



## Research Article

# Effect of pre-harvest spray of PGRs, calcium and cow urine on yield and quality of aonla fruit (*Emblica officinalis* Gaertn.)

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## Abstract

Aonla or Indian gooseberry is an indigenous fruit to Indian subcontinents, which is regarded as amritphal. It is cultivated in India in 95000 ha area out of which more than 70% area is covered by cultivar NA-7. In north India, 30-80 percent of fruits are affected by brown spots. Such type of affected fruits has poor marketability and is not very suitable for processing purposes. Therefore, an investigation was carried out on the effect of the pre-harvest spray of PGRs, calcium, and cow urine. The experiment was laid out in a randomized block design (RBD) with three replications and nine treatments i.e., T<sub>1</sub>- control, T<sub>2</sub>- Salicylic Acid @ 2 mmol + Mulch, T<sub>3</sub>- Calcium Nitrate (CN) @1% + Mulch, T<sub>4</sub>- Benzyl Adenine (BA) @75 ppm+ Mulch, T<sub>5</sub>- Salicylic acid @2 mmol + BA (Benzyl Adenine) @75ppm + Mulch, T<sub>6</sub>- Salicylic acid @2 mmol + Calcium nitrate @1% + Mulch, T<sub>7</sub>- Calcium nitrate @1% + BA (Benzyl Adenine) @75ppm + Mulch, T<sub>8</sub>- Cow Urine @35% + Mulch, T<sub>9</sub>- Mulch on aonla fruit at the Main Horticulture Experiment Station, A.N.D.U.A and T, Kumarganj, Ayodhya during the year 2021-22. These treatments were sprayed twice on the aonla tree, in order to standardize the best pre-harvest treatment for improving the yield and quality of aonla fruits. Maximum fruits length (3.64cm), width (3.58cm), fruit weight (33.32g), fruit volume (30.23cm<sup>3</sup>), stone weight (2.18g), stone pulp ratios (14.62), fruit firmness (12.75 kg/cm<sup>3</sup>), yield (34.96 kg/tree), T.S.S. (10.33Brix<sup>0</sup>), total sugars (7.89%), reducing sugar (4.19%) and non-reducing sugars (3.70%), ascorbic acid (477mg/100g) and minimum blemished fruit (13%), and acidity (1.85%) were found with the treatment T<sub>8</sub>- Cow urine + mulch followed by T<sub>5</sub>- Salicylic acid + benzyl adenine + mulch.

**Keywords** aonla, benzyl adenine, calcium nitrate, cow urine, mulch, salicylic acid

## Introduction

Aonla (*Emblica officinalis* Gaertn), commonly known as Indian gooseberry, is a prominent fruit crop native to India and cultivated across various agro-climatic regions in the country [1]. Aonla fruits are fleshy, yellowish green in colour having six vague perpendicular furrows enclosing seeds. It is considered a sacred tree and referred to as Amritphal in ancient literature. Apart from India, aonla trees are also found in natural forests in various countries, including Cuba, USA,

Received: 01 May 2023  
Accepted: 11 September 2023  
Online: 18 September 2023

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Emer Life Sci Res (2023) 9(2): 131-136

E-ISSN: 2395-6658  
P-ISSN: 2395-664X

DOI: <https://doi.org/10.31783/elsr.2023.92131136>



Pakistan, Sri Lanka, Malaysia, China, Java, and the West Indies [2]. It is used in Ayurvedic medicine to make Triphala and Chyavanprash. Due to its hardy nature, high productivity, nutritional and therapeutic values, and its suitability for various value-added products, aonla has become an important fruit crop in the 21st century [3]. The fruit is effective against several ailments and can be used to create various value-added products. Additionally, aonla powder, made from the fruit, is considered superior to synthetic vitamin C in treating deficiencies. Nutritional, commercial, and medicinal significance of aonla fruit makes it popular all over the world [4]. Aonla is an excellent source of ascorbic acid (300-900 mg/100 g), amino acid and minerals along with phytochemicals such as polyphenols, tannins, emblicol, linoleic acid, corilagin, phyllembin and rutin [5-8].

