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Organic nutrient management in Aonla under semi arid region of North Gujarat

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ABSTRACT

An experiment was carried out to comprised the different organic sources of nutrients with inorganic source on growth and yield of Aonla (cv. NA-7) during 2009-10 to 2015-16. The experiment comprised of nine treatments viz. T_1: RDF (1000:500:500 NPK g /tree) through chemical fertilizers, T_2: 100 % N through FYM, T_3: 100 % N through Poultry manure, T_4: 100 % N through Vermicompost, T_5: 100 % N through decomposed castor shell, T_6: 50 % N through FYM + 50 % N through Poultry manure, T_7: 50 % N from FYM + 50 % N through Vermicompost, T_8: Enrich FYM through bio fertilizer, T_9: Control under Randomized Block Design. Among these treatments the application of 100 % RDF (1000:500:500 g NPK /tree)through chemical fertilizers gave significantly the highest fruit length(3.73 cm), fruit breadth(3.94 cm) , number of fruits(3903 /tree) and fruit yield (126.89 kg /tree) over rest of treatments. The treatment 100% N through FYM gave significantly the highest fruit weight (32.47g /fruit) and pulp weight (29.12 g /fruit) over rest of the treatments.

The treatment of RDF (1000:500:500 NPK g / tree) gave higher gross return (Rs.1, 97,950 ha^{-1}), net return (Rs.1, 89,529 ha^{-1}) and benefit cost ratio (1:5.7) for aonla (Cv. NA-7). While looking to organic fertilizer treatments 100% N through FYM recorded highest gross return (197410 ha^{-1}), net return (181510 ha^{-1}) and B:C ratio (1:2.5).

Key words: Aonla, castor shell, FYM, poultry manure, vermicompost

Aonla (E*mblica officinalis* Gaertn.) belongs to the family *Euphorbiaceae,* is one of the important minor fruit crops in our country. The tree is being grown successfully across the country in varied agroclimatic conditions in more than 91,000 ha area land with a production of 9.89 lakh MT (Annonymous,2017). The edible fruit is highly nutritious and among the fruits it is the richest source of vitamin–C. Soil type, fertility and nutrient management play an important role in obtaining higher growth and yields of aonla. Nowadays cost of inorganic fertilizers are gradually increasing. Indiscriminate use of chemical fertilizers, pesticides, weedicides etc. over the last four decades had adversely affected the soil fertility, water quality, yield and quality of the produce and increased level of resistance in pests (Kalloo, 2003). The Farm Yard Manure (FYM) seems to be directly responsible in increasing crop yields either by accelerating the respiratory process by increasing cell permeability by hormone growth action or by a combination of all these processes. It supplies nitrogen, phosphorus, potassium and sulphur in available forms to the plants through biological decomposition. Indirectly it improves the physical properties of soil such as aggregation of soil, permeability and water holding capacity. Hence, the present

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investigation was undertaken to study the effect of different organic manures, biofertilizers and chemical fertilizers for higher growth, fruit yield of rainfed aonla and higher net return.

MATERIALS AND METHODS

An experiment was carried out to comprised the different organic sources of nutrients with inorganic source on growth and yield of Aonla (cv. NA-7) during 2009-10 to 2015-16. The trial was laid out in a Randomized Block Design with nine treatments and four replications. Total nine treatments *viz.* T_1: RDF (1000:500:500 NPK g */tree*) through chemical fertilizers, $T_{2:}$ 100 % N through FYM, $T_{3:}$ 100 % N through Poultry manure, $T_{4:}$ 100 % N through Vermicompost, $T_{5:}$ 100 % N through decomposed castor shell, $T_{6:}$ 50 % N through FYM + 50 % N through Poultry manure, $T_{7:}$ 50 % N from FYM + 50 % N through Vermicompost, $T_{8:}$ Enrich FYM through bio fertilizer, $T_{9:}$ Control were comprised in randomized block design. Observations on plant morphological characters i.e. plant height, plant stem girth, plant spread (N-S) and (E-W) and yield attributes like fruit length, fruit breadth, fruit weight, pulp weight, number of fruits per tree and fruit yield per tree were recorded at harvest of the mature fruits. The Total Soluble Solids (TSS) content of the aonla fruit juice was directly measured by using digital hand refractometers and ascorbic acid content of aonla fruit juice was determined by visual titration method (Ranganna, 1986) using 2, 6 diclorophenol indophenols.

