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Short communication

Effect of nutrients and plant growth regulators on fruit retention, yield and physico-chemical characteristics in aonla cv. NA-10

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ABSTRACT

To check pre-mature fruit drop in aonla cv. NA-10, an investigation was undertaken during 2007 and 2008 in a Seven year old private orchard at Jhargram, Paschim Midnapore, West Bengal, where the soil is red laterite and pH ranges between 4.5 and 5.5. Treatments included foliar spray of urea (0.2%) + DAP (0.2%), $ZnSO_4$ (0.5%), Borax (0.4%), NAA (10 and 20 ppm), Vermiwash (3 ml/l), Humaur (2 ml/l) and water spray (control). Results of two years of investigation revealed that spray of NAA at 10 ppm was the best to increase fruit retention, followed by NAA 20 ppm, Vermiwash and Borax, which consequently resulted in the highest fruit yield of 54.9, 52.0, 46.8 and 36.2 kg/plant, respectively, against 13.8 kg in the control. Fruit weight was maximum with 0.5% $ZnSO_4$ spray, followed by NAA 10 ppm. Fruit quality with regard to TSS, total sugar and ascorbic acid content was better in all the treated fruits compared to control.

Key words: Aonla, fruit quality, laterite soil, growth regulators, nutrients, yield

Aonla (*Emblica officinalis* Gaertn.), is being grown in diverse soil and climate for its high nutritive and therapeutic value. In West Bengal, the demand for aonla fruits has been progressively increased due to its popularity for preparation of *chip bits* and *morabba*. Its cultivation has been gradually expanded and red laterite zone of the state is now being utilized for the purpose. In red and laterite soils of West Bengal, the plant starts bearing at the age of 2nd year and reaches its full bearing capacity at the age of 8th year. 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), the fruit drop in laterite soil is severe and it continued till harvest resulting low yield of mature fruits. To check the pre-mature fruit drop in aonla and to improve the yield and fruit quality, an investigation was carried out with the application of major and minor nutrients and plant growth regulators.

The experiment was carried out on seven year old budded plants of aonla cv. NA-10 planted at a spacing of 5 m x 5 m during 2007 and 2008 in a private farm which is situated near the Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Jhargram, Paschim Midnapore, West Bengal. The soil of the experimental orchard was laterite having surface soil pH 5.5. There were eight treatments viz., T_1- Urea 0.2% + DAP (Di-ammonium phosphate) – 0.2%, T_2-$ZnSO_4$ – 0.5%, T_3-Borax – 0.4%, T_4-NAA-10 ppm, T_5-NAA-20 ppm, T_6- Vermiwash – 3 ml/l, T_7-Humaur 2 ml/l and T_8-water spray (control). The Humaur is a bio-organic foliar nutrient, manufactured by Hindustan Antibiotics Ltd., Pimpri, Pune and reported to have enzymes, vitamins and organic acid precursor. The plants were sprayed with the chemicals after sunset three times *i.e.*, on 25th May, 5th July and 5th August of 2007 and 2008. The experiment was laid out in a Randomized Block Dsign with four replications. The plants were fertilized with 40 kg FYM, 200g N, 100g P_2O_5 and 100g K_2O/plant/year. Observations were recorded on per cent fruit retention, yield and physico-chemical composition of fruits. The acidity, total sugar and ascorbic acid content were estimated as per the methods suggested by A.O.A.C. (1990). 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.

It is evident from the data presented in Table 1 that fruit drop in aonla is severe in laterite soil and gave only

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2.5% retention as observed from the control plants. It was also observed that fruit drop in aonla was mainly associated with the hormonal imbalances as NAA 10 ppm sprayed gave maximum fruit retention of 22.3% followed by NAA 20 ppm, which resulted in second best fruit retention (17.1%). Singh *et al* (2007) also observed reduce 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 bio-chemical process of inhibition of abscission (Tomaszewska and Tomaszewska, 1970). Besides, hormone and micronutrient were observed to be one of the controlling factors for improving fruit retention in aonla. Among the two micronutrients, boron gave the better result in aonla than zinc in 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). It was further observed that vermiwash application, a bye-product of vermi-compost, showed a beneficial effect on fruit retention (13.4%) in aonla. Beneficial effect of vermiwash in fruit retention may be explained as it contain most of the macro and micronutrients, hormones, enzymes etc. in minute quantity which may helped to activate and regulate many physiological processes within the plant. It was interestingly noted that nitrogen and phosphorus application in the form of urea and di-ammonium phosphate 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), Guava (Arora and Singh, 1970), Cashew (Ghosh and Chatterjee, 1990), etc.

