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Effect of foliar spray of nutrients and plant growth regulators on yield, quality and physiochemical characteristics in Aonla cv NA 10

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Abstract

Aonla (*Emblica officinalis Gaertn*) is an important crop indigenes to Indian subcontinent which is used in alternative medicine, health food and herbal products. Nutrients and plant growth regulators play a vital role in growth, development, fruit retention, yield and quality. A field experiment was conducted on Aonla (*Emblica officinalis Gaertn*) at KVK farm Bhilwara, MPUAT, Udaipur. The treatment comprised Urea (0.2%), Borax (0.5%), Vermiwash (3 ml/l), NAA (20ppm), NAA (40ppm) and their combination, Urea (0.2%) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (20 ppm) and Urea (0.2 %) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (40 ppm) and water spray as control. The results revealed that spray of Urea (0.2%) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (20 ppm) was the best to increase the fruit retention followed by Urea (0.2 %) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (40 ppm) which results in the highest fruit yield. The significant differences were observed for fruit retention, yield, fruit weight, total soluble solids, total sugars and ascorbic acid among all the treatments. The shelf life also increased and found significant among all the treatments whereas, the internal fruit necrosis was significantly decreased in treated samples as compared to the control. Hence, these treatments were useful to improved nutritional quality and storage life of aonla fruit.

Keywords: Aonla, vermiwash, nutrients, fruit yield, fruit quality, borax

Introduction

Aonla or Indian gooseberry (*Emblica officinalis Gaertn*) is one of the important indigenous fruit of India which belongs to family 'Euphorbiaceae' subfamily Phyllanthoidae is native of Tropical South East Asia particularly in Central and Southern India Emblica known by several vernacular names such as Amla, Dhartiphala, Amolphal, Amlay in different parts of the country. The fruit is known for Kayakalp (Restore health and vitality) and has been recognized as 'Amrit Phael' in ancient Indian mythological literatures like Vedas, Puran, Ramayan and Charak Samhita etc. Its commercial cultivation is common in India particularly in Rajasthan, Uttar Pradesh, Haryana, Punjab and Gujarat etc. In India it is estimated that aonla is cultivated in about 108 thousand ha area with production of 1286 thousand MT. In Rajasthan, it is estimated that aonla is cultivated in about 1603 ha area with production of 13747 MT. (Anonymous, 2017)

One of the major constraints of aonla cultivation in this zone is occurrence of heavy fruit drop. Although fruit drop in aonla is a common phenomenon (Allemullah and Ram, 1990) [2] but it continued till harvest resulting low yield of mature fruits. To check the premature fruit drop in aonla foliar feeding has been used as a means of spraying supplemental dose of nutrients, plant hormones, stimulants and other beneficial substance. The application of PGR can provide significant economic advantages to growers when used in appropriate situations as these have proven effective in stimulating a number of desired responses such as increase in fruit size and fruits maturity. Boron (B) application is also very important for optimal plant growth, physiological and biochemical pathway in aonla cultivation. Hence to improve the yield and fruit quality, the present experiment was undertaken to find out the effect of foliar spray of nutrients and plant growth regulators on yield, quality and Physico-chemical characteristics in Aonla cv NA-10.

Material and Methods

The experiment entitled "Effect of foliar spray of nutrients and plant growth regulators on yield, quality and Physico-chemical characteristics in Aonla cv.

NA-10" was carried out on 13 year old budded plants of aonla planted at a spacing of 6m×6m during 2013-14 and 2014-15 at the Krishi Vigyan Kendra, Bhilwara, MPUAT, Udaipur. The soil of the experimental site was sandy loam having soil pH 8.1. The experiment comprised eight treatments viz., T₁ – Urea (0.2%), T₂ – Borax (0.5%), T₃ – Vermiwash (3ml /l), T₄ – NAA (20 ppm), T₅ – NAA (40 ppm), T₆ – (Urea 0.2% + Borox – 0.5% + Vermiwash – 3 ml /l + NAA – 20 ppm) T₇ – (Urea 0.2% + Borax 0.5% + Vermiwash – 3ml/l + NAA- 40 ppm) and T₈ – water spray (Control). The treatments were sprayed on plants after sunset three times i.e. on 25th May, 5th July and 5th August of 2013-14 and 2014-15. The experiment was laid out in a Randomized Block Design with four replications. The plants were fertilized with 40 Kg FYM, 200 g N, 100 g P₂O₅ and 100 g K₂O/plant/year. Observations were recorded on per cent fruit retention, fruit weight, yield, physiological loss in weight, and physico-chemical composition of fruits and internal fruit necrosis. The acidity, total sugar and ascorbic acid content were estimated as per the methods suggested by A.O.A.C. (1990) [1]. For recording fruit retention, 4 shoots/plant in four directions were tagged and counted when the fruits were pea size and final counting was made at maturity and thereby percentage of retention was calculated.