In India, aonla is cultivated in the 95,000-hectare area with 1107000 MT production (NHB2019-20). Among the commercially grown varieties, the cultivar 'NA-7' is the most popular variety of aonla which covers more than 70 percent area of the total cultivated area of our country. Narendra Aonla-7 is a mid-season, precocious, and prolific bearer. Fruits are medium to large, semi-translucent, and free from necrosis. In north India, blemished fruit is a serious problem and such types of fruits have poor market quality and are not very suitable for processing. Fruit quality is maintained in part by calcium, and calcium treatments enhance vitamin C content, prevent rotting, and maintain fruit firmness. Cow urine has antifungal properties which prevent many fungal diseases and also has micronutrients such as calcium, iron, zinc, magnesium, and potassium. Salicylic acid is best known as plant growth hormone for its different physiological responses, it encourages plant processes like germination of seeds, vegetative growth, photosynthesis, respiration, thermogenesis, flowering, seed production, and the reduction of biotic and abiotic stresses. Benzyl adenine is a first-generation synthetic cytokinin that induces responses in plant growth and development, causing blossoms to appear and promoting fruit richness by stimulating division. Mulching helps to manage weeds, prevent soil erosion, reduce fertilizer leaching, increase soil productivity, and improve the production and quality of field and fruit crops. It also prevents water loss through evaporation. However, Pre-harvest spray of PGRs, calcium, and cow urine on yield and quality of fruit is not well documented. Hence a study was initiated to evaluate the effect of PGRs, calcium, and cow urine on yield and quality of fruit.

## Methodology

The present study "Pre-harvest spray of PGRs, calcium, and cow urine on yield and quality of aonla fruit (*Emblica officinalis* Gaertn.) cv. NA-7" was carried out on thirty-year-old aonla tree cultivar NA-7 during the years 2021- 2022 at the Main Experiment Station, Horticulture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India. The study was conducted in (RBD) Randomized Block Design with nine treatments viz., T<sub>1</sub>- control, T<sub>2</sub>- Salicylic Acid @2 mmol + Mulch, T<sub>3</sub>- Calcium Nitrate (CN) @1% + Mulch, T<sub>4</sub>- Benzyl Adenine (BA) @75 ppm+ Mulch, T<sub>5</sub>- Salicylic acid @2 mmol + BA (Benzyl Adenine) @75ppm + Mulch, T<sub>6</sub>- Salicylic acid @2 mmol + Calcium nitrate @1% + Mulch, T<sub>7</sub>- Calcium nitrate @1% + BA (Benzyl Adenine) @75ppm + Mulch, T<sub>8</sub>- Cow Urine @35% + Mulch, T<sub>9</sub>- Mulch, was replicated thrice. The percentage of blemished fruits were calculated, taken hundred fruits randomly and separated blemished fruits and then counted. Yield data was observed after manually harvesting of all fruits from the tree. The total weight of the fruits per tree was taken and expressed in kilograms (kg). After harvesting random sample of five fruits from each treatment was taken and fresh weight, length, width, volume, stone weight, and stone pulp ratio of fruit was measured/calculated. Fruit firmness was measured using a pressure tester and a 5/16 plunger in (kg/cm<sup>2</sup>) and two readings were taken at two opposite sides of the fruits. Acidity was determined by the sample titrated against N/10 NaOH method [9]. T.S.S. of fruits were taken with a hand refractometer. Ascorbic acid of fruit was determined by using 2, 6-dichlorophenol indophenol dye, method [9]. Sugars were estimated by the Somogyi method [10].



**Statistical analysis of experimental data**

The experimental data recorded on various parameters during the investigation were analyzed statistically using the method of analysis of variance (ANOVA) for Randomized Block Design (RBD) by Yates and Mather [11]. Whenever the F' test was found significant for comparing the means of two treatments, critical differences (C.D. at 5%) were worked out.

**Results and Discussion**

**Physical parameters of fruit**

The data on Fruit weight (g), Fruit length (cm), Fruit width (cm), Fruit volume (cm<sup>3</sup>), Fruit firmness (kg/cm<sup>2</sup>), Blemished fruit (%), and Fruit yield were observed significantly maximum as compared to control. Whereas, stone weight (g) and flesh: stone ratio were found to be non-significant and are given in the Table 1.