Fruit yield in aonla was directly co-related with the fruit retention under different treatments (Table 1). The highest yield of 54.9 kg/plant was recorded from the plant treated with NAA - 10 ppm followed by NAA 20 ppm (52.0 kg/plant) and they were statistically at par among themselves in fruit production. The highest fruit yield in NAA treated plants was due to highest fruit retention as compared to other treatments. Vermiwash application gave the 2nd highest yield in aonla (46.8 kg/plant) after NAA (10 and 20 ppm). Micronutrients (Zn and boron) and Humaur application also showed better result in yield improvement in aonla as compared to control. No response of urea and DAP application was observed with regard to their effect on yield enhancement as compared to control. From this investigation, it is clearly understood that application of micronutrients and hormones like NAA are needed in addition to macronutrients during fruit setting and development process for obtaining a good harvest of aonla in laterite soil.

Fruit weight was significantly the highest (31.3 g) in the plants sprayed with $ZnSO_4$ at 0.5% followed by NAA 10 ppm (29.4 g) and 20 ppm (28.4 g). Beneficial effect of zinc in improving fruit weight was also observed by Langthasa and Bhattacharyya (1993) in Assam lemon, Wali and Sharma (1997) in Kinnow mandarin and Ghosh and Besra (2000) in Sweet orange. 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. Fruit length and breadth were also improved due to different treatments but they were not statistically significant. Similarly pulp content was also slightly improved due to different nutrients and plant growth regulator application and was maximum under 0.5%

Table 1. Effect of nutrients and plant growth regulators on fruit retention, yield and fruit quality in aonla cv. NA 10 (average of two years)

Treatment	Fruit retention (%)	Yield/ plant (kg)	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Pulp (%)	TSS (^{0}B)	Acidity (%)	Total sugar (%)	Vit. C (mg/100g)
Urea – 0.2% + DAP-0.2%	2.8 (9.63)	14.2	21.3	4.0	4.3	93.2	8.7	1.1	4.9	545
$ZnSO_4$ – 0.5%	6.1 (14.30)	29.4	31.3	4.6	4.8	95.2	8.4	1.1	4.9	540
Borax – 0.4%	8.6 (17.05)	36.2	25.6	4.4	4.5	92.0	8.6	1.1	4.7	518
NAA – 10 ppm	22.3 (28.18)	54.9	29.4	4.5	4.7	93.7	9.5	1.5	5.1	528
NAA – 20 ppm	17.1 (24.43)	52.0	28.4	4.5	4.6	92.7	9.3	1.2	5.2	566
Vermiwash – 3ml/l	13.4 (21.47)	46.8	27.6	4.4	4.7	92.6	9.0	1.2	4.9	535
Humaur – 2 ml/l	4.9 (12.79)	23.5	22.9	3.9	4.5	93.0	9.0	1.0	5.1	563
Control (Water spray)	2.5 (9.10)	13.8	20.0	3.8	4.3	92.1	8.2	1.0	4.6	488
CD*(P=0.05)*	2.1	4.2	1.2	NS	NS	NS	0.4	NS	0.2	6.5

Figures in parentheses are angular transformed value

zinc sulphate spray (95.2%) but the treatments were not statistically significant.

Total soluble solids and total sugar content were significantly more in the fruits treated with NAA 10 ppm, NAA 20 ppm, vermiwash and humaur, which resulted 9.0 to 9.5^{0}B in T.S.S. and 4.9 to 5.2% total sugars as compared to 8.2^{0}B and 4.6% of TSS and total sugars, respectively in control. Fruit acidity was not significantly improved due to different treatments. However, ascorbic acid content was significantly better in all the treated plants as compared to control. The ascorbic acid content in fruit was estimated as the highest in fruits in treatment with NAA 20 ppm (566 mg/100 g), which was closely followed by Humaur (563 mg/100 g) and lowest in control (488 mg/100 g). Singh *et al* (2007) also observed higher ascorbic acid content in aonla fruits treated with micronutrients (0.5% $ZnSO_4$ and 0.4% $CuSO_4$) and plant growth regulators (10 ppm NAA and 25 ppm GA_3).

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