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Effect of multimicronutrient on fruit yield of aonla (*Emblca officinalis* Gaertn.) Cv. Gujarat aonla-1

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Abstract

The research experiment was carried out on “Effect of multimicronutrient on fruit yield of aonla (*Emblca officinalis* Gaertn.) Cv. Gujarat Aonla-1” at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *Kharif-Rabi* season of the year 2017-18. The experiment was laid out in Completely Randomized Design with factorial concept (FCRD). There were three levels of soil application viz., S₁ - Control, S₂ - 250 g/tree multimicronutrient (Grade-V) and S₃ - 500 g/tree multimicronutrient (Grade-V) and three levels of foliar application viz., F₁-Control, F₂-1 % Spray of multimicronutrient (Grade-IV) and F₃ - 2 % Spray of multimicronutrient (Grade-IV). Soil application of multimicronutrient (Grade-V) was done at onset of monsoon and multimicronutrient (Grade-IV) was foliar sprayed at pin head and pea stage. Among all the treatments, F₂ (1 % spray of multimicronutrient Grade-IV) treatment recorded significantly maximum number of fruit set per branch, number of fruit retention per branch, fruit length, fruit diameter, fruit weight, fruit volume, number of fruits per tree, A grade fruit yield, B grade fruit yield, C grade fruit yield and total fruit yield whereas, there was significant effect of soil application of multi micronutrient (Grade-V) on total yield. Among all the treatments, S₃ (500 g/tree multimicronutrient Grade-V) was obtained significantly maximum total fruit yield.

Keywords: multimicronutrient, grade, fruit set, fruit retention and yield

Introduction

Aonla being a hardy in nature and it is successfully cultivated in wide range of soil and climatic conditions. It is being cultivated since long back and occupies an important place among indigenous fruits of India. The success of aonla cultivation under arid ecosystem is largely based on efficient management of available natural resources (Shukla *et al.* 2004)^[8]. Fruit drop and necrosis are major problems in reducing yield and quality of aonla fruit. Despite initial high fruit set, the ultimate retention of fruits is quite low in aonla. The intensity of fruit drop varies with variety to variety. The fruit drop at maturity stages significantly affects final fruit retention and fruit yield. Deficiency of nutrients and hormonal imbalance may be most internal factors leading to post fertilization drop in aonla. This results into competition among over crowded fruit set and other factors which are responsible for fruit drop are climate, diseases and pest incidence. Micronutrients are the key elements in fruit crops for their growth and development. These elements play very important role in various enzymatic activities and synthesis. Their acute deficiencies some time poses the problem of incurable nature in plants (Kumar, 2002)^[4]. The foliar application of macro and micro nutrients have immense important role in improving fruit set, fruit retention, yield parameters and productivity of fruits. It has also beneficial role in recovery of nutritional and physiological disorder in fruit trees. Soil and foliar application of multimicronutrient is important for recover the trees from noticed deficiency for healthy growth of tree and could be achieved a good fruit yield. Application of multimicronutrient are helpful in increasing yield parameters like number of fruit set per branch, fruit retention per branch, fruit weight, fruit length, fruit diameters, fruit volumes and number of fruit per tree.

Materials and Methods

The experiment was conducted on “Effect of multimicronutrient on fruit yield of aonla (*Emblca officinalis* Gaertn.) cv. Gujarat Aonla -1”. The experiment was conducted during *kharif – Rabi* season of the year 2017-18 at Horticultural Research Farm and P. G. Laboratory,

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Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand. The experiment was laid out in Completely Randomized Design with factorial concept (FCRD). The soil of the experimental plot was sandy loam type. There were three levels of soil application viz., S₁ - Control, S₂ - 250 g/tree multimicronutrient (Grade-V) and S₃ - 500 g/tree multimicronutrient (Grade-V) and three levels of foliar application viz., F₁-Control, F₂-1 % Spray of multimicronutrient (Grade-IV) and F₃ - 2 % Spray of multimicronutrient (Grade-IV). Multimicronutrient (Grade-V) was given as soil application at onset of monsoon and multimicronutrient (Grade-IV) was foliar sprayed at pin head and pea stage. Multi micronutrient (Grade IV) is combination of 4.0 % Iron, 1.0 % Manganese, 6.0 % Zinc, 0.5 % Copper and 0.5 % Boron and multi micronutrient (Grade V) is combination of 2.0 % Iron, 0.5 % Manganese, 5.0 % Zinc, 0.2 % Copper and 0.5 % Boron. Multimicronutrients was sprayed at pin head and pea stages. Whereas, soil application of multimicronutrient was done at onset of monsoon. Recommended dose of farm yard manure and NPK fertilizers were given as common dose in all the treatments. The mature and uniform sized fruits were harvested from the respective trees and observations were recorded regarding the yield parameters of the fruits.

