) [1], Chauhan *et al.*

al. (2020) ^[2], Sharma *et al.* (2020) ^[18], Thounaojam and Dhaduk (2020) ^[20], Khobragade *et al.* (2021) ^[6], Homeshvari *et al.* (2022) ^[3], Prakash *et al.* (2025) ^[14] and

Janbandhu *et al.* (2026) ^[4] in charoli, Vasantha *et al.* (2014) ^[21] in tamarind and Palepad *et al.* (2017) ^[11] in custard apple.

Table 2: Germination percent as influenced by different pre sowing seed treatment in charoli

Treatments	Seed Germination percent (%)			
	2019-20	2020-21	2021-22	Pooled mean
T ₁ : Seed soaking in GA ₃ 200 ppm for 24 hrs.	54.33 (47.49)	55.67 (48.26)	62.33 (52.15)	57.44 (49.30)
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	57.33 (49.23)	61.00 (51.37)	63.66 (52.94)	60.66 (51.17)
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	61.67 (51.74)	67.33 (55.14)	69.33 (56.38)	66.11 (54.42)
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs.	69.67 (56.58)	71.99 (58.07)	75.00 (60.02)	72.22 (58.21)
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	51.33 (45.76)	54.66 (47.68)	53.13 (46.80)	53.04 (46.75)
T ₆ : Seed soaking in cow urine for 7 days	37.33 (37.66)	39.66 (39.03)	37.99 (38.04)	38.32 (38.25)
T ₇ : Seed soaking in cow dung slurry for 7 days	36.67 (37.26)	33.99 (37.42)	33.33 (35.25)	34.66 (36.07)
T ₈ : Control (No pre sowing seed treatment)	31.67 (34.25)	30.33 (33.41)	29.67 (33.01)	30.55 (33.54)
'F' test	Sig.	Sig.	Sig.	Sig.
SE (m) ±	1.31 (0.87)	1.57 (1.02)	1.61 (1.04)	1.44 (0.94)
CD at 5%	4.01 (2.66)	4.82 (3.06)	4.92 3.11	4.42 (2.86)

*Figures in parenthesis denote the arc sine transformation value

Seedling height (cm)

The data in respect of seedling height was recorded at 180 days after sowing of charoli is presented in Table 3. It is revealed from the table that, seedling height was significantly influenced by different pre sowing seed treatments. Significantly maximum seedling height (15.94 cm) was recorded in treatment T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs followed by the treatments T₃ (12.70 cm), T₂ (11.35 cm) and T₁ (10.37 cm). However, minimum seedling height (8.94 cm) was recorded in control treatment. The increase in seedling height might be due to Physical scarification enabled early and uniform emergence. It plays a key role in giving the seedling a longer total duration for active vegetative growth during the

season. On the other hand, GA₃ may be associated with the alteration of plant cell wall plasticity, where it could drive extensive cellular elongation in the stem internodes and enhance the sink strength of the apical meristem that might be the reason for increased seedling height. Similar results were found by Sharma (2016) ^[17], Joshi *et al.* (2017) ^[5], Sadashiv *et al.* (2017) ^[16], Chauhan *et al.* (2020) ^[2], Sharma *et al.* (2020) ^[18], Khobragade *et al.* (2021) ^[6], Mahadev *et al.* (2021) ^[8], Homeshvari *et al.* (2022) ^[3], Prakash *et al.* (2025) ^[14] and Janbandhu *et al.* (2026) ^[4] in charoli, Vasantha *et al.* (2014) ^[21] in tamarind, Palepad *et al.* (2017) ^[11] in custard apple, Patel *et al.* (2017) ^[13] in mango and Lalitha *et al.* (2020) ^[7] in aonla.

Table 3: Seedling height as influenced by different pre sowing seed treatments in charoli

Treatments	Seedling height (cm) at 180 DAS			
	2019-20	2020-21	2021-22	Pooled mean
T ₁ : Seed soaking in GA ₃ 200 ppm for 24 hrs.	10.66	10.34	10.13	10.37
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	12.00	10.67	11.40	11.35
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	13.56	12.47	12.07	12.70
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs	17.66	15.40	14.77	15.94
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	10.27	10.07	9.67	10.00
T ₆ : Seed soaking in cow urine for 7 days	10.33	9.27	9.63	9.74
T ₇ : Seed soaking in cow dung slurry for 7 days	9.66	8.67	9.37	9.23
T ₈ : Control (No pre sowing seed treatment)	9.33	8.37	9.13	8.94
'F' test	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.57	0.39	0.45	0.42
CD at 5%	1.75	1.18	1.37	1.28