**Table 1. Effect of pre-harvest spray of PGRs, calcium, and cow urine on yield and physical parameters of aonla Cv. NA-7**

Treatments	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Fruit volume (cm <sup>3</sup> )	Stone weight (g)	Fruit pulp: stone ratio	Fruit firmness (kg/cm <sup>2</sup> ).	Blemished fruit (%)	Fruit yield (kg/tree)
T <sub>1</sub>	3.22	3.19	26.12	23.79	1.85	14.34	12.36	69.33	22.00
T <sub>2</sub>	3.30	3.26	27.62	25.52	1.85	14.35	12.74	35.00	24.21
T <sub>3</sub>	3.32	3.28	28.80	26.14	1.87	14.35	12.98	32.33	25.98
T <sub>4</sub>	3.38	3.33	29.52	26.84	1.91	14.38	12.73	21.00	26.99
T <sub>5</sub>	3.53	3.48	30.62	28.32	2.00	14.47	12.77	34.00	29.32
T <sub>6</sub>	3.43	3.39	30.61	28.00	1.97	14.43	12.94	18.66	29.23
T <sub>7</sub>	3.42	3.36	29.53	26.92	1.92	14.42	12.79	17.63	28.26
T <sub>8</sub>	3.64	3.58	33.32	30.23	2.18	14.62	12.75	13.00	34.96
T <sub>9</sub>	3.37	3.31	28.81	26.22	1.88	14.31	12.71	25.00	26.30
<b>SEm±</b>	<b>0.06</b>	<b>0.03</b>	<b>0.34</b>	<b>0.07</b>	-	-	<b>0.14</b>	<b>0.51</b>	<b>0.35</b>
<b>CD at 5%</b>	<b>0.17</b>	<b>0.10</b>	<b>1.01</b>	<b>0.21</b>	<b>NS</b>	<b>NS</b>	<b>0.43</b>	<b>1.52</b>	<b>1.05</b>

\*NS: - non-significant

Experimental data revealed that all the pre-harvest treatments increased the fruit length and width of fruits were found significantly superior compared to the control. The maximum fruit length of 3.64 cm and width of 3.58 cm were noticed in plants, treated with T<sub>8</sub> (Cow Urine @35% + Mulch) which was found at par with treatment T<sub>5</sub> (salicylic acid and benzyl adenine + mulch). The maximum Fruit weight was recorded 33.32g in treatment T<sub>8</sub> (Cow Urine @35% + Mulch) which was significantly superior among all the treatments. Plants treated with T<sub>8</sub> (Cow Urine @35% + Mulch) contain significantly the highest fruits volume 30.23cm<sup>3</sup>. The Maximum stone weight and pulp stone ratio was found in fruit plants treated with T<sub>8</sub> (Cow Urine @35% + Mulch) with a value of 2.18g and 14.62 respectively which was found to be non-significant. The maximum fruit firmness was recorded with treatment T<sub>6</sub> (salicylic acid+ calcium nitrate +mulch) but the difference between firmness up to all the treatments was recorded as non-significant. A very less number of blemished fruit (13.00%) was recorded with treatment T<sub>8</sub> (Cow Urine @35% + Mulch) which was significantly superior among all the treatments. The significantly highest yield (34.96 kg/tree) was recorded with treatment T<sub>8</sub> followed by T<sub>5</sub> (29.32 kg/tree). Fruits treated with cow urine + mulch were found superior in all the physical parameters along with the highest yield and very less number of blemished fruits. It may be due to the presence of urea, minerals, salts, hormones, and enzymes in cow urine.

According to Randhawa and Sharma [12] cow urine contains nitrogen, manganese, sulphur, potassium, amino acids, cytokines, lactose, calcium, phosphorus, carbonic acid, carbon dioxide, and potash but the literature on the effect of cow urine on these characters are limited. Cow urine treated aonla trees fruits were less affected by brown spots this may be due to the presence of antifungal/



antimicrobial compounds like sulfur, sodium, manganese, iron, enzymes, and chlorine in the cow urine [13]. Mulching plays a very crucial role to conserve soil moisture, increase the nutrient status of soil, and remove the residual effects of pesticides, fertilizer, and heavy metals [14]. Mulch plays a significant role in maintaining soil temperature and aiding microbial activity, which helps convert complex fertilizers into readily available forms for plants. This leads to improved fruit quality and increased yield. A similar response was also observed in Methi and Bhindi [15]. Fruit firmness is recorded highest in the fruits treated with salicylic acid and calcium nitrate. Fruit firmness is depended on the amount of pectin in fruit flesh which is available in the form of calcium pectate. Calcium is a constituent of calcium pectate which provides strengthens in fruit. Similar results were also reported in guava [16], in apple cv. Jonathan [17] in apple cv. Jonagold. [18], in Chinese jujube [19], in peach cv. Cresthaven [20] in peach cv. Flordaking [21].

