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Effect of integrated nutrient management on fruit quality and shelf life of Aonla (*Emblica officinalis* Gaertn.) cv. Gujarat Aonla - 1

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Abstract

An experiment was carried out to study the “Effect of integrated nutrient management on quality and shelf life of Aonla (*Emblica officinalis* Gaertn.) cv. Gujarat Aonla - 1” at Horticultural Research Farm and P.G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *Kharif-Rabi* season of the year 2018-19. The experiment was laid out in completely randomized design with three repetitions. Among all the treatments, T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree) treatment was found most effective treatment and recorded significantly maximum in pulp weight at maturity stage, pulp:stone ratio at maturity stage, total soluble solids, ascorbic acid, shelf life and minimized the acidity in Aonla fruits.

Keywords: Aonla, INM, Ascorbic acid and shelf life

Introduction

Aonla (*Emblica officinalis* Gaertn.) belongs to family Euphorbiaceae and subfamily *Phyllanthoidae*. It is native of Tropical South-East Asia, particularly in central and southern India. Aonla being hardy in nature and it is successfully cultivated in wide range of soil and climatic condition. Aonla is drought hardy fruit crop which is characterized by deep root system and exhibits deciduous nature due to abscission and shedding of determinate shoot during February and March. The success of Aonla cultivation under arid ecosystem is largely based on efficient management of available natural resources. The chemical composition of Aonla is found to be influenced by environmental factors. It has been found that the chemical parameters viz. total soluble solids, acidity, sugars, ascorbic acid, etc., change during growth and development of fruits. Total soluble solids, sugars and ascorbic acid gradually increased reaching the maximum at maturity, whereas acidity, phenol and tannin content decreased up to the minimum at maturity. The shelf life of Aonla fruit is 12-15 days under normal conditions. It becomes difficult to process entire fruit production in short span of time. At the peak harvest season, the availability of the fruits exceeds whereas the demand and the market price falls very low. The proper nutrient management approach is indispensable for sustaining high quality fruit production without detrimental effects on soil caused by inorganic fertilizers. It is also recognized that integrated nutrient management plays an important role in improving the soil fertility, physico-chemical conditions of soil and crop productivity.

Organic manures supply plants nutrients and micronutrients. They improve soil physical properties like soil structure, infiltration rate, porosity, water holding capacity, bulk density etc. and also increases the availability of nutrients. Organic manures act as a buffering agents and supplies food for beneficial living organisms. Biofertilizers are microbial preparations containing living cells of different microorganisms which have the ability to mobilize plant nutrients in soil from unusable to usable form through biological process. They are environmental friendly and play significant role in crop production. Hence, in order to develop a sustainable integrated nutrient management technology for Aonla, the present investigation was undertaken. Keeping the above facts in the mind, the present investigation was undertaken with an objective of finding out the effect of integrated nutrient management on quality and shelf life of Aonla.

Materials and Methods

The present experiment was carried out at Horticultural Research Farm, and P.G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *Kharif-Rabi* season of the year 2018-19. The experiment was laid out in completely randomized design with three repetitions comprising nine treatments. The soil of the experimental plot was sandy loam type. The chemical fertilizers like nitrogen, phosphorus and potash were applied in the form of urea, single super phosphate and murate of potash, respectively as per treatments. Half dose of nitrogen and full dose of phosphorus and potash was given one week after organic fertilizer application and remaining half dose of nitrogen given on 14th September. Well decomposed FYM 100 kg per tree was given as common recommended basal dose of all the treatments, vermicompost and castor cake was applied as per treatments requirement on 10th July. Biofertilizer *i.e.* Anubhav Bio NPK consortium was obtained from department of Agricultural Microbiology, Anand Agricultural University, Anand. It was applied 1 m away from main stem at the time of application of organic manures as mixing with FYM in the soil as per 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 integrated nutrient management on quality and shelf life of Aonla are presented in Table 1 and 2.

The results revealed that effect of integrated nutrient management on internal necrosis affected fruits was found non-significant.

