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Effect of Pre-sowing seed treatments on root growth and survival of Ber (*Zizyphus mauritiana* L.)

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Abstract
The present investigation entitled "Effect of Pre-sowing seed treatments on root growth and survival of Ber (*Zizyphus mauritiana* L.)" the experiment was conducted at dry land horticulture field sirsod, College of Agriculture, Gwalior (M.P.) during 2018-19. The experiment was laid out in Completely Randomized Block Design with twelve treatments including control and replicated three times each. The twelve treatments consisting of three factors i.e. cow urine, water and plant growth regulators are T_0 (Control), T_1 (GA_3 @ 200 ppm for 24 hrs.), T_2 (GA_3 @ 300 ppm for 24 hrs.), T_3 (GA_3 @ 400 ppm for 24 hrs.), T_4 (NAA @ 50 ppm for 24 hrs.), T_5 (NAA @ 100 ppm for 24 hrs.), T_6 (NAA @ 200 ppm for 24 hrs.), T_7 (soaking in water for 24 hrs.), T_8 (soaking in water for 48 hrs.), T_9 (soaking in water for 72 hrs.), T_{10} (Cow urine for 24 hrs.) and T_{11} (Cow urine for 48 hrs.) T_{12} (Cow urine for 72 hrs.) respectively were tested under the experiment. The observations were recorded on different aspects of root growth and survival *viz*. diameter of tap root The result of experiment revealed that the GA_3 @ 400 ppm for 24 hr (T_3) significantly reduce the mortality of plants and improved other parameter like diameter of tap root (0.68 mm) at 120 days after sowing, length of secondary root (4.43, 5.40 and 6.80 cm) at 60, 90 and 120 days after sowing, fresh weight of root and shoot (2.44 and 38.00 g), dry weight of root and shoot (1.85 and 26.33 g), and survival percentage (72.33%) of seedling at 120 days.

Keywords: Pre-sowing, survival, *Zizyphus mauritiana* L.

Introduction
Ber (*Zizyphus mauritiana* L.), is called as poor man's apple. It is one of the most ancient and common fruit's indigenous to India, belongs to the family Rhamnaceae. Ber is popular due to high economic returns, low cost of cultivation wider adaptability and ability to withstand drought (Pareek, 1983 and Pareek, 1993) [7, 8]. Generally Ber seed are sown for root stock and growth are important constants in ber seeds. Many treatments like soaking in water, cow urine and PGRs are found suitable for enhancing the seed germination and growth of root stock.Pre-sowing treatments with Soaking in water, cow urine and plant growth regulators have a significant role on the seed germination, seed emergence, seedling height, number of leaves, number of roots and several % Ber crops. Soaking seeds in aqueous solutions of GA_3, NAA and soaking in water & cow urine has been found to induce early germination, enhance germination percentage and promote seedling growth in fruit crops like Mango, Custard apple, Karonda and Tamarind etc. Plant growth regulators like GA_3 and NAA enhance the germination, growth and survival of seedlings. GA_3 is used for weakening of the seed coat so that the radical of the seedling can break through the seed coat. The seed soaked in GA_3 and NAA for 24hour resulted in high germination and shoot length. The germination of seeds is also accelerated by soaking in cow urine and water for 24, 48 and 72 hours, in which germination is occurred more than doubled. Cow urine contains Iron, urea, Uric acid, estrogens and progesterone which affect the inhibitory responses to shoot growth and seedling vigour.

Material and Methods
The experiment was conducted at the dry land horticulture field sirsod, Department of Horticulture, College of Agriculture, Gwalior (M.P.). The experiment was laid out in Completely Randomized Design (CRD). All the treatments were replicated thrice. The experiment was under taken in order to Effect of Pre-sowing seed treatments on root growth and survival of Indian Ber (*Zizyphus mauritiana* L.). Selected well ripened healthy, disease free three kg fruits of Ber were taken and seeds were extracted carefully. Extracted seeds were washed in tap water and dried under shade for 24 hours. Poly bags of length 20 cm and diameter of 30 cm having 200 gauge thicknesses were used.

The bags were filled with the media comprised of soil + send + FYM in the ratio of 2:1:1, respectively. Required quantity 200, 300, 400 mg of GA_3 and 50, 100, 200 mg NAA were weighing with the help of an electronic balance. After weighing growth regulators were transferred separately into different glass beaker with the help of soft brush. For dissolving the growth regulators, a few drops of 95% ethyl alcohol were added just to dissolve the growth regulators. 1000 ml of distilled water was added in each concentration of growth regulators containing labelled beakers to make the solution of 200, 300, 400 ppm of GA_3 and 50, 100,200 ppm NAA. One seed were hand dipped at 2 cm depth in each poly bag. Watering and other operation were done as per requirements.