Number of leaves seedling⁻¹

The data in respect of number of leaves seedling⁻¹ was recorded at 180 days after sowing is presented in Table 4. It is revealed from the table that, number of leaves seedling⁻¹ was significantly influenced by different pre sowing seed treatments. Significantly maximum pooled number of leaves seedling⁻¹ (9.13) was recorded in treatment T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs followed by the treatments T₃ (8.11), T₂ (7.94) and T₂ (7.61). However, minimum number of leaves seedling⁻¹ (6.36) was recorded in treatment control. The increase in the number of leaves might be due to Physical scarification, which broke the mechanical seed barrier early. It plays a key role in transitioning the plant from heterotrophic to autotrophic

growth much sooner. On the other hand, GA₃ (300 ppm) may be associated with stimulating cell division and elongation in the apical meristem, where it could lead to faster internodal development, earlier differentiation of leaf primordia, and enhanced nitrogen metabolism and chlorophyll synthesis that might be the reason for the increased number of leaves. Similar results were found by Sharma (2016) ^[17], Joshi *et al.* (2017) ^[5], Chauhan *et al.* (2020) ^[2], Sharma *et al.* (2020) ^[18], Mahadev *et al.* (2021) ^[8], Homeshvari *et al.* (2022) ^[3], Prakash *et al.* (2025) ^[14] and Janbandhu *et al.* (2026) ^[4] in charoli, Vasantha *et al.* (2014) ^[21] in tamarind, Palepad *et al.* (2017) ^[11] in custard apple and Lalitha *et al.* (2020) ^[7] in aonla.

Table 4: Number of leaves seedling⁻¹ as influenced by different pre sowing seed treatments in charoli

Treatments	Number of leaves seedling ⁻¹ at 180 DAS			
	2019-20	2020-21	2021-22	Pooled mean
T ₁ : Seed soaking in GA ₃ 200 ppm for 24 hrs.	7.53	7.53	7.78	7.61
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	7.63	7.93	8.26	7.94
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	7.89	8.33	8.13	8.11
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs.	8.89	9.33	9.18	9.13
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	6.80	7.80	7.66	7.42
T ₆ : Seed soaking in cow urine for 7 days	6.03	7.07	6.99	6.69
T ₇ : Seed soaking in cow dung slurry for 7 days	5.70	6.87	6.70	6.42
T ₈ : Control (No pre sowing seed treatment)	5.45	7.20	6.45	6.36
'F' test	Sig.	Sig.	Sig.	Sig
SE (m) ±	0.23	0.21	0.25	0.29
CD at 5%	0.67	0.62	0.74	0.87

Stem Diameter of seedling (cm)

The data in presented in Table 5 revealed that, the stem diameter of seedling recorded at 180 days after sowing was found significant as influenced by different pre sowing seed treatments. Significantly, maximum stem diameter (0.71cm) was recorded in T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs which was followed by the treatments T₃ (0.61 cm) and T₂ (0.57 cm). However, stem diameter of seedling⁻¹ (0.46 cm) was recorded in treatment control. The increase in stem diameter might be due to Physical scarification, which facilitated rapid germination and early establishment. It plays a key role in allowing the

root system to uptake optimal soil nutrients, which structures the stem. On the other hand, GA₃ (300 ppm) may be associated with enhanced cambial activity, where it could develop a larger initial leaf area, generate abundant photo-assimilates and promote radial cell division in the vascular cambium that might be the reason for increased stem diameter. Similar results were found by Sharma (2016) [17], Joshi *et al.* (2017) [5], Chauhan *et al.* (2020) [2], Sharma *et al.* (2020) [18], Mahadev *et al.* (2021) [8] and Janbandhu *et al.* (2026) [4] in charoli, Vasantha *et al.* (2014) [21] in tamarind, Palepad *et al.* (2017) [11] in custard apple and Lalitha *et al.* (2020) [7] in aonla.