Result and Discussion

It is evident from the data presented in Table 1 that fruit drop in aonla is severe in sandy loam soil and only 2.5% fruit retention was observed from the control plants. It was also observed that fruit drop in aonla was mainly associated with the hormonal imbalances as treatment T₆ (Urea -0.2% + Borox – 0.5% + Vermiwash – 3 ml /l + NAA – 20 ppm) gave maximum fruit retention of 30.2% follow by treatment T₇, which resulted in second best fruit retention (26.7%). Singh *et al.* (2007) [13] also observed reduced fruit drop in aonla with NAA 10 ppm at Faizabad (U.P.). Beneficial effect of NAA application in reducing fruit drop may be explained from the fact that it maintains the on-going physiological and biochemical process of inhibition of abscission (Tomaszewska and Tomaszewska, 1970) [16], Besides, hormone and micro nutrient were observed to be one of the controlling factors for improving fruit retention in aonla. Boron also gave the better result in aonla controlling fruit drop. It is well known that boron play a significant role in carbohydrate transport and various physiological processes like nitrogen metabolism, active salt absorption, hormone metabolism, fat metabolism etc. within the plant (Nason and McElroy, 1963) [8]. It was further observed that vermi wash application a byproduct of vermicompost, showed a beneficial effect on fruit retentions (8.7 %) in aonla. Beneficial effect of vermiwash in fruit retention may be explained as it contain most of the macro and micronutrients, hormone enzymes etc. in minute quantity which may helped to activate and regulate many physiological processes within the plant. It was interestingly noted that nitrogen application in the form of urea had no positive role in fruit retention, although beneficial effect of urea spray on fruit retention and yield was observed in many fruit crops like Mango (Sharma *et al.*, 1977) [9], Guava (Arora and Singh, 1970) [3], and hew (Ghosh and Chatterjee, 1990) [7].

Fruit yield in aonla was directly co-related with the fruit retention under different treatments (Table 1). The highest yield of 62.1 kg/plant was recorded in treatment T₆ (Urea - 0.2% + Borox – 0.5% + Vermiwash – 3 ml /l + NAA 20 ppm) followed by treatment T₇ (58.3 kg/plant) and they were statistically at par among themselves in fruit production. The

highest fruit yield in NAA treated plant was due to highest fruit retention as compared to other treatments. Boron and Vermiwash application also showed better result in yield improvement in aonla as compared to control. No response of urea was observed with regard to their effect on yield enhancement as compared to control. From this investigation, it is clearly understand that application of micronutrients and hormones like NAA are needed in addition to macro nutrients during fruit setting and development process for obtaining a good harvest of aonla.

Fruit weight was recorded significantly higher with treatment T₆ (31.3 g). It was noted that all the treatments i.e. macro and micronutrients and plant growth regulators sprayed helped to increase fruit weight significantly as compared to control.

The different nutrient and plant growth regulators exhibited significant influence on physiological loss in weight of aonla fruits. Among the different treatments, treatments T₆ (Urea - 0.2% + Borax 0.5% + Vermiwash 3 ml/l + NAA 20 ppm) was found significantly superior over the rest of the treatments and lowest physiological loss in weight after 15th days storage period for aonla fruit. The reduction of weight loss in the fruit treated with treatment T₆ might be due to its anti senescence action. This resulted into decrease in the tissue permeability and thereby reduces the rate of water loss. The reduced PLW in fruits during storage is mainly due to reduced rate of transpiration and respiration. The results are also in accordance with the finding of Srivastava and Jain (2006) [15] in mango, Yadav and Shukla (2009) [18] in aonla fruits.

The total soluble solids were found significantly higher in treatment T₆ (9.5⁰B) which was at par with T₇ (9.3⁰B). The minimum total soluble solids (Table 1) was found significantly in treatments T₈ (7.99⁰B). The increase in total soluble solids might be due to rapid transformation of complex carbohydrates into soluble sugars and also fast mobilization of metabolites from source to sink under influence of growth substances. The total soluble sugars was found significantly higher in treatment T₆ (5.2 %) which was followed by T₇ (5.1 %), T₄ and T₂ (4.9 %). This might be due to activation of enzymes which affect the physiological processes, which in turn hydrolyzed the starch and helps in metabolic activity during the change in available starch into sugar and soluble solid content. NAA had shown significant increase in the total sugar of aonla fruits and this might be due to synthesis of auxin in plants, it increased the physiological activities. The results are also in accordance with the finding of Bhati and Yadav (2004) [4] in *ber*, Ghosh *et al.* (2009), Srivastava *et al.* (2009) [14], Yadav and Shukla *et al.* (2009) [18] in aonla. Fruit acidity was not significantly improved due to different treatments.

