

## Original Research Article

# Effect of integrated nutrient management on flowering and fruiting behavior of Aonla Cv. Francis

### Abstract

The present investigation was carried with aim to know the effect of integrated nutrient management on fruiting of aonla cv. Francis. The experiment was conducted in two consecutive years. The experiment comprised of ten treatments, replicated thrice with randomized block Design. The study revealed the fruit set and retention per cent for both the year was noted maximum with the use of T<sub>7</sub>, whereas T<sub>6</sub> was found to equally good with T<sub>1</sub>. The maximum fruit size was recorded with the use of T<sub>7</sub> during both the year which was at par with the soil application T<sub>6</sub>. The study concluded that the application of 75% RDF + 30 kg *Vermicompost*+ 250g *Azotobacter*+ 250g PSB produced quality fruit yield.

Keywords: INM, fruit set, fruit retention, fruit and fruit size, Aonla

### Introduction

Aonla or Indian gooseberry (*Emblica officinalis* Gaertn. Syn. *Phyllanthusemblica*) is one of the important indigenous fruits of the Indian subcontinent, known for its medicinal and therapeutic properties and considered as a wonder fruit for the health-conscious population. It has been grown and known in India for last more than 3500 years. In fact, it finds a special mention in ancient Indian text 'Ayurveda' by Sushruta, the father of ancient medicine during 1500 BC-1300 BC. The aonla tree is native to tropical Southeast Asia, particularly central or southern India, Pakistan, Bangladesh, Sri Lanka, Malaya, Southern China and to Mascarene Islands and it is also growing naturally in Cuba, Puerto Rico, Hawaii, Florida, Iran, Iraq, Java, West Indies, Trinidad, Singapore, southern Thailand, Pakistan, Malaya and China and Panama Canal regions.

In India, aonla seedling trees are of common occurrence in the mixed deciduous dry forests ascending from sea level (Western and Eastern ghats, Aravali and Vindhyan hills) to 1300 m amsl, from northwest Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand) to eastern Himalayas in Assam, Meghalaya, Mizoram, Manipur and Tripura. India ranks first in production of aonla. It occupies an area of 94 thousand hectares with a production of 1098 thousand metric tons (Anonymous, 2019a). In Jammu and Kashmir State, aonla is being successfully grown in Kathua, Samba, Akhnoor, parts of Udhampur and Reasi districts on an area of 1701 ha with

annual production of 3780 metric tons, respectively (Anonymous, 2019b). Aonla is richest source of vitamic C among fruits next to Barbados Cherry. Due to high potential of productivity per unit area, very hardy in nature, highest medicinal value and enormous uses, particularly under wasteland conditions, in salt affected soils, the area under aonla cultivation is increasing in the India. Aonla is considered as a most ideal crop for arid and semi-arid regions. Due to its importance and many medicinal uses, it is also known as “Amrit Phal” and “Wonder Drug” (Tripathi et al, 2007).

The continuous use of chemical fertilizers affects the soil health, soil quality, fruit production, fruit size and fruit quality. The integrated nutrient management paves a way to overcome of these pollutions and maintain fruit quality as well as productivity. Therefore, efficient use of integrated plant nutrient supply system is a prerequisite for achieving continuous advances in productivity of fruits crops in ecologically sustainable manner (Chundawat, 2001). This calls for moving away from chemical agriculture and embracing organic matter management, which improves all soil properties and brings nitrogen through organic manures and useful microorganisms. INM is the best approach for sustainable crop production.

## **Materials and methods**

The was investigated at Main Experiment Station (MES) Horticulture A.N.D. University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) on 28-year-old plants of aonla uniformly healthy and well-maintained square system of an orchard. The climatic condition of experimental site comes under the semi-arid comprising of three district seasons viz rainy or wet, winter and summer or hot. The rainy season starts from the last week of June to last September or extends up to October with an average rainfall of 1200 mm. Sporadic rains also occur during winter. The winter season starts from November and continuous up to the first week of March with mean temperature ranging from 15-25° C. The month of December and January are very cold while January is the coldest month with a lower temperature. The hot season prevails from April to June. The temperature during summer is intense and recording a little below 45°C. The relative humidity during summer <2- varies from 35 to 60 per cent. Severe drought occurs quite frequently A accompanied by very low relative humidity, sensitive and wind velocity. There were thirteenth treatment viz., **T1**:100 % RDF (1:0.5:1: N: P: K + 10kg FYM plant<sup>-1</sup>), **T2**:75 % RDF + 10kg Vermicompost, **T3**:75 % RDF + 10kg Vermicompost+ 250g Azotobacter+ 250g PSB, **T4**:75 % RDF + 20kg Vermicompost, **T5**:75% RDF + 20kg Vermicompost + 250g Azotobacter + 250g PSB, **T6**:75% RDF + 30kg Vermicompost, **T7**:75% RDF + 30 kg Vermicompost+ 250g Azotobacter+ 250g PSB, **T8**:50 % RDF + 10kg Vermicompost, **T9**:50 % RDF + 10kg Vermicompost+ 250g Azotobacter+ 250 g PSB, **T10**:50 % RDF + 20kg

