Influence of nutrient management through bio-organic manures on bio-chemical attributes of Aonla (*Emblica officinalis* Gaertn.) cv. Na-10

ABSTRACT

The present investigation entitled "Integrated nutrient management in Aonla (*Emblica officinalis* Gaertn.) cv. Na-10" was carried out at Main Experiment Station, Horticulture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during the year 2021. The experiment was laid out 10 treatments T_1 – Control, T_2- RDF 100% (1kg.N: 0.5kg.P:1kg.K per tree), T_3- FYM (10kg./tree) + RDF 100%, T_4- Poultry Manure (7.5kg./tree) + RDF 100%, T_5- FYM (10kg./tree) + RDF 50% + *Azospirillium* (10ml./tree), T_6- Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml./tree), T_7 -FYM (10kg./tree) + RDF 50% + PSB (10ml./tree), T_8- Poultry Manure + RDF 50% + *Azospirillium* (10ml./tree), T_9 –FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml./tree) + PSB (10ml./tree) and T_{10}- Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml./tree), the experiment was laid out in Randomized Block Design and replicated thrice. It is concluded that among the different treatments T_{10}- Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml./tree) recorded maximum TSS (11.83^0 Brix), Ascorbic acid content (599.98 mg/ 100g fruit pulp), reducing sugar (3.28%), non-reducing sugar (3.00%), total sugar (6.29%) and minimum acidity (1.32%) of aonla which was at par with T_9-FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml./tree) + PSB (10ml./tree) and showed better response as compare to other treatment.

Keywords: Aonla, *Azospirillium*, Nutrient management, Poultry Manure

INTRODUCTION

The Indian gooseberry or aonla (*Emblica officinalis* Gaerten) belongs to family "Euphorbiaceae" with the chromosome number 2n=28. Aonla also known as different names in different region like Amla, Amolphal, Amalakamu, Dhatri, Nelli, Usirika and Maryobalan. **(Sharma, and Nagaich (2022).** It is native of Indo- China, particularly in central and southern India. In India Aonla cultivation is done mainly in northwest Himalayas to eastern Himalaya. The domestication of aonla was first started in Varanasi, Uttar Pradesh with the initiative of Maharaja of Kashi. Banarasi, a superior genotype was selected from the wild aonla trees available in large number in the nearby Vindhyan hills. Authentic information regarding its cultivation dates back to 1881-82 in the Pratapgarh district of Uttar Pradesh **(Singh *et al.*, 2019).** It occupies an area of 100 thousand ha.

with a production of 1206 thousand MT **(Anonymous, 2021-22).**

In Uttar Pradesh Aonla more cultivated in near by the belt of Pratapgarh fallowed by Ayodhya district. Area under aonla orchard in Pratapgarh district is about 1300 hectares. Whereas, the area in Sadder block of district of Pratapgarh approximately 3250 hectares **(Rai *et al.*, 2017).** Aonla is a subtropical plant and prefers dry subtropical climate but it can be successfully cultivated in wide range of soil and climatic condition. Owing to its hardy nature, suitability to various wastelands, high productivity, nutritive and therapeutic value aonla has become an important fruit. Aonla is a medium sized, much- branched tree occupying height of 10-20 m. Inflorescence is racemose type, flower minute, unisexual with short pedicel. Fruit depressed round, globuse or oblate, indened at the base. It is richest sources of vitamin C (400-1300mg./100g fruit pulp) among the fruits next to Barbados cherry. **(Tripathi *et al.*, 2022).** Sustained nutrient management is the passport to enter into the 21st century. In view of these situations, the application of nutrients from the combinations of inorganic, organic and biological sources not only fulfills the nutrient requirement of the crop but also improve the soil health. Hence integrated nutrient management practices will help to increase the productivity of the crop and enrich the soil **(Sharma *et al.*, 2018)**. Organic manures supply plant nutrients and micronutrients. They improve soil physical properties like soil structure, infiltration, porosity, water holding capacity, bulk density etc. Organic manures act as buffering agents and supplies food for beneficial living organism **(Aal *et al.*, 2020).**