RESULTS AND DISCUSSION

The experimental data were statistically analyzed by the analysis of variance method. The data presented in Table 1 were obtained at the end of 7 years of experimentation showed that the plant height and plant spread (N-S) and (E-W) did not differed significantly. *Significantly the highest stem girth 68.50 cm per plant was found fewer than* 100 % N through decomposed castor shell. Similar results were obtained by Mustafa *et al*. (2013) and Mandal *et al*. (2013) on Aonla cv. NA-7 using integrated treatment of organic manure and inorganic fertilizer.

Considering the yield attributes of aonla which is the average of five years responses (Table-2) explicit that significantly the maximum fruit length (3.73 cm), fruit breadth (3.94cm), was recorded in treatment RDF 1000:500:500 NPK g per tree and it was followed by the treatment 100% N through FYM .Significantly the highest fruit weight (32.47 g/fruit) and pulp weight (29.12 g) of aonla fruit was recorded in treatment 100% N through FYM and it was followed by treatment RDF 1000:500:500 NPK g per tree were 31.96g/ fruit and 28.71 g/fruit, respectively. Significantly the highest numbers of fruits (3903) per tree were noted under the treatment of RDF 1000:500:500 NPK g per tree and it was followed by the treatment 100% N through FYM treatment (3901). Application of inorganic (RDF 1000:500:500 NPK per plant) or organic manures i.e. 100% N from FYM to aonla produced more number of fruits per plant over rest of the treatments.

The treatment RDF 1000:500:500 NPK g per plant gave significantly highest fruit yield 126.89 kg per plant followed by 100% N from FYM per plant treatment 126.55 kg per plant. Hence, the treatment of chemical fertilizer (RDF 1000:500:500 NPK g) per pant and organic manure (100% N from FYM) to the aonla tree produced more yield than the application of integration of either poultry manure or vermicompost with FYM. The result is accordance with Yadav *et al*. (2007), Katiyar *et al*. (2010) and Mandal *et al*. (2013)

The data showed in table -3 revealed that the fresh aonla juice contained maximum 656.19 mg/100 g of ascorbic acid in the treatment in 100 % RDN through vermicompost. The TSS of the juice was found non significant

among all treatments. Nurbhanej *et al*. (2016) also recorded similar result in the integrated nutrient management effect on acid lime.

Looking the economic data in table 4 revealed that the treatment of RDF (1000:500:500 NPK g / tree) gave higher gross return (Rs.197950 ha^{-1}), net return (Rs.189529 ha^{-1}) and Benefit cost ratio (1:5.7) for aonla (Cv. NA-7). While looking to the organic farming treatments 100% N through FYM recorded highest gross return (1, 97,410 ha^{-1}), net return (1, 81,510 ha^{-1}) and B: C ratio (1:2.5).

Table 1 Effect of organic farming on growth attributes of aonla (At the end of 7th years)

Treatments	Plant height (m)	Stem Girth (cm)	Plant spread N-S (m)	Plant spread E-W (m)
T_1: RDF (1000:500:500 NPK g /tree)	5.00	68.00	4.85	4.53
T_2: 100 % N through FYM	4.95	67.75	4.60	4.48
T_3: 100 % N through Poultry manure	4.45	63.50	4.83	4.63
T_4: 100 % N through Vermicompost	4.55	62.25	4.35	4.93
T_5: 100 % N through decomposed castor shell	4.23	68.50	4.93	4.83
T_6: 50 % N through FYM + 50 % N through Poultry manure	4.58	64.00	5.00	4.80
T_7: 50 % N from FYM + 50 % N through Vermicompost	4.48	63.25	5.15	5.23
T_8: Enrich FYM through bio fertilizer	4.78	63.25	4.33	4.70
T_9: Control	3.95	56.75	5.30	5.25
SEm (±)	0.25	3.04	0.35	0.21
CD at 5%	NS	8.88	NS	NS
C.V. %	11.38	9.55	14.67	8.91