The application of integrated nutrient was significantly influenced on pulp weight at maturity stage. Significantly maximum pulp weight at maturity stage (39.67 g) was

recorded under treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree). It was statistically at par with the treatments T₂, T₃, T₄, and T₈. While, minimum pulp weight at maturity stage (34.70 g) was recorded in control. An increase in pulp weight of fruits might be on account of incorporation of organic manures and biofertilizers along with inorganic fertilizers. Organic manures and biofertilizers have direct role in nitrogen fixation, production of phytohormones like substances and increased uptake of nutrients hence quality improvement reflected in fruit characters. These observations are in agreement with the findings of Mandal *et al.* (2013)^[6] in Aonla Baviskar *et al.* (2011)^[11], Patel and Naik (2010)^[10] in sapota, Madhavi *et al.* (2008)^[5] in mango.

The results revealed that effect of integrated nutrient management on stone weight at maturity stage was found non-significant.

The results indicate that treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree) was found significantly maximum in pulp:stone ratio at maturity stage (17.61). It was statistically at par with the treatments T₃, T₄, T₅ and T₈. Whereas, minimum pulp:stone ratio at maturity stage (14.56) was recorded with control. This might be due to accumulation of more food material in the trees by an efficient utilization for development of fruits. The marked effect of nitrogen on fruit was due to increase in the efficiency of metabolic processes and thus encouraged the growth of the plant in general and consequently the various parts of the plant including fruit. The application of N, P and K fertilizers might have resulted in high rate of photosynthesis results leads to higher carbohydrates accumulation in fruit and thereby increasing pulp: stone ratio of the fruit. The results reported by Mandal *et al.* (2013)^[6] and Singh *et al.* (2008)^[15] in Aonla, Nehete (2013)^[7] in mango, Verma *et al.* (2014)^[18] and Ram *et al.* (2012)^[13] in phalsa.

Table 1: Effect of integrated nutrient management on internal necrosis affected fruit, pulp weight, stone weight and pulp: stone ratio of Aonla cv. Gujarat Aonla – 1

Sr. No.	Treatments	Internal necrosis affected fruit (%)	Pulp weight (g)	Stone weight (g)	Pulp: stone ratio
T ₁	100 % RDF (1000:500:500 NPK g/tree) (Control)	9.38	34.70	2.38	14.56
T ₂	75 % RDF through chemical fertilizer + 25 % RDN through castor cake/tree	9.11	37.72	2.32	15.28
T ₃	50 % RDF through chemical fertilizer + 50 % RDN through castor cake/tree	8.95	38.25	2.23	17.13
T ₄	75 % RDF through chemical fertilizer + 25 % RDN through vermicompost/tree	9.22	39.12	2.27	17.26
T ₅	50 % RDF through chemical fertilizer + 50 % RDN through vermicompost/tree	9.29	36.60	2.29	15.96
T ₆	75 % RDF through chemical fertilizer + 10 ml Anubhav Bio NPK Consortium/tree	9.39	36.39	2.34	15.57
T ₇	50 % RDF through chemical fertilizer + 20 ml Anubhav Bio NPK Consortium/tree	9.36	36.29	2.36	15.35
T ₈	50 % RDF through chemical fertilizer + 25 % RDN through castor cake + 10 ml Anubhav Bio NPK Consortium/tree	9.15	37.48	2.29	16.34
T ₉	50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree	8.99	39.67	2.25	17.61
S.E.m. ±		0.53	0.92	0.04	0.62
C.D. at 5%		NS	2.74	NS	1.84
C.V. %		9.90	4.27	2.85	6.67

Significantly maximum total soluble solids (16.54 °Brix) was recorded under treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree). It was statistically at par

with the treatments T₂, T₄, T₅ and T₈. While, significantly minimum total soluble solids (14.30 °Brix) was recorded in control. An increase in total soluble solids might be due to beneficial role of nutrient on the process of photosynthesis

which ultimately led to the accumulation of large amount of carbohydrates and increase in total soluble solid content of fruits. The vermicompost play important role in placing the nutrient and plant hormones, which are directly or indirectly involved in improving the fruit quality. Similar results were also obtained by Yadav *et al.* (2013)^[20] in Aonla, Ram *et al.* (2012)^[13] and Sutariya *et al.* (2018)^[16] in phalsa. Ingle *et al.* (2001)^[4] in acid lime, Dubey and Yadav (2003)^[2] and Ramamurthy *et al.* (2006)^[14] in mandarin, Patel *et al.* (2009)^[11] in sweet orange, Yadav *et al.* (2011)^[19] in papaya.