The ascorbic acid content was significantly better in all the treated plants as compared to control. The ascorbic acid content in fruit was recorded as the highest in fruits in treatment T₆ (901.89 mg / 100 g), which was closely followed by T₇ (896.39 mg/100 g) and lowest in control (815.58 mg/100 g). The increase in ascorbic acid might be due to catalytic influence of growth regulators on its biosynthesis from its precursor glucose-6- phosphates throughout the development of fruits which is thought to be precursor of vitamin-C. The application of NAA and boron may have favorably influenced the metabolic activities possibly due to their increased endogenous level which increased the ascorbic acid of aonla. The results are also in accordance with the findings of Srivastava and Jain (2006) [15] in mango, Shukla *et al.* (2011) [9, 10], Srivastava *et al.* (2009) [14] and Yadav and

Shukla (2009) [18] in aonla fruits.

The shelf life of aonla fruits was extended up to 16 days at room temperature when the treatment was given in combination of nutrients and plant growth regulator i.e. Urea - 0.2% + Borox - 0.5% + Vermiwash - 3 ml/l + NAA 20 ppm. It might be due to antagonistic effect of GA₃ which inhibit ethylene production and delayed the conversion of starch to sugar. The results are also in view with the findings of Srivastava and Jain (2006) [15] in mango. Yadav and Shukla (2009) [18] in aonla.

The physiological disorders like internal necrosis are very dangerous for the aonla cultivation. The minimum internal fruit necrosis (4.02) was measured with foliar application of treatment T₆ (Urea - 0.2% + Borax - 0.5% + Vermiwash- (3 ml/l) + NAA-20 ppm) and maximum internal fruit necrosis was recorded under control (Table 2). This may be due to the fact that boron has significant role in mobilization of food

material from source to sink as a result accumulate the photosynthates which control fruit necrosis. The results are also in line with the findings of Singh *et al.* (2011) [12] in aonla and Ghosh and Besra (2000) [5] in sweet orange.

From the foregoing discussion and the results obtained from this investigation it can be concluded that foliar spray of Urea - 0.2% + Boron - 0.5% + Vermiwash - 3 ml/l + NAA - 20 ppm in aonla fruits found beneficial for yield and better fruit quality i.e. increased in fruit retention fruit weight, yield, total soluble solids, total soluble sugars, ascorbic acid and decreased in acidity and internal fruit necrosis. Significantly minimum physiological loss in weight and maximum shelf - life of fruit was also found with same treatment.

Thus, it can be concluded that spraying of Urea - 0.2% + Borax - 0.5% + Vermiwash - 3 ml/l + NAA - 20 ppm was useful to improved nutritional quality and storage life of aonla fruit.

Table 1: Effect of foliar spray of nutrients and plant growth regulators on yield and its characteristics in Aonla cv. NA 10

	Treatments	Fruit Retention ((%))	Yield (kg/Plant)	Fruit Weight (g)	Physiological loss in weight(%) after 15 th days of storage	Shelf Life (Days)
T ₁	Urea (0.2%)	2.9	14.2	21.3	14.06	12.89
T ₂	Borax (0.5%)	17.5	52.0	27.6	12.89	14.15
T ₃	Vermiwash (3 ml/l)	8.7	36.4	22.9	13.14	13.51
T ₄	NAA - 20 ppm	22.4	54.4	28.4	12.49	14.34
T ₅	NAA - 40 ppm	13.7	45.8	25.6	12.95	13.88
T ₆	Urea(0.2%) + Borax (0.5%) Vermiwash (3 ml/l) + NAA (20 ppm)	30.2	62.1	31.3	10.75	15.85
T ₇	Urea (0.2%) + Borax (0.5%) Vermiwash (3 ml/l) + NAA (40 ppm)	26.7	58.3	29.4	11.58	16.13
T ₈	Control	2.5	11.3	20.0	14.10	11.13
	CD 0.5%	2.1	4.2	1.2	1.94	1.42

Table 2: Effect of foliar spray of nutrients and plant growth regulators on quality and physico chemical characteristics in Aonla cv. NA10

	Treatments	TSS (-Brix)	Acidity (%)	Total Sugars (%)	Ascorbic acid (mg/100 of edible pulp)	Internal Fruit Necrosis (%)
1.	Urea (0.2%)	8.2	1.0	4.3	844.72	12.57
2.	Borax (0.5%)	8.7	1.1	4.9	879.21	11.43
3.	Vermiwash (3 ml/l)	8.4	1.1	4.6	852.23	12.00
4.	NAA - 20 ppm	9.0	1.2	4.9	885.54	9.49
5.	NAA - 40 ppm	8.6	1.1	4.7	876.11	11.46
6.	Urea (0.2%) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (20 ppm)	9.5	1.5	5.2	901.89	4.02
7.	Urea (0.2%) + Borax (0.5%) + Vermiwash (3 ml/l) + NAA (40 ppm)	9.3	1.2	5.1	896.39	7.86
8.	Control	7.99	1.0	4.0	815.58	13.14
	C.D. (0.05%)	0.4	NS	0.2	38.80	1.14

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