Table 2 Effect of organic farming on Yield and yield attributes of aonla (Average of five years)

Treatments	Fruit Length (cm)	Fruit Breadth (cm)	Fruit Weight (g/fruit)	Pulp weight (g/fruit)	Number of Fruits Per tree	Fruit Yield Per tree (Kg)
T_1: RDF (1000:500:500 NPK g /tree)	3.73	3.94	31.96	28.71	3903	126.89
T_2: 100 % N through FYM	3.64	3.93	32.47	29.12	3901	126.55
T_3: 100 % N through Poultry manure	3.56	3.81	29.63	26.25	3366	97.79
T_4: 100 % N through Vermicompost	3.56	3.86	30.40	22.01	3680	111.73
T_5: 100 % N through decomposed castor shell	3.46	3.66	28.37	25.00	3752	105.98
T_6: 50 % N through FYM + 50 % N through Poultry manure	3.45	3.76	28.33	24.92	3443	97.90
T_7: 50 % N from FYM + 50 % N through Vermicompost	3.53	3.83	29.81	26.39	3857	115.90
T_8: Enrich FYM through bio fertilizer	3.61	3.93	31.90	28.52	3549	111.35
T_9: Control	3.48	3.67	28.69	25.25	3166	90.67
SEm (±)	0.03	0.03	0.50	0.49	153	4.27
CD at 5%	0.09	0.10	1.39	1.38	424	11.85
Y x T	NS	NS	NS	NS	NS	NS
C.V. %	4.04	4.18	8.03	8.03	20.69	19.09

Table 3 Effect of organic farming on quality parameters of aonla (Average of two years)

Treatments	Ascorbic acid (mg/100 g)	TSS (°brix)
T_1: RDF (1000:500:500 NPK g /tree)	620.77	10.70
T_2: 100 % N through FYM	618.66	10.44
T_3: 100 % N through Poultry manure	605.02	10.41
T_4: 100 % N through Vermicompost	656.19	10.85
T_5: 100 % N through decomposed castor shell	628.49	10.48
T_6: 50 % N through FYM + 50 % N through Poultry manure	589.36	10.79
T_7: 50 % N from FYM + 50 % N through Vermicompost	594.03	10.28
T_8: Enrich FYM through bio fertilizer	604.75	11.05
T_9: Control	618.47	10.81
SEm (±)	9.70	0.22
CD at 5%	27.49	NS
Y x T	NS	NS
C.V. %	4.82	9.63

Table 4 Economics of different organic farming treatments on aonla

Treatments	Yield (kg/ha)	Gross return (Rs/ha)	Cost of Treat. (Rs/ha)	Net return (Rs/ha)	Additional Income (Rs/ha)	B:C ratio
T_1: RDF (1000:500:500 NPK g /tree)	19795	197950	8421	189529	48089	1:5.7
T_2: 100 % N through FYM	19720	197410	15900	181510	40070	1:2.5
T_3: 100 % N through Poultry manure	15255	152550	18384	134166	-7274	--
T_4: 100 % N through Vermicompost	17430	174300	28680	145620	4180	1:0.1
T_5: 100 % N through decomposed castor shell	16533	165330	10350	154980	13540	1:1.3
T_6: 50 % N through FYM + 50 % N through Poultry manure	15272	152720	25092	127628	-13820	--
T_7: 50 % N from FYM + 50 % N through Vermicompost	18080	180800	30240	150560	9120	1:0.3
T_8: Enrich FYM through bio fertilizer	17370	173300	16068	157232	15792	1:0.9
T_9: Control	14144	141440	--	141440	--	--

CONCLUSION

On the basis of the results obtained from the study concluded that application of chemical fertilizer i.e. RDF 1000:500:500 NPK g per tree recorded the higher fruit length, breadth, yield and economically profitable for Aonla cv.NA-7 and it was followed by the application of organic manure i.e. 100% N through FYM (200kg FYM /tree). Thus the application of inorganic chemical fertilizer RDF (1000:500:500 NPK g per tree) or organic manure (100% N through FYM (200 kg FYM /tree) recommended for aonla cv.NA-7 under semi arid region of north Gujarat.

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100 % Nitrogen through FYM