Table 5: Stem diameter of seedling as influenced by different pre sowing seed treatments in charoli

Treatments	Stem diameter (cm) at 180 DAS			
	2019-20	2020-21	2021-22	Pooled mean
T ₁ : Seed soaking in GA ₃ 200 ppm for 24 hrs.	0.55	0.51	0.55	0.53
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	0.56	0.53	0.63	0.57
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	0.57	0.63	0.65	0.61
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs.	0.66	0.69	0.77	0.71
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	0.56	0.53	0.63	0.57
T ₆ : Seed soaking in cow urine for 7 days	0.54	0.54	0.52	0.53
T ₇ : Seed soaking in cow dung slurry for 7 days	0.51	0.52	0.50	0.51
T ₈ : Control (No pre sowing seed treatment)	0.49	0.47	0.43	0.46
'F' test	Sig.	Sig.	Sig.	Sig
SE (m) ±	0.02	0.01	0.02	0.03
CD at 5%	0.06	0.03	0.07	0.08

Survival percent

The data presented in Table 6 revealed that, the survival percent of seedling was recorded at 180 days after sowing was significantly influenced by different pre sowing seed treatments. Significantly pooled maximum survival percent (81.90%) was recorded in treatment T₄-Physical scarification + seed soaking in GA₃ 300 ppm for 24 hrs followed by the treatment T₃(77.53%) and T₂ (75.28%). However, minimum survival percent (50.95%) was recorded in control treatment (T₈). The increase in survival percentage might be due to Physical scarification ensured that the emerging hypocotyl did not exhaust its energy reserves struggling against a tough endocarp. It plays a key role in preserving cellular energy for immediate vegetative growth and providing early, robust and uniform germination

for a competitive head start. On the other hand, GA₃ (300 ppm) may be associated with enhancing early cell elongation and metabolic activity in the hypocotyl and primary roots, where it could lead to the rapid establishment of a functional root system, efficient nutrient and water uptake and fortification against early-stage damping-off or environmental stress that might be the reason for the increased survival percentage. Similar results were found by Narayan *et al.* (2014) [10], Joshi *et al.* (2017) [5], Chauhan *et al.* (2020) [2], Sharma *et al.* (2020) [18], Homeshvari *et al.* (2022) [3], Prakash *et al.* (2025) [14] and Janbandhu *et al.* (2026) [4] in charoli, Manekar *et al.* (2011) and Lalitha *et al.* (2020) [7] in aonla, Patel *et al.* (2017) [13] in mango and Palepad *et al.* (2017) [11] in custard apple.

Table 6: Survival percent as influenced by different pre sowing seed treatments in charoli

Treatments	Survival percent (%) at 180 DAS			
	2019-20	2020-21	2021-22	Pooled mean
T ₁ : Seed soaking in GA ₃ 200 ppm for 24 hrs.	74.26 (59.49)	65.85 (54.21)	73.71 (59.13)	71.27 (57.61)
T ₂ : Seed soaking in GA ₃ 300 ppm for 24 hrs.	76.91 (61.94)	72.49 (58.34)	76.43 (60.94)	75.28 (60.17)
T ₃ : Physical scarification + seed soaking in GA ₃ 200 ppm for 24 hrs.	77.53 (61.68)	77.21 (60.78)	77.84 (62.58)	77.53 (61.67)
T ₄ : Physical scarification + seed soaking in GA ₃ 300 ppm for 24 hrs.	82.33 (66.12)	81.63 (63.87)	81.73 (64.67)	81.90 (64.79)
T ₅ : Seed soaking in Conc. H ₂ SO ₄ for 2 min.	70.33 (56.97)	70.73 (57.23)	65.24 (53.85)	68.77 (56.02)
T ₆ : Seed soaking in cow urine for 7 days	63.66 (52.91)	62.89 (52.45)	61.24 (51.48)	62.60 (52.28)
T ₇ : Seed soaking in cow dung slurry for 7 days	61.33 (51.52)	59.76 (50.61)	57.77 (49.45)	59.62 (50.53)
T ₈ : Control (No pre sowing seed treatment)	51.43 (45.81)	52.11 (46.19)	49.41 (44.64)	50.98 (45.55)
'F' test	Sig.	Sig.	Sig.	Sig.
SE (m) ±	1.16 (0.25)	1.08 (0.25)	1.22 (0.14)	1.36 (0.85)
CD at 5%	3.49 (0.74)	3.27 (0.76)	3.68 (0.42)	4.10 (2.55)

*Figures in parenthesis denote the arc sine transformation value

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