Table 1: Show the treatment Survival Length of secondary roots

Treatment	No. of secondary roots	Root/shoot ratio	Survival %	Length of secondary roots (cm)		
	120 DAS	120 DAS	120 DAS	60 DAS	90 DAS	120 DAS
T_0 - Control	19.33	0.30	55.33	3.37	4.07	4.17
T_1 - GA_3 @ 200 ppm for 24 hr.	28.67	0.28	70.67	4.07	4.97	6.30
T_2 - GA_3 @ 300 ppm for 24 hr.	29.00	0.28	71.67	4.27	5.10	6.40
T_3 - GA_3 @ 400 ppm for 24 hr.	30.67	0.27	72.33	4.43	5.40	6.80
T_4 - NAA @ 50 ppm for 24 hr.	25.00	0.29	67.67	3.90	4.73	5.55
T_5 - NAA @ 100 ppm for 24 hr.	25.33	0.29	67.33	3.97	4.77	5.60
T_6 - NAA @ 200 ppm for 24 hr.	26.33	0.29	68.67	4.07	4.87	6.00
T_7 - Soaking in water for 24 hr.	21.00	0.33	59.33	3.57	4.20	4.53
T_8 - Soaking in water for 48 hr.	22.00	0.31	60.33	3.67	4.37	4.67
T_9 -Soaking in water for 72 hr.	22.33	0.31	62.00	3.70	4.47	4.80
T_{10} - Soaking in cow urine for 24 hr.	23.00	0.31	65.00	3.80	4.53	5.00
T_{11} - Soaking in cow urine for 48 hr.	23.33	0.30	65.33	3.87	4.57	5.17
T_{12} - Soaking in cow urine for 72 hr.	24.00	0.30	65.67	3.87	4.63	5.22
S.Em	0.911	0.010	0.887	0.112	0.142	0.187
C.D. at 5% level	2.704	NS	2.634	0.334	0.421	0.556

Table 2: Different of Length of tap root (cm) Diameter of tap root (mm) Fresh weight of roots (g) Dry weight of roots (g)

Treatment	Length of tap root (cm)	Diameter of tap root (mm)	Fresh weight of roots (g)	Dry weight of roots (g)
	120 DAS	120 DAS	120 DAS	120 DAS
T_0 - Control	8.43	0.30	1.89	1.18
T_1 - GA_3 @ 200 ppm for 24 hr.	10.30	0.61	2.37	1.73
T_2 - GA_3 @ 300 ppm for 24 hr.	10.54	0.65	2.38	1.79
T_3 - GA_3 @ 400 ppm for 24 hr.	10.70	0.68	2.44	1.85
T_4 - NAA @ 50 ppm for 24 hr.	9.53	0.55	2.28	1.63
T_5 - NAA @ 100 ppm for 24 hr.	9.60	0.58	2.29	1.67
T_6 - NAA @ 200 ppm for 24 hr.	9.90	0.59	2.31	1.70
T_7 - Soaking in water for 24 hr.	8.67	0.36	1.99	1.28
T_8 - Soaking in water for 48 hr.	8.83	0.42	2.02	1.34
T_9 -Soaking in water for 72 hr.	8.97	0.44	2.02	1.48
T_{10} - Soaking in cow urine for 24 hr.	9.10	0.47	2.08	1.55
T_{11} - Soaking in cow urine for 48 hr.	9.37	0.47	2.14	1.58
T_{12} - Soaking in cow urine for 72 hr.	9.43	0.50	2.15	1.62
S.Em	0.307	0.019	0.062	0.038
C.D. at 5% level	0.911	0.055	0.184	0.113

Result and Discussion

The maximum diameter (0.68 mm) of tap root was observed in T_3 (GA_3 at 400 ppm for 24 hr) treatment. The minimum diameter (0.30 mm) of tap root was recorded under treatment T_0 (control). The beneficial effect of GA_3 was probably due to cell elongation and quicker multiplication of cells after the germination. These results are in conformity with the findings of Harshavardhan and Rajasekhar (2012) [5], Chiranjeevi *et al.* (2017) [2].

Application of NAA at 200 ppm for 24 hr recorded significantly higher diameter (0.59 mm) of tap root over their respective lower concentrations. These findings were supported by Choudhary and Chakrawar (1982) [3].

Cow urine for 72 hr recorded significantly higher diameter (0.50 mm) of tap root over Cow urine and water soaking at different time. These findings were supported by Desai *et al.* (2017) [4].

The maximum secondary roots length at 60, 90 and 120 DAS (4.43, 5.40 and 6.80 cm) was recorded under T_3 (GA_3 at 400 ppm for 24 hr) which was significantly superior over rest of the treatments. The minimum secondary roots length (3.37, 4.07 and 4.17 cm) was recorded under control T_0. According to these results we conclude that gibberellins are well known cell elongation, thereby leading the increase in secondary roots length. These findings are supported by Munde and Gajbhiye (2010) [6].

