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Response of micro-nutrient on yield of Aonla (*Emblica officinalis* Gaertn) cv. Narendra aonla-6

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Abstract
The present investigation entitled on "Response of micro-nutrient on yield of Aonla (*Emblica officinalis* Gaertn) cv. Narendra Aonla-6" was carried out at the Main Experiment Station Department of Horticulture NDUAT, Kumarganj-Faizabad (U.P.) during the year 2014-15. The experiment was conducted with seven treatments and replicated thrice consisting of various levels of nutrients $ZnSO_4$ (0.5%), $CuSO_4$ (0.4%), $MnSO_4$ (0.5%), $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%), $CuSO_4$ (0.4%) + $MnSO_4$ (0.5%), $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) and control (Water spray) in RBD Randomized Block Design. The foliar applications of these nutrients were applied two times after fruit set in the month of mid June and mid July. The observations were recorded on per cent fruit drop, fruit retention, fruit size, fruit weight, pulp: stone ratio and fruit quality at different stages of fruit development. The minimum (73.47%) of fruit drop and maximum (26.53%) of fruit retention (was recorded with $ZnSO_4$ (0.5%) + $CuSO_4$. Significant increase in fruit size, fruit weight, pulp: stone ratio was also recorded with the foliar application of $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%) as compared to other treatments. The maximum fruit yield (73.03 kg/tree).

Keywords: aonla, micro-nutrient, weight and yield

Introduction
The Aonla (*Emblica officinalis* Gaertn) is one of the most important indigenous fruit of India, which is also known as 'Indian goose berry belongs to family Euphorbiaceae. It is native to South- East Asia, particularly Central and South India (Morton, 1960), which is grown in India since ancient times due to its religious, nutritional and therapeutic values. It is also recognized as a 'Amritphal' and 'Wonder drug' for its significance to health, wealth and vitality. Among the sub- tropical arid fruit, aonla has potential and wider adaptability to grow under variable range of soils and agro-edaphic condition. However, the traditional cultivation of Aonla predominantly is occupied in Uttar Pradesh, particular in Pratapgarh, Sultanpur, Varanasi districts. During a last decades, the commercial cultivation of aonla was expanded in almost all the states of India, because of its high nutritional values, wider adaptability and economic important. Being a most hardy naturally grown indigenous fruit species, it has vast potential for utilization of unproductive waste land/ marginal/ sodic land, revine land and degraded forest land, which are widely distributed in rainfed, arid- zone and drought prone areas of India. Under the present changing scenarios of degradation of prime natural resources viz., land, water and vegetation, the promotion of plantation of most hardy fruit species- aonla, is very helpful in rehabilitation and greening of waste land/ degraded land, which resulted to balancing of eco- systems.

Material and Method
The present investigation entitled "Effect of foliar spray of micro-nutrients on fruit yield and quality of aonla (*Emblica officinalis* Gaertn) cv. NA-6" was undertaken during the course of M. Sc. Hort. degree programme in Discipline of Horticulture, College of Horticulture and Forestry, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). The field experiment was carried out at Main Experiment Station, Horticulture and analytical works undertaken in P.G. laboratory, Department of Horticulture during the year of 2013-14. The experiment laid out Randomized block design with treatment 7 and replicate thrice. The treatment were T_1 - $ZnSO_4$ (0.5%), T_2 - $CuSO_4$ (0.4%), T_3 - $MnSo_4$ (0.5%), T_4 - $ZnSo_4$ (0.5%) + $CuSo_4$ (0.4%), T_5 - $CuSo_4$ (0.4%) + $MnSo_4$ (0.5%), T_5 - $CuSo_4$ (0.4%) +

$MnSo_4$ (0.5%), T_6 - $ZnSo_4$ (0.5%) + $MnSo_4$ (0.5%) and T7 - Control (water spray). The solutions were prepared as per required concentrations of nutrients (ZnSO4, CuSO4, Mn So4,) The required quantity of chemicals/salts was weighed using balance and dissolved in distilled water in measuring cylinder. The dissolved solution was diluted and volume made up to 10 liters in plastic buckets as per required quantity of solutions. The foliar sprays of nutrients
were applied twice after fruit set. The first spray of nutrients was applied during Mid-June 2013 and second sprays after one months of first spray i.e. Mid-June at the time of fruit bud development stage using Aspee pneumatic foot sprayer fitted with nozzle. The observation were recorded size of fruit, weight of fruit, pulp stone ratio and fruit yield.