Vermicompost, **T11**:50 % RDF + 20kg Vermicompost+ 250g Azotobacter+ 250g PSB,**T12**:50% RDF + 30kg Vermicompost,**T13**:50% RDF+ 30 kg Vermicompost+ 250g Azotobacter+ 250g PSB. Observations was recorded on the basis of following procedure-

Fruit set (%): It was calculated as the number of fruit set, divided by the number of flowers appeared. It is expressed in percentage.

$$\text{Fruit set} = \frac{\text{Number of set flower}}{\text{Total number of flowers marked}} \times 100$$

Fruit retention (%):It was computed as the number of fruits retained till maturity divided by the number of fruit sets and expressed in per cent.

$$\text{Fruit retention\%} = \frac{\text{Number of fruit retained till maturity}}{\text{Number of fruit set}} \times 100$$

Fruit yield kg/plant):Fruit yield per plant (kg) was recorded with the help of balance at the time of fruit harvesting.

Fruit weight (g):Weight of five fruits was taken on balance and the average value was expressed in gram.

Analysis of data: The two years data obtained during experimentation were statistically analysed as per the method given by Panse and Sukhatme (1985) and the result was evaluated at 5% level of significance.

The standard error (SEm±) for the difference of treatment means were computed as follows.

$$\text{SEm}\pm = \sqrt{\frac{2\text{MSE}}{r}}$$

Where, MSE= Mean sum squares due to error

r= number of replication

The calculation of CD at 5% of tale value was carried out with the help of following formula.

SEm± = Standard error of the mean

CD = SEm ± × t value at 5%

CD = Critical difference

## **Result and discussion**

On the basis of investigation it is indicated that highest fruit set and fruit retention percentage was recorded with the application of T<sub>7</sub> (75% RDF + 30 kg Vermicompost+ 250g Azotobacter+ 250g PSB,) which was at par with T<sub>6</sub>(75% RDF + 30kg Vermicompost) and both treatment were significantly superior over rest of the treatments. It might be due to supply of all the plant nutrient and growth hormones in optimum amount and proportion right from starting of the experimentation to the harvest of the crop, which induces the more flowering and retention of fruit due to production and supply of photosynthesis at critical requirement. The results are in conformed with the findings of Pereira and Mitra (1999) and Huchcheet *et. al.*, (1998). The fruit length and fruit width were also influenced significantly as treatment applied. It was noted maximum with the use of T<sub>7</sub> (75% RDF + 30 kg Vermicompost+ 250g Azotobacter+ 250g PSB,). Application of T<sub>6</sub> (75% RDF + 30kg Vermicompost) was found at par with T<sub>1</sub>(100 % RDF (1:0.5:1: N: P: K + 10kg FYM plant<sup>-1</sup> ) and proved equally good. The increase in individual fruit weight due to the optimum supply of plant nutrient and growth hormones in precise amount during entire crop period caused more vegetative growth, ultimately more photosynthesis, resultant more fruit length, weight and diameter. Pereira and Mitra (1999) reported highest average fruit weight with the integration of 75g+100g+75g NPK kg/ha+1.5 kg neem cake/plant and Yadav et al. (2007) also reported maximum fruit length, width and fruit weight in aonla with the soil application of 50%NPK+100kg FYM+200g each Azotobacter + Azospirillum+PSB+25g sulphur. Integrated nutrient management significantly influenced the yield parameters over the control, prove by Aal et. Al (2020).

Among the treatments the maximum fruit yields were recorded with the soil application of T<sub>6</sub> 50%NPK+50% FYM+250g each (Azotobacter+ Azospirillum +PSB) being at par with T<sub>5</sub> 75%NPK+25% FYM+250g each (Azotobacter+ Azospirillum +PSB) and both are significantly superior. The enhancement in yield mainly because of proper supply of nutrients and induction of growth hormones, which stimulated cell division, cell elongation, increase in number of fruit and weight, ultimately increased fruit yield. Similar findings were also reported by Yadav *et al.*, (2007) and Babu and Sharma 2005. Likewise Tiwari et al (1999) also reported maximum fruit yield in banana with the soil application of bio-fertilizer particularly inoculation with Azospirillum could be substitute 50%N requirement. The present findings are also supported with the results of Bahadur and Manohar (2001), Ram and Raj Paut (2000). The increase in yield parameter in present investigation with the application on of NPK + biofertilizers might be due to its dual role in nitrogen fixation and production of phyto hormones and increase uptake of nutrient.