Results and discussion

The results obtained from the research experiment on effect of multimicronutrient on fruit yield of aonla are presented in Table 1 to 6.

There were non-significant effect of soil application of multi micronutrient (Grade-V) on yield parameter viz., number of fruit set per branch, number of fruit retention per branch, fruit length, fruit diameter, fruit weight, fruit volume, number of fruits per tree, A grade, B grade and C grade fruit yield whereas, there was significant effect of soil application of multi micronutrient (Grade-V) on total yield (Kg/tree and tones/ha). Among all the treatment, S₃ (500 g/tree multimicronutrient Grade-V) treatment was recorded significantly maximum total yield (104.14 Kg/tree). The significantly maximum fruit yield (104.14 Kg/tree) was recorded with the soil application of 500 g/tree multi micronutrients (Grade-V) might be due to fact that micronutrients played a pivotal role in vegetative growth, flowering, development of plant and are also directly involved

in the process of photosynthesis, this means that a possibility of increasing dry matter percentage as well as yield. This observation is in agreement with findings of Patel *et al.* (2003)^[6], Tamboli *et al.* (2015)^[12], Katiyar *et al.* (2010)^[3] in aonla.

There were significant effect of number of fruit set per branch and number of fruit retention per branch at 15 days interval. Among all the treatments, F₂ (1 % spray of multimicronutrient Grade-IV) treatment was most effective treatment and which was recorded significantly maximum number of fruit set per branch at 15th day (14.93), 30th day (17.67), 45th (19.55), 60th day (22.74) and 75th day (24.51) and number of fruit retention per branch at 30th day (13.47), 45th day (14.77), 60th day (17.49), 75th day (20.27), 90th day (23.28), 105th day (22.45), 120th day (22.87) and 135th day (22.81). It might be due to boron which play important role in pollen germination and pollen tube growth which is associated with better pollination, fertilization and fruit setting (Thompson and Batjer, 1950)^[13]. Application of zinc might be promoted the auxin synthesis in the plant system which might delayed the formation of abscission layer during early stage of fruit development (Nason and McElroy, 1963)^[5] and which might be increased the endogenous level of micronutrient. The synthesis of micro nutrients and their translocation to growing of fruit bud. The results were also in accordance with the findings of Verma *et al.* (2008)^[16], Vishwakarma *et al.* (2013)^[17] and Chandra and Singh (2015)^[11] in aonla.

The foliar application of multimicronutrient were significantly influenced on fruit length and diameter of aonla. The significantly maximum fruit length (3.44 cm) and fruit diameter (3.99 cm) were obtained with F₂ (1 % spray of multimicronutrient Grade-IV) treatment. The significant effect of 1 % spray of multi micronutrient (Grade-IV) on fruit length and fruit diameter might be due to cumulative effect of combined treatment of micronutrient might be resulted higher fruit length. The other possible reason for increased in fruit weight by the micronutrients might be due to faster loading and mobilization of photo assimilates to fruits and involvement in cell division and cell expansion which ultimately reflected into more length in treated plants. Similar results were also found by Verma *et al.* (2008)^[16], Vishwakarma *et al.* (2013)^[17], Ghose *et al.* (2009), Shukla *et al.* (2004)^[8] and Chandra and Singh (2015)^[11] in aonla.

Table 1: Effect of soil and foliar application of multimicronutrient on number of fruit set per branch of aonla Cv. Gujarat Aonla -1

Treatments	Number of fruit set per branch (day)				
	15 th	30 th	45 th	60 th	75 th
A. Soil application (S)					
S ₁ : Control	11.40	13.81	16.12	18.98	20.66
S ₂ : 250 g/tree multimicronutrient (Grade-V)	12.65	14.53	16.87	19.02	21.19
S ₃ : 500 g/tree multimicronutrient (Grade-V)	13.10	15.63	17.54	20.43	23.22
S.Em. ±	0.47	0.48	0.38	0.44	0.96
C.D. at 5%	NS	NS	NS	NS	NS
B. Foliar application (F)					
F ₁ : Control	9.91	11.70	13.64	16.78	18.60
F ₂ : 1% Spray of multimicronutrient (Grade-IV)	14.93	17.67	19.55	22.74	24.51
F ₃ : 2% Spray of multimicronutrient (Grade-IV)	12.31	14.59	17.34	18.92	21.96
S.Em. ±	0.47	0.48	0.38	0.44	0.96
C.D. at 5%	1.40	1.45	1.13	1.31	2.85
S × F Interaction					
S.Em.±	0.81	0.84	0.66	0.76	1.66
C.D. at 5%	NS	NS	NS	NS	NS
C.V. %	11.41	10.0	6.81	6.82	13.28