### Chemical parameters of fruit

The data on total soluble solid (<sup>o</sup>Brix), acidity (%), ascorbic acid (mg/100g pulp), Sugar (reducing sugars (%), non-reducing sugar (%), and total sugars (%) of fruits were observed significantly maximum and lowest amount of acidity are presented in Table 2.

**Table 2. Effect of pre-harvest of PGRs, calcium and cow urine on chemical parameters of aonla Cv. NA-7**

Treatments	T.S.S ( <sup>o</sup> Brix)	Acidity (%)	Ascorbic Acid (mg/100g)	Reducing sugars (%)	Non-reducing sugar (%)	Total sugars (%)
T <sub>1</sub>	8.86	2.42	450.00	3.41	3.16	6.57
T <sub>2</sub>	9.33	1.91	455.33	3.56	3.16	6.72
T <sub>3</sub>	9.43	2.22	452.33	3.61	3.18	6.79
T <sub>4</sub>	9.66	2.23	455.33	3.66	3.01	6.87
T <sub>5</sub>	10.26	1.92	470.66	3.95	3.50	7.45
T <sub>6</sub>	9.73	2.18	467.66	3.90	3.41	7.31
T <sub>7</sub>	9.33	1.94	462.33	3.57	3.15	6.72
T <sub>8</sub>	10.33	1.85	477.00	4.19	3.70	7.89
T <sub>9</sub>	9.86	2.25	467.66	3.75	3.27	7.02
<b>SEm±</b>	<b>0.4</b>	<b>0.06</b>	<b>1.54</b>	<b>0.46</b>	<b>0.13</b>	<b>0.16</b>
<b>C.D at 5%</b>	<b>0.72</b>	<b>0.19</b>	<b>4.63</b>	<b>1.36</b>	<b>0.39</b>	<b>0.48</b>

Fruits treated with treatment T<sub>8</sub> (Cow Urine @35% + Mulch) having maximum T.S.S. (10.33%), ascorbic acid (477mg/100g), sugars (reducing (4.19 %,) non-reducing (3.70%) and total sugars (7.89%) and minimum acidity (1.98%) were recorded significantly. Total soluble solids (TSS) in fruits primarily consist of carbohydrates, organic acids, proteins, fats, and minerals. Cow urine contains urea, minerals, salts, hormones, and enzymes, which can contribute to the synthesis of carbohydrates, leading to an increase in TSS levels in fruits [22]. Fruits with lower acidity can be attributed to the presence of potassium and nitrogen in cow urine. These elements exhibit a negative correlation with titratable acidity in fruits [23-24]. Fruits treated with cow urine having maximum vitamin C may be due to the presence of nutrients and plant hormones in the cow urine may help in the synthesis of ascorbic acid. These hormones and nutrients may increase the sugar galactose. Fruits were treated with cow urine having maximum total sugars because cow urine contains potassium, nitrogen, and hormones that help in the synthesis of sugar in the fruits [22]. Among the treatments, mulching continues to play a significant role in enhancing fruit quality. By creating a cozy



environment for plant roots, mulching effectively prevents soil compaction. This leads to healthy root growth, ultimately resulting in improved fruit quality.

## Conclusion

All the pre-harvest treatments were found better than control in improving fruit yield and quality of fruits. Pre-harvest treatment with T<sub>8</sub> (Cow Urine @35% + Mulch) was found better to increase the yield and fruit quality with respect to fruit size, weight, TSS, ascorbic acid, reducing sugar, non-reducing sugar, total sugars, and less number of spotted fruits and highest firmness in fruit treated with T<sub>6</sub> (salicylic acid + calcium nitrate). Therefore, the combination of pre-harvest treatment with T<sub>8</sub> (Cow Urine @35% + Mulch) is suggested to aonla growers and traders for more income with quality production of aonla fruits.

## Acknowledgements

The authors are highly thankful to the HOD of Fruit Science, ANDUAT, Kumarganj, Ayodhya for providing lab facilities and other resources to conduct the study.

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