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**Table 1: Effect of Integrated nutrient management on fruit set, fruit retention and fruit yield of aonla.**

Treatments		Fruit set (%)		Fruit retention (%)		Fruit yield (kg/plant):	
		2018	2019	2018	2019	2018	2019
T <sub>1</sub>	100 % RDF (1:0.5:1: N: P: K + 10kg FYM plant <sup>-1</sup> )	22.00	64.80	64.80	10.56	64.80	66.72
T <sub>2</sub>	75 % RDF + 10kg <i>Vermicompost</i>	22.75	66.96	66.96	10.92	66.96	69.00
T <sub>3</sub>	75 % RDF + 10kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	26.00	75.28	75.28	12.48	75.28	76.92
T <sub>4</sub>	75 % RDF + 20kg <i>Vermicompost</i>	24.25	71.40	71.40	11.64	71.40	73.52
T <sub>5</sub>	75% RDF + 20kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	27.75	79.20	79.20	13.32	79.20	8095
T <sub>6</sub>	75% RDF + 30kg <i>Vermicompost</i>	25.00	73.16	73.16	12.00	73.16	75.84
T <sub>7</sub>	75% RDF + 30 kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	28.50	85.00	85.00	13.68	85.00	90.89
T <sub>8</sub>	50 % RDF + 10kg <i>Vermicompost</i>	22.50	66.24	66.24	10.80	66.24	68.24
T <sub>9</sub>	50% RDF + 10kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250 g PSB	25.50	73.76	73.76	12.24	73.76	77.32
T <sub>10</sub>	50 % RDF + 20kg <i>Vermicompost</i>	23.25	68.40	68.40	11.16	68.40	70.56
T <sub>11</sub>	50 % RDF + 20kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	26.50	76.90	76.90	12.72	76.90	77.76
T <sub>12</sub>	50% RDF + 30kg <i>Vermicompost</i>	23.75	69.92	69.92	11.40	69.92	72.00
T <sub>13</sub>	50% RDF+ 30 kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	27.25	77.03	77.03	13.08	77.03	80.72
	SEm ±	1.08	1.28	1.28	0.45	1.28	1.27
	CD	3.15	3.74	3.74	1.39	3.74	3.71

**Table 2: Effect of Integrated nutrient management on fruit length, width and weight of aonla**

Treatments		Fruit length (cm)		Fruit width (cm)		Fruit weight (g)	
		2018	2019	2018	2019	2018	2019
T <sub>1</sub>	100 % RDF (1:0.5:1: N: P: K + 10kg FYM plant <sup>-1</sup> )	3.56	3.70	3.46	3.59	35.90	37.31
T <sub>2</sub>	75 % RDF + 10kg <i>Vermicompost</i>	3.69	3.80	3.57	3.71	37.13	38.58
T <sub>3</sub>	75 % RDF + 10kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	4.21	4.37	4.09	4.24	42.43	44.10
T <sub>4</sub>	75 % RDF + 20kg <i>Vermicompost</i>	3.93	4.07	3.81	3.95	39.58	41.13
T <sub>5</sub>	75% RDF + 20kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	4.50	4.66	4.36	4.52	45.29	47.06
T <sub>6</sub>	75% RDF + 30kg <i>Vermicompost</i>	4.05	4.20	3.93	4.07	42.16	43.81
T <sub>7</sub>	75% RDF + 30 kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	4.62	4.79	4.48	4.64	46.51	48.34
T <sub>8</sub>	50 % RDF + 10kg <i>Vermicompost</i>	3.65	3.78	3.54	3.67	36.72	38.16
T <sub>9</sub>	50% RDF + 10kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250 g PSB	4.13	4.28	4.01	4.16	41.62	43.25
T <sub>10</sub>	50 % RDF + 20kg <i>Vermicompost</i>	3.77	3.91	3.65	3.79	37.94	39.43
T <sub>11</sub>	50 % RDF + 20kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	4.29	4.45	4.16	4.32	43.25	44.94
T <sub>12</sub>	50% RDF + 30kg <i>Vermicompost</i>	3.85	3.99	3.73	3.87	38.76	40.28
T <sub>13</sub>	50% RDF+ 30 kg <i>Vermicompost</i> + 250g <i>Azotobacter</i> + 250g PSB	4.41	4.58	4.28	4.44	44.47	46.22
	SEm ±	0.19	0.17	0.15	0.17	1.579	1.604
	CD	0.56	0.49	0.45	0.50	4.608	4.680