MATERIALS AND METHODS

The present investigation was carried out at Main Experiment Station, Horticulture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during the year 2021-2022. The experiment was laid out in Randomized Block Design with 10 treatments **T_1**Control,**T_2** RDF 100% (1kg.N: 0.5kg.P:1kg.K per tree), **T_3** FYM (10kg./tree) + RDF 100%, **T_4** Poultry Manure (7.5kg./tree) + RDF 100%, **T_5** FYM (10kg./tree) + RDF50% + *Azospirillium* (10ml./tree), **T_6** Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml./tree), **T_7** FYM (10kg./tree) + RDF 50% + PSB (10ml./tree),**T_8** Poultry Manure (7.5kg/tree) + RDF 50% + PSB (10ml./tree), **T_9** FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml./tree) + PSB (10ml./tree),**T_{10}** Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* + (10ml/tree) + PSB (10ml./tree) and replicated thrice. The prescribed schedule for the aonla plantation was followed for the usual cultural operations, plant protection measures, and basal application of manures and fertilizers. The observations on TSS, ascorbic acid, acidity, reducing sugar, non-reducing sugar and total sugar were made along with numerous other fruit characteristics. Data were examined, and the mean results are shown here. TSS was calculated using a hand refractometer and displayed in ^{0}Brix. By using the standard procedure outlined in **AOAC (1990)**, several chemical parameters, including total sugars, ascorbic acid, and acidity were measured. The data obtained during experimentation were statistically analyzed as per the method given by **Panse and Sukhatme (1985)** and the result was evaluated at 5% level of significance.

RESULT AND DISCUSSION

Total Soluble Solid (^{0}brix):

The data recorded on total soluble solids of fruits were significantly influenced by various INM treatments. The application of treatment T_{10}- Poultry Manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) +PSB (10ml/tree) had recorded significantly maximum total soluble solids value (11.82^{0}Brix) followed by T_9- FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) +PSB (10ml/tree). The lowest total soluble solid (8.82 ^{0}brix) was observed with treatment T_1 i.e. control. TSS content are increased with *Azospirillum* and FYM application may be attributed due to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to the developing fruits, conversion of complex polysaccharides into simple sugars. **Kumar *et al.* (2018)** reported that application of 100% recommended dose of fertilizers (RDF) along with vermicompost + poultry manure + *Azospirillum* + PSB has recorded the maximum fruit TSS. The present finding also conformity with **Babiskar *et al.* (2011)**, **Sharma *et al.* (2022)** in kiwifruit and **Jaiswal *et al.* (2023)** in guava

Ascorbic acid (mg./100g fruit pulp):

The highest ascorbic acid value 599.98 was recorded with the treatment T_{10} Poultry Manure (7kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml/tree), followed by treatment T_9-FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) +PSB (10ml/tree). However the lowest ascorbic acid 488.16 was observed with treatment T_1-control. The qualitative characters of fruit were influenced by different treatments. The results indicated that maximum ascorbic acid were recorded by the application of FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) +PSB (10ml/tree) which were significantly superior to control. These results are in conformity with the findings of **Yadav *et al.* (2007), Bohane *et al.* (2014), Kour *et al.* (2019), Sharma *et al.* (2022)**.

Acidity (%):

The application of treatment T_{10}- Poultry Manure (7.5 kg/tree) + RDF 50% + *Azospirillium*

(10ml/tree) + PSB (10ml/tree) which reduced acidity percent and obtained minimum fruit acidity value (01.32%) followed by FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) that is treatment T_9. The decrease in acidity of fruits may be attributed to their conversion into sugars and their derivatives by the reactions involving reversal of glycolytic pathway or might be used in respiration or both. **Athani (2009), Yadav *et al.* (2007)** reported that the low acidity content in aonla fruit with the application of 500g Nitrogen + 250g Phosphorous +250g Potassium + 25g Sulphur + 100kg FYM + 200g each (*Azotobacter* + *Azospirillum* + PSB) found. Similar findings were also reported by **Bohane *et al.* (2014), Jamra *et al.* (2018), Sharma *et al.* (2022)** and **Jaiswal *et al.* (2023)** in guava**.**

Reducing Sugar (%):

Significantly maximum reducing sugar percent (3.28 %) with application of Poultry Manure (7.5 kg./tree) + RDF 50% + *Azospirillium* (10ml./tree) +PSB (10ml./tree) followed by FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml./tree). However minimum reducing sugar percent (2.10%) recorded with treatment T_1 that is control. An increase in reducing sugars contents with *Azospirillum* and Farm Yard Manure application may be attributed due to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to the developing fruits, conversion of complex polysaccharides into simple sugars. Similar results were noted by **Jamra *et al.* (2018), Kour *et al.* (2019)** in aonla, **Verma *et al. (*2014)** in phalsa, **Rai *et al.* (2009)** in Pear and **Chawla *et al.* (2020)**