Table 2: Effect of soil and foliar application of multimicronutrient on number of fruit retention per branch of aonla Cv. Gujarat aonla-1

Treatments	Number of fruit retention per branch (day)							
	30 th	45 th	60 th	75 th	90 th	105 th	120 th	135 th
A. Soil application (S)								
S ₁ :Control	10.21	11.42	13.12	16.96	19.75	20.08	20.51	19.86
S ₂ :250 g/tree multimicronutrient (Grade-V)	10.75	11.77	13.74	17.45	20.54	20.36	20.71	20.22
S ₃ :500 g/tree multimicronutrient (Grade-V)	11.67	12.37	14.42	18.70	20.94	20.93	21.41	21.06
S.Em. ±	0.39	0.26	0.34	0.49	0.33	0.23	0.26	0.34
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
B. Foliar application (F)								
F ₁ :Control	8.41	9.19	10.64	14.82	17.66	17.95	18.92	17.49
F ₂ :1% Spray of multimicronutrient (Grade-IV)	13.47	14.77	17.49	20.27	23.28	22.45	22.87	22.81
F ₃ :2% Spray of multimicronutrient (Grade-IV)	10.76	11.59	13.14	18.03	20.28	20.97	20.85	20.84
S.Em. ±	0.39	0.26	0.34	0.49	0.33	0.23	0.26	0.34
C.D. at 5%	1.16	0.77	1.03	1.46	0.98	0.68	0.78	1.01
S × F interaction								
S.Em.±	0.68	0.45	0.60	0.85	0.57	0.40	0.45	0.59
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	10.84	6.61	7.61	8.34	4.86	4.00	3.77	5.02

Table 3: Effect of soil and foliar application of multimicronutrient on fruit length and fruit diameter of aonla Cv. Gujarat Aonla -1

Treatments	Fruit length (cm)	Fruit diameter (cm)
A. Soil application (S)		
S ₁ : Control	3.24	3.70
S ₂ : 250 g/tree multimicronutrient (Grade-V)	3.29	3.91
S ₃ : 500 g/tree multimicronutrient (Grade-V)	3.37	3.92
S.Em. ±	0.04	0.07
C.D. at 5%	NS	NS
B. Foliar application (F)		
F ₁ : Control	3.15	3.66
F ₂ : 1% Spray of multimicronutrient (Grade-IV)	3.44	3.99
F ₃ : 2% Spray of multimicronutrient (Grade-IV)	3.31	3.89
S.Em. ±	0.04	0.07
C.D. at 5%	0.126	0.21
S × F Interaction		
S.Em.±	0.07	0.12
C.D. at 5%	NS	NS
C.V. %	3.87	5.68

There were significant effect of foliar application of multimicronutrient on fruit weight and fruit volume of aonla. Among all the treatments, F₂ (1 % spray of multimicronutrient Grade-IV) treatment was recorded significantly maximum fruit weight (41.18 g) and fruit volume (45.08 cc). It might be due to foliar feeding of nutrient resulting in rapid cell division, cell elongation and development and increase in fruit weight and volume with the spray of boron might be due to its

involvement in hormonal metabolism which increased cell division and expansion of cell. The involvement of zinc directly in growth and boron is stimulate rapid mobilization of water and sugar in the fruit which ultimately reflected into volume of fruit in treated plants. Similar results were also found by Singh *et al.* (2001)^[1], Vishwakarma *et al.* (2013)^[17], Verma *et al.* (2008)^[16], Singh *et al.* (2012)^[11], Chandra and Singh (2015)^[1] and Verma *et al.* (2016)^[15] in aonla.

Table 4: Effect of soil and foliar application of multimicronutrient on fruit weight and fruit volume of aonla Cv. Gujarat Aonla -1

Treatments	Fruit weight (g)	Fruit volume (cc)
A. Soil application (S)		
S ₁ : Control	37.66	43.70
S ₂ : 250 g/tree multimicronutrient (Grade-V)	37.86	44.15
S ₃ : 500 g/tree multimicronutrient (Grade-V)	38.83	44.50
S.Em. ±	0.81	0.37
C.D. at 5%	NS	NS
B. Foliar application (F)		
F ₁ : Control	33.62	43.03
F ₂ : 1% Spray of multimicronutrient (Grade-IV)	41.18	45.08
F ₃ : 2% Spray of multimicronutrient (Grade-IV)	39.55	44.24
S.Em. ±	0.81	0.37
C.D. at 5%	2.40	1.11
S × F Interaction		
S.Em.±	1.40	0.64
C.D. at 5%	NS	NS
C.V. %	6.38	2.55