NAA at various concentrations showed significant effect, the maximum length (4.07, 4.87 and 6.00 cm) of secondary roots at 60, 90 and 120 DAS in T_6 (NAA @ 200 ppm for 24 hr) was recorded.

At different time of soaking of Cow urine and water the maximum length of secondary root (3.87, 4.63 and 5.22 cm) was recorded in T_{12} (Cow Urine for 72 hr). These findings were closely related to Desai *et al.* (2017) [4].

The maximum tap root length (10.70 cm) was recorded under T_3 (GA_3 400 ppm for 24 hr) which was significantly superior over rest of the treatments on other side minimum (8.43 cm) root length of was recorded under control T_0 120 days after sowing. It revealed that maximum length and more number of roots observed under the treatments because it absorbed more

food material and might be increased the physiological activities of seedlings, which was essential for cell division or cell enlargement or both, because growth of the plant occurs by two processes i.e. cell division by mitosis which add new cells and elongation of already existing cells by enlargement of the vacuoles. This finding was reported by Ramteke V. *et al.* (2015) [9].

The different concentration of NAA showed significant effect on root length, the maximum tap root length (9.90 cm) at 120 DAS was recorded in T_6 (NAA @ 200 ppm for 24 hr) was recorded.

In various soaking time of cow urine and water, the highest root length (9.43 cm) at 120 DAS was observed in T_{12} (Cow Urine for 72 hr). These finding are supported by Shinde V. V. and Malshe K. V. (2015) [10].

Maximum number of secondary roots (30.67) per seedling was recorded under T_3 (GA_3 400 ppm for 24 hr) whereas, minimum number of secondary root (19.33) was recorded under control T_0. Hence, vigorous root growth due to GA_3 might have resulted in more production of photosynthesis and their translocation through phloem to the root zone, which might be responsible for improving the root growth. Similar findings were seen by Suradinata Y.R. *et al.* (2017) [11].

Among the different concentration of NAA showed significant effect on number of secondary roots per seedling at 120 DAS, the maximum number of secondary roots (26.33) per seedling at 120 DAS T_6 (NAA @ 200 ppm for 24 hr) treatment were found superior under NAA.

The difference in number of secondary roots per seedling at 120 DAS under various time of soaking of Cow urine and water, the maximum number of secondary roots (24.00) per seedling was recorded under T_{12} (Cow urine for 72 hr) roots. Similar findings were reported by Shinde V. V. and Malshe K. V. (2015) [10].

The maximum Root-shoot Ratio of seedlings (0.33) was recorded under T_7 (Soaking in water for 24 hr.) but it was significantly at par over rest of treatments while minimum Root-shoot Ratio (.0.27) seedling was recorded under T_3 (GA_3 @ 400 ppm for 24 hr) at 120 days after seed sowing. Similar findings were reported by Shinde V. V. and Malshe K. V. (2015) [10].

Maximum fresh weight of root (2.44 g) was recorded under T_3 (GA_3 400 ppm for 24 hr) whereas, minimum fresh weight of root (1.89 g) was recorded under control T_0. Hence, fresh weight of root due to GA_3 might have resulted in more production of photosynthesis, which might be responsible for improving the fresh weight of root.

Among the different concentration of NAA showed significant effect on fresh weight of root (2.31g) at 120 DAS, the fresh weight of root at 120 DAS T_6 (NAA @ 200 ppm for 24 hr) treatment were found superior under NAA.

The difference in fresh weight of root (2.15 g) at 120 DAS under various time of soaking of Cow urine and water, the maximum fresh weight of root was recorded under T_{12} (Cow urine for 72 hr) roots.

Maximum dry weight of root (1.85 g) was recorded under T_3 (GA_3 400 ppm for 24 hr) whereas, minimum dry weight of root (1.18 g) was recorded under control T_0. Hence, dry weight of root due to GA_3 might have resulted in more production of photosynthesis, which might be responsible for improving the dry weight of root.

Among the different concentration of NAA showed significant effect on dry weight of shoot (1.70 g) at 120 DAS, the dry weight of root at 120 DAS T_6 (NAA @ 200 ppm for 24 hr) treatment were found superior under NAA.

The difference in dry weight of root at 120 DAS under various time of soaking of Cow urine and water, the maximum dry weight (1.62 g) of root was recorded under T_{12} (Cow urine for 72 hr) roots. Similar findings were reported by Shinde V. V. and Malshe K. V. (2015) [10].

Maximum survival percentage (72.33%) of seedlings was recorded under T_3 (GA_3 400 ppm for 24 hr) and found superior over rest of treatments while minimum survival percentage (55.33 %) of seedling was recorded under T_0 at 120 days after seed sowing. This result has been supported by Ak *et al.* (1995) [1], Ramteke V. *et al.* (2015) [9] revealed that by treating with GA_3 at 400 ppm are well known for better germination, seedling growth and vigour are highly suitable for commercial cultivation and their germination and seedling health can be improved.

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