Non-reducing sugar (%):

Application of Poultry Manure (7.5 kg/tree) + RDF 50% *Azospirillium* + (10ml/tree) +PSB (10ml/tree) had significantly maximum non- reducing sugars percent (3.00%) followed by FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) PSB (10ml/tree). While, minimum non-reducing sugar percent (1.9%) observed with treatment T_1 (control). An also increase in non-sugars contents with Azospirillum and Farm Yard Manure application may be attributed due to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to the developing fruits, conversion of complex polysaccharides into simple sugars. The highest non-reducing sugar were also recorded with application of Poultry Manure (7.5 kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml/tree). These types finding were noted by **Verma *et al (*2014)** in Phalsa. Similar result also conformity with **Chawla *et al.* (2020), Jamra *et al.* (2018), Kour *et al.* (2019)** in aonla.

Total Sugar (%):

The highest total sugars value (6.29%) were recorded in T_{10} treatment that is Poultry Manure (7.5 kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) +PSB (10ml/tree) which were followed by T_9 treatment FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml/tree) and T_8 were proved equally good with T_{10}. However minimum total sugar percent (4.00%) recorded with treatment T_1 that is control. The similar results are also corroborating withthe findings of **Singh *et al.* (2008), Sharma *et al.* (2022), Kour *et al.* (2019)** in aonla fruits, **Verma *et al.* (2014)** and **Yadav *et al.* (2008)** in Phalsa.

CONCLUSION:

Based on the results of this present investigation, it can be concluded that treatment T_{10} (Poultry Manure (7.5kg/ tree) + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml/tree) produced the maximum TSS (11.83^0 Brix), Ascorbic acid content (599.98 mg/ 100g fruit pulp), reducing sugar (3.28%), non-reducing sugar (3.00%), total sugar (6.29%) and minimum acidity (1.32%) of aonla which was at par with T_9-FYM (10kg/tree) + RDF 50% + *Azospirillium* (10ml./tree) + PSB (10ml./tree) can be recommended to aonla growers in eastern Uttar Pradesh for obtaining higher yield with better quality fruits

FUTURE SCOPE

Integrated nutrient management, developed on the principles of eco-friendly and efficient balanced fertilizer and based in optimization of nutrient supplies from all the available sources, inorganic and organic, which lowers production costs and increases productivity, were the greatest ways to cultivate Aonla.

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	Treatments	**TSS (^{0}Brix)**	**Ascorbic acid (mg/100g fruit pulp)**	**Acidity (%)**	**Reducing sugar (%)**	**Non-reducing sugar (%)**	**Total sugars (%)**
T_1	Control	8.82	488.16	2.01	2.10	1.9	4.00
T_2	RDF 100 % (1kg N : 0.5kg P : 1kg K per tree)	9.40	499.58	1.97	2.39	2.17	4.57
T_3	FYM (10kg/tree) + RDF 100%	9.48	509.51	1.85	2.65	2.25	4.91
T_4	Poultry manure (7.5kg/tree) + RDF 100%	9.54	512.16	1.79	2.76	2.30	5.06
T_5	FYM (10kg/tree) + RDF50% + *Azospirillium* (10ml/tree)	9.69	529.50	1.73	2.88	2.39	5.27
T_6	Poultry manure (7.5kg/tree) + RDF 50% + *Azospirillium* (10ml/tree)	10.25	536.90	1.66	2.92	2.52	5.45
T_7	FYM (10kg/tree) + RDF 50% + PSB (10ml/tree)	10.50	555.37	1.55	3.10	2.62	5.72
T_8	Poultry manure + RDF 50% + PSB (10ml/tree)	10.58	569.63	1.49	3.16	2.88	6.04

T_9	FYM + RDF 50% + *Azospirillium* (10ml/tree) + PSB (10ml/tree)	10.66	596.01	1.40	3.25	2.92	6.18
T_{10}	Poultry manure (7.5kg/tree) + RDF 50% + *Azospirillum* (10ml/tree) + PSB (10ml/tree)	11.83	599.98	1.32	3.28	3.00	6.29
	SEm ±	0.47	1.35	**0.01**	0.03	0.04	0.05
	CD at 5%	1.41	4.02	**0.04**	0.08	0.12	0.14

Table 1: Effect of integrated nutrient management on bio-chemical attributes of Aonla (*Emblica officinalis* Gaertn.) cv. Na-10