Result and Discussion

The average fruit size was measured with respect to length and width at the fruit harvest stage The maximum (4.17cm) fruit length was recorded with foliar spray of $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%) followed by $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) (4.11cm) as compared to other treatments. The minimum (3.53cm) fruit length was recorded under control. The minimum (3.60cm) fruit width was recorded under control.

The maximum (42.38g) average fruit weight was observed due to foliar spray of $ZnSO_4$ 0.5% + $CuSO_4$ followed by $ZnSO_4$ (0.5%) + $MnSO_4$ (0.4%) spraying (40.21g) as compared with other treatments. The minimum (31.99g) average fruit weight was recorded under control.

Table 1: Effect of micro-nutrient on fruit size of aonla fruit

Treatment	Fruit Size (cm)	
	Length	Width
T_1- $ZnSO_4$ (0.5%)	3.89	4.13
T_2- $CuSO_4$ (0.4%)	3.81	4.07
T_3- $MnSO_4$ (0.5%)	3.57	3.95
T_4 - $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%)	4.17	4.46
T_5 - $CuSO_4$ (0.4%) + $MnSO_4$ (0.5%)	4.09	4.18
T_6 -$ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%)	4.11	4.27
T_7 - Control (Water Spray)	3.53	3.60
S.Em.±	0.12	0.14
C. D. at 5%	0.36	0.14

The maximum (21.59:1) pulp: stone ratio was recorded in $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%). The lowest (11.64:1) pulp: stone ratio was observed under control. However, the most of the treatments were found at par.

The highest (73.03 Kg/tree) fruit yield was recorded with foliar spray of $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%), followed by $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%), as compared with other treatments where as the lowest (62.64 Kg/tree) fruit yield was recorded under control. However, the other treatments were found at par and significantly higher over control.

The present finding is in conformity with observations recorded by Singh *et al.* (2001) in aonla cv. Francis, Rao *et al*. (2004) in ber cv. Banarasi Karaka, Umran, Singh *et. al.* (2007) [19] in aonla cv. N.A. 10, Shamshad *et al.* (2009) in aonla cv. Narendra Aonla- 6, Kumar and Shukla (2010) ber cv. Gola. Khera *et al.* (1985) in citrus cv. Blood Red, Kumar *et al.* (2004) in litchi cv. Dehradun, Dutta *et al*. (2007) [9] on guava cv. Sardar, Modi *et al.* (2012) on papaya (*Carica papaya* L.) cv. Madhu Bindu and f *et al.* (2012) in aonla cv. Banarasi.

Table 2: Effect of micro-nutrient on fruit weight, Pulp: stone ratio and yield of aonla fruit

Treatment	Weight (g)	Pulp: stone ratio	Yield (Kg/tree)
T_1- $ZnSO_4$ (0.5%)	36.70	15.48:1	68.59
T_2 - $CuSO_4$ (0.4%)	35.40	14.39:1	66.50
T_3 - $MnSO_4$ (0.5%)	34.36	13.70:1	64.40
T_4 - $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%)	42.38	21.59:1	73.03
T_5- $CuSO_4$ (0.4%) + $MnSO_4$ (0.5%)	38.66	16.58:1	69.88
T_6 - $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%)	40.21	18.14:1	72.35
T_7 - Control (Water Spray)	31.99	11.64:1	62.64
S.Em. ±	1.32	1.28	2.01
C.D.	4.08	3.95	6.20

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