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Research Article

EFFECT OF DRIP IRRIGATION REGIMES AND MULCHING METHODS ON LEAF NUTRIENTS UPTAKE OF AONLA (*Emblica officinalis* Gaertn) Cv. NA-10 UNDER SODIC SOIL

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Abstract: The study was carried out on drip irrigation regimes and mulching method on nutrients uptake of anola (*Emblica officinalis* Gaertn) Cv. NA-10. The nitrogen uptake was significant (2.52) analyses in 1_3 (IW/CPE=0.6) regime; while P, K and Mg was recorded significantly in 1_1 (IW/CPE=1.0). Mulching with paddy straw shows highest concentration of N, K, Ca and Mg in leaf while P content maximum was absorbed in black polythene mulch. Interaction of irrigation regime and mulching shows significant maximum N, K and Ca content in 1_3 M_2, 1_2M_2, and I_1M2, combination, respectively.

Keywords: Drip, Mulching N, P, K, Ca. & Mg

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Introduction

Anola or Indian Goosberry (*Emblica officinalis* Gaernt) thrives well in varied climate and soil conditions in the country. In recent years its cultivation is increasing rapidly particularly in salt affected soil (sodic/saline) and also in ravines area of the country. Drip irrigation coupled with mulching can play an important role in conserving soil moisture, regulating soil temperature, reducing soil erosion, improving soil structure and control the weed population. Continuous use of organic mulches also helps in physio-chemical and biological properties of the soil. In the lower level of soil the available of nutrients are less, therefore, fruit trees with deep root system suffer from deficiency of nutrients. If the water is made available at the upper level of soil the plant will flourish by producing feeding roots at this level of the soil. The present investigation was design to find out the effect of drip irrigation and mulching on nutrient uptake of aonla [1].

Materials and methods:

A two years field experiment was conducted at Main Experimental Station of N.D.U.A. & T. Kumarganj, Faizabad. The site is lies between latitude of 24.470 and 26.560 and longitude of 81.120 and 83.890 at an elevation of 113.0 meter of mean sea level. The ten year old orchard of