

## Effect of Different Chemicals on Seedling Growth and Biomass of Chironji (*Buchanania lanzan* Spreng.)

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### ABSTRACT

#### Keywords

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The seeds of Chironji (*Buchanania lanzan* Spreng.) were treated with H<sub>2</sub>SO<sub>4</sub> (5 percent), Mechanical scarification, GA<sub>3</sub> (200 and 300 ppm), KNO<sub>3</sub> (1 and 2 per cent), Thiourea (1 per cent), Biomix (50 g per kg seed), Cow urine (5 per cent) Cow dung slurry (5 per cent) and soaking in distilled water as control for 24 hours. The maximum seedling height (6.35, 15.21, and 36.78 cm), seedling diameter (0.21, 0.35 and 0.45 cm) and number of leaves per plant (4.90, 10.22, and 14.63 cm) was found in seeds treated with GA<sub>3</sub> 200 ppm treatment at 60,120 and 180 DAS respectively. Similarly, maximum leaf area (48.47 cm<sup>2</sup>) was also found in seeds treated with GA<sub>3</sub> 200 ppm treatment at 180 DAS. Maximum fresh weight of shoot and root (14.33 g and 8.22 g respectively), dry weight of shoot and root (8.10 g and 4.25 g respectively) and total biomass (12.83 g) was also noticed in seeds subjected to GA<sub>3</sub> 200 ppm treatment at the end of the experiment (180 DAS). Pre sowing treatment like GA<sub>3</sub> 200 ppm and mechanical scarification found equally better on growth and biomass parameters of Chironji seedlings.

### Introduction

Chironji or Charoli, (*Buchanania lanzan* Spreng.), a member of the family Anacardiaceae, originated in the Indian sub-continent, is an excellent tree of agro forestry. It assumes great significance due to its multifarious uses and capacity to withstand adverse climatic conditions. At present, it is growing under forest condition as an under exploited fruit and gives monetary reward to tribal community of the country. The oily kernels are the most important part and are used in preparation of puddings. The kernel is highly nutritious and rich in protein (25-30%) and yield sweet oil, which can be used to

substitute olive and almond oil. It is a medium size tree, up to 40-50 ft. height with a straight trunk. Trees have the alternate bearing nature as present in the mango. It flowers in the month of January- February and ripen in April-May.

Kernels are of very high value and fetch Rs. 800-1000 per kg in market. The tree is found growing as wild in the tropical deciduous forests of north, west and central India mostly in the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Rajasthan and

Maharashtra. In Gujarat, it is found mainly in Dang, Valsad, Vadodara and Dahod district. *Buchanania lanzan* being a vulnerable medicinal plant is included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources (IUCN).

This species has high socioeconomic value providing livelihood to tribal population of the area and has high potential as commercial horticulture species. Unfortunately, over-exploitation and indiscriminate harvesting (lopping and cutting) leading severe threat to it, hence urgent conservation efforts are required at all levels. Chironji seeds exhibits poor germination percentage even if exposed to favourable conditions of germination owing to seed dormancy. It may be due to morphological factors such as hard seed, thick testa or due to incorrect storage or handling (secondary dormancy). Such condition ultimately leads to reduced vegetative growth and biomass of chironji seedlings.

Thus, such seeds may require special treatments like stratification, scarification, soaking in water, growth regulators etc., for overcoming dormancy with better vegetative growth. Pre-sowing treatment with chemicals like GA<sub>3</sub>, KNO<sub>3</sub> and thiourea (Rajamanickam *et al.*, 2002) improve the seed germination and vegetative growth of chironji.

It is felt that chironji plantation can be conserved and increased by bringing more area under new plantations. Keeping these facts in mind and also to meet out the local demand of quality planting material of chironji, the research work on effect of different chemicals on seedling growth and biomass of chironji (*Buchanania lanzan* Spreng.) was conducted for developing a suitable technology facilitating easy multiplication, regeneration and conservation of this important species.