The foliar application of multimicronutrient were significantly influenced on number of fruits per tree of aonla. The significantly maximum number of fruit per tree (2951.89) was recorded with F₂ (1 % spray of multimicronutrient Grade-IV) treatment. It might be due to an application of Zinc, Iron and Boron sprayed alone or in combination involved directly in various physiological processes and enzymatic activity for higher accumulation of food materials and thus, ultimately

increased yield. The balance of auxin in plant also regulates the fruits drop or retention in plants, which ultimately increased the total number of fruits per tree. The role of boron is also reported in fruit setting, which ultimately increased the number of fruits per tree (Thompson and Batjer, 1950) [13]. The above results were confirmed by the findings of Saraswathy *et al.* (2002) [7] in sapota and Venu *et al.* (2014) [14] in acid lime.

Table 5: Effect of soil and foliar application of multimicronutrient on number of fruits per tree of aonla Cv. Gujarat Aonla -1

Treatments	Number of fruits per tree
A. Soil application (S)	
S ₁ : Control	2447.89
S ₂ : 250 g/tree multimicronutrient (Grade-V)	2615.56
S ₃ : 500 g/tree multimicronutrient (Grade-V)	2670.22
S.Em. ±	63.67
C.D. at 5%	NS
B. Foliar application (F)	
F ₁ : Control	2256.67
F ₂ : 1% Spray of multimicronutrient (Grade-IV)	2951.89
F ₃ : 2% Spray of multimicronutrient (Grade-IV)	2525.11
S.Em. ±	63.67
C.D. at 5%	189.17
S × F Interaction	
S.Em.±	110.28
C.D. at 5%	NS
C.V. %	7.41

There were significant effect of foliar application of multimicronutrient on A grade fruit yield, B grade fruit yield, C grade fruit yield and total fruit yield. The significantly maximum A grade fruit yield (62.46 Kg/tree), B grade fruit yield (40.88 Kg/tree), C grade (17.84 Kg/tree) and total fruit yield (121.18 Kg/tree) were recorded with F₂ (1 % spray of multimicronutrient Grade-IV) treatment. It might be due to cumulative effect of number of fruits, reduction in fruit drop and higher fruit weight by the effect of foliar spray of multi micronutrients. Foliar spray of micronutrients might be

affected the physiological processes resulting into higher fruit yield. This observation is in agreement with findings of Patel *et al.* (2003) [6], Singh *et al.* (2007) [9], Verma *et al.* (2008) [16], Vishwakarma *et al.* (2013) [17], Singh *et al.* (2012) [11] and Chandra and Singh (2015) [1] in aonla.

The interaction effect between soil and foliar application of multi micronutrient was found non-significant effect on number of fruit set per branch, number of fruit retention per branch, fruit length, fruit diameter, fruit weight, fruit volume, number of fruit per tree and fruit yield (Kg/tree and t/ha).

Table 6: Effect of soil and foliar application of multimicronutrient on yield (Kg/tree and tones/ha) of aonla Cv. Gujarat Aonla -1

Treatments	Yield (kg/tree)				Yield (tones/ha)
	A grade	B grade	C grade	Total	
A. Soil application (S)					
S ₁ : Control	46.99	33.14	13.06	93.18	14.54
S ₂ : 250 g/tree multimicronutrient (Grade-V)	50.76	35.20	13.53	99.49	15.52
S ₃ : 500 g/tree multimicronutrient (Grade-V)	53.83	36.29	14.02	104.14	16.25
S.Em. ±	1.82	1.02	0.29	2.03	0.31
C.D. at 5%	NS	NS	NS	6.04	0.94
B. Foliar application (F)					
F ₁ : Control	37.99	29.29	8.54	75.82	11.83
F ₂ : 1% Spray of multimicronutrient (Grade-IV)	62.46	40.88	17.84	121.18	18.90
F ₃ : 2% Spray of multimicronutrient (Grade-IV)	51.12	34.47	14.22	99.81	15.57
S.Em. ±	1.82	1.02	0.29	2.03	0.31
C.D. at 5%	5.41	3.05	0.86	6.04	0.94
S × F Interaction					
S.Em.±	3.15	1.78	0.50	3.52	0.55
C.D. at 5%	NS	NS	NS	NS	NS
C.V. %	10.81	8.85	6.47	6.17	6.16

Conclusion

The result obtained from research experiment concluded that, 1 % spray of multimicronutrient (Grade-IV) at pin head and pea stage recorded maximum number of fruit set per branch, number of fruit retention per branch, fruit length (cm), fruit volume (cc), fruit diameter (cm), fruit weight (g), number of

fruits per tree and yield (Kg/tree and tones/hectare) in aonla cv. Gujarat Aonla-1.

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