Significantly minimum acidity (1.82 %) was noted in treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree). It was statistically at par with the treatments T₂, T₄, T₅ and T₈. While, significantly maximum acidity (1.92 %) was recorded in T₁ (control). It is obtained that acidity decrease due to an increase in total soluble solids and total sugar. The results reported by Yadav *et al.* (2013)^[21] in Aonla, Ram *et al.* (2012)^[13] and Sutariya *et al.* (2018)^[16] in phalsa, Dubey and Yadav (2003)^[2] in mandarin, Patel *et al.* (2009)^[11] in sweet orange, Nurbhanej *et al.* (2016)^[8] in acid lime and Ram *et al.* (2007)^[7] in guava.

Significantly maximum ascorbic acid content (845.17 mg/100 g pulp) was recorded under treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree). It was statistically at par with the treatments T₂, T₃, T₄, T₅ and T₈. While, significantly minimum ascorbic acid content (797.77 mg/100 g pulp) was recorded in T₁ (control). This is might be due to

nutrient stimulated the functioning of number of enzymes in the physiological process and proper supply of nutrient induced the photosynthesis carbohydrate and sugar metabolisms which improved the quality of fruits. The vermicompost play an important role in placing the nutrient and plant hormones, which are directly or indirectly involved in improving the fruit quality. Similar trends were also observed by Yadav *et al.* (2013)^[20] in Aonla, Ram *et al.* (2012)^[13] and Sutariya *et al.* (2018)^[16] in phalsa. Nurbhanej *et al.* (2016)^[8] and Ingle *et al.* (2001)^[4] in acid lime, Dubey and Yadav (2003)^[2] in mandarin, Patel *et al.* (2009)^[11] in sweet orange, Yadav *et al.* (2011)^[19] in papaya, Yadav *et al.* (2011)^[19] in mango.

It is clear from the results that treatment T₉ (50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree) was most effective treatment and which was recorded significantly maximum shelf life (17.33 day). It was statistically at par with the treatments T₄, T₅ and T₈. While, significantly minimum shelf life (12.03 day) was recorded in control. This extended shelf life has been the consequence of slow down the ethylene synthesis and ultimately ripening process through minimum reduction in weight loss and other physiological parameters as well as bio-chemical changes in fruits. The results of present findings are in conformation with the earlier workers Patel *et al.* (2017)^[10], Patel and Naik (2010)^[10] in sapota, Thakkar (2015)^[17] and Godage *et al.* (2013)^[3] in guava.

Table 2: Effect of integrated nutrient management on total soluble solids, acidity, ascorbic acid and shelf life of Aonla cv. Gujarat Aonla – 1

Sr. No	Treatments	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg/100 g pulp)	Shelf life (days)
T ₁	100 % RDF (1000:500:500 NPK g/tree) (Control)	14.30	1.92	797.77	12.03
T ₂	75 % RDF through chemical fertilizer + 25 % RDN through castor cake/tree	15.30	1.87	822.83	15.19
T ₃	50 % RDF through chemical fertilizer + 50 % RDN through castor cake/tree	14.98	1.89	816.81	14.90
T ₄	75 % RDF through chemical fertilizer + 25 % RDN through vermicompost/tree	15.34	1.86	834.56	16.63
T ₅	50 % RDF through chemical fertilizer + 50 % RDN through vermicompost/tree	16.11	1.83	828.57	16.90
T ₆	75 % RDF through chemical fertilizer + 10 ml Anubhav Bio NPK Consortium/tree	14.61	1.90	809.55	14.19
T ₇	50 % RDF through chemical fertilizer + 20 ml Anubhav Bio NPK Consortium/tree	14.35	1.91	801.04	14.02
T ₈	50 % RDF through chemical fertilizer + 25 % RDN through castor cake + 10 ml Anubhav Bio NPK Consortium/tree	15.71	1.84	839.60	16.86
T ₉	50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree	16.54	1.82	845.17	17.33
S. Em. ±		0.48	0.02	10.50	0.72
C.D. at 5%		1.42	0.07	31.19	2.13
C.V. %		5.41	2.25	2.21	8.11

Conclusion

The result obtained from research experiment, it can be concluded that 50 % RDF through chemical fertilizer + 25 % RDN through vermicompost + 10 ml Anubhav Bio NPK Consortium/tree was found beneficial to increases pulp weight at maturity stage, pulp: stone ratio at maturity stage, total soluble solids, ascorbic acid, shelf life and minimized the acidity in Aonla cv. Gujarat Aonla - 1.

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