## Materials and Methods

The present investigation was carried out at Agriculture Experimental Station, Navsari Agricultural University, Paria, Valsad (Gujarat), India during 2016-2017. The experimental design was Completely Randomized Design (CRD). Eleven different treatments were imposed including control. Fresh seeds from fruits were collected from the forest area of Rajpipla region (Narmada, Gujarat). Healthy seeds of uniform size were selected and used for the experiment. Hundred seeds were used for each treatment, which was replicated thrice. The treatments were T<sub>1</sub>-H<sub>2</sub>SO<sub>4</sub> at 5% (10 min.), T<sub>2</sub>-Mechanical scarification (Breaking hard seed coat by hammering), T<sub>3</sub>-GA<sub>3</sub> at 200 ppm (24 hr), T<sub>4</sub>-GA<sub>3</sub> at 300 ppm (24 hr), T<sub>5</sub>-KNO<sub>3</sub> at 1% (24 hr), T<sub>6</sub>-KNO<sub>3</sub> at 2% (24 hr), T<sub>7</sub>-Thiourea at 1% (24 hr), T<sub>8</sub>-Biomix at 50gm/kg seed (24 hr), T<sub>9</sub>-Cow urine at 5% (24 hr), T<sub>10</sub>-Cow dung at 5% (24 hr), T<sub>11</sub>-Control (Water soaking for 24 hr). Before sowing all seeds were soaked in water for 24 hours and after that seeds were dipped in chemicals for 24 hour except seeds treated with concentrated H<sub>2</sub>SO<sub>4</sub> which were dipped for 10 minutes. Hard seed coats were broken down by hammering in seeds which are treated with mechanical scarification before sowing. Biomix solution is made up by mixing equal amount of Phosphate solubilising bacteria, *Azospirillum*, *Trichoderma viridae* and *Pseudomonas fluorescense*. After imposing treatments, the seeds were shade dried for 10 minutes and were sown in polythene bag containing media 1:1:1 ratio (Soil, FYM, Sand) at 1 cm depth and were kept in the poly house. The polythene bags were watered daily till final data were recorded. Observations were recorded monthly for vegetative parameters and 180 DAS for biomass parameters since the date of seed sowing. Fresh weight of shoot and root was taken on electronic balance. The

fresh weighed seedlings were used and they were placed in brown paper bags, properly labeled and dried in oven at 60° C and after stabilization of weight, this stabilized weight was recorded as a dry weight of shoot and root. The data collected from the five labelled seedlings in each treatment in a repetition were averaged and subjected to statistical analysis (Panse and Sukhatme).

## Results and Discussion

### Vegetative growth characters

Height, diameter, number of leaves and leaf area are the important parameters in judging quality of seedlings. All the treatments seem to play positive role (Table 1) in improving the vegetative growth characters of chironji under the present study. The maximum seedling height (6.35, 15.21, and 36.78 cm), seedling diameter (0.21, 0.35 and 0.45 cm) and number of leaves per plant (4.90, 10.22, and 14.63 cm) was found in seeds treated with T<sub>3</sub> (GA<sub>3</sub> at 200 ppm) treatment at 60,120 and 180 DAS respectively which was at par with T<sub>2</sub> (mechanical scarification) treatment recording seedling height (6.20, 14.32 and 35.26 cm), seedling diameter(0.19, 0.33 and 0.43 cm) and number of leaves per plant (4.67, 9.77 and 13.61 cm).Similarly, maximum leaf area (48.47 cm<sup>2</sup>) was also recorded in treatment T<sub>3</sub> (GA<sub>3</sub> at 200 ppm) followed by T<sub>2</sub> (mechanical scarification) treatment recording leaf area (48.37 cm<sup>2</sup>) at 180 days after sowing. Minimum seedling height (6.20, 14.32 and 35.26 cm), stem diameter (0.11, 0.17 and 0.24 cm), leaves per plant (2.21, 4.99 and 8.70 cm) and leaf area (18.12 cm<sup>2</sup>) was noticed in control.

The increased seedling height with GA<sub>3</sub> 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 (Sen *et al.*, 1990). The production of more number of leaves might be due to higher growth of seedlings and also due to activity of GA<sub>3</sub> at the apical meristem resulting in more synthesis of nucleoprotein responsible for increasing leaf initiation (Sen and Ghunti, 1976).

The maximum leaf area might be due to increase in leaf length and width, which ultimately increased in leaf area of the plant. Present findings are supported by (Sharma 2016) in chironji who revealed that the considerable plant height (31.33 cm) and number of leaves (13) was recorded by seed treatment with GA<sub>3</sub> at 200 ppm concentration. Similarly, Muralidhara *et al.*, (2015) also found better plant height (21.6 cm), more number of leaves (22.5) and leaf area (255.4 cm<sup>2</sup>) in mango stones treated with GA<sub>3</sub> at 200 ppm. Increase in different growth parameters by mechanical scarification is might be due to early germination and favorable growing conditions under scarification treatment (Sharma 2016). Centre of forest research and human resource development, Chhindwara (Annual Report, 2006) also reported that the seed of chironji treated mechanically by hammer gave better seedling growth.

### Biomass characters

The statistical analysed data presented in the (Table 1) revealed that the biomass of chironji seedlings was significantly affected by different chemicals at the end of the experiment (180 DAS). The results revealed that among different chemicals, maximum fresh weight of shoot and root (14.33 g and 8.22 g respectively), dry weight of shoot and root (8.10 g and 4.25 g respectively) and total biomass (12.83 g) was noticed in seeds subjected to T<sub>3</sub> (GA<sub>3</sub> at 200 ppm) treatment at the end of the experiment (180 DAS).

**Table.1** Effect of different chemicals on vegetative growth and biomass of chironji seedlings

Treatment	Seedling height (cm)			Stem diameter (cm)			Number of leaves/ plant			Leaf area (cm <sup>2</sup> )	Biomass (g)			
	60 DAS	120 DAS	180 DAS	60 DAS	120 DAS	180 DAS	60 DAS	120 DAS	180 DAS		Fresh weight		Dry weight	
											shoot (g)	root (g)	shoot (g)	root (g)
<b>T<sub>1</sub> - H<sub>2</sub>SO<sub>4</sub> @ 5%</b>	6.10	13.32	30.31	0.19	0.30	0.41	4.62	9.29	13.16	44.23	11.69	7.41	7.72	3.63
<b>T<sub>2</sub> - Mechanical scarification</b>	6.20	14.32	35.26	0.19	0.33	0.43	4.67	9.77	13.61	48.37	13.64	7.90	8.00	4.08
<b>T<sub>3</sub> - GA<sub>3</sub> @ 200 ppm</b>	6.35	15.21	36.78	0.21	0.35	0.45	4.90	10.22	14.63	48.47	14.33	8.22	8.10	4.25
<b>T<sub>4</sub> - GA<sub>3</sub> @ 300 ppm</b>	4.10	8.14	21.93	0.16	0.28	0.36	3.67	6.99	11.25	40.03	10.40	6.54	6.44	3.33
<b>T<sub>5</sub> - KNO<sub>3</sub> @ 1%</b>	4.07	8.32	21.33	0.17	0.27	0.34	2.96	6.07	10.51	38.50	10.35	5.84	5.78	3.13
<b>T<sub>6</sub> - KNO<sub>3</sub> @ 2%</b>	4.30	8.14	22.43	0.17	0.29	0.39	3.15	6.21	10.64	42.28	10.56	6.72	6.68	3.23
<b>T<sub>7</sub> - Thiourea @ 1%</b>	4.00	7.79	21.32	0.15	0.25	0.33	2.73	5.28	10.02	31.30	10.28	4.69	5.36	2.54
<b>T<sub>8</sub> - Biomix @ 50gm/kg seed</b>	4.00	7.79	20.15	0.15	0.24	0.31	2.70	5.21	10.00	27.68	10.29	4.62	5.34	2.50
<b>T<sub>9</sub> - Cow urine @ 5%</b>	4.25	8.14	22.39	0.17	0.28	0.36	3.12	6.17	10.64	38.38	10.34	6.63	6.40	3.36
<b>T<sub>10</sub> - Cow dung</b>	4.05	8.30	21.24	0.16	0.27	0.34	2.95	6.04	10.38	35.33	10.30	5.50	5.70	3.13
<b>T<sub>11</sub> - Control</b>	3.30	6.69	14.50	0.11	0.17	0.24	2.21	4.99	8.70	18.12	10.16	4.35	3.84	2.53
<b>S.Em±</b>	0.14	0.40	0.63	0.01	0.01	0.01	0.10	0.30	0.36	0.36	0.24	0.28	0.18	0.08
<b>C.D. at 5%</b>	0.40	1.16	1.83	0.02	0.02	0.03	0.30	0.88	1.07	1.07	0.70	0.82	0.53	0.24
<b>CV%</b>	5.10	7.11	4.45	5.68	3.85	4.10	5.21	7.47	5.63	1.68	3.69	7.83	4.96	4.37

T<sub>2</sub> (mechanical scarification) treatment was found to be at par with T<sub>3</sub> treatment recording fresh weight of shoot and root (13.64 and 7.90 g respectively) and dry weight of shoot and root (8.00 and 4.08 g respectively). The lowest fresh weight of shoot and root (10.16 and 4.35 g respectively), dry weight of shoot and root (3.84 and 2.53 g respectively) and total biomass (6.35 g) was found in control. 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 photosynthates within the seedling and hence, resulted in higher fresh and dry weight and total biomass. Thus, increased growth is a consequence of increased dry matter accumulation. These results were dully supported by Sharma (2016) in chironji. He revealed that the considerable improvement in fresh and dry weight of shoots (13.00 g and 8.18 g, respectively), fresh and dry weight of roots (7.93 g and 4.13 g, respectively) was recorded under GA<sub>3</sub> at 200 ppm. Similarly, Pampanna and Sulikeri (1999) in sapota observed the highest fresh and dry weight of seedling (1096.37 mg and 349.00 mg respectively) by treating seed with GA<sub>3</sub> at 400 ppm concentration. Results of present investigation showed favorable response of mechanical scarification on fresh and dry weight of shoot and root. It may be due to higher vegetative growth favored by early germination after scarification. The results are in close conformity with the findings of Sharma (2016) in chironji.

Based on the results of the present investigation entitled “Effect of different chemicals on seedling growth and biomass of chironji (*Buchanania lanzan* Spreng.)”, it can be concluded that the seeds soaked in water for 24 hrs followed by dipping in GA<sub>3</sub> at 200 ppm for 24 hours gave the optimum vegetative growth and biomass of chironji seedlings. Therefore, pre sowing treatment with gibberellic acid can be used for production of vigorous seedlings with higher biomass of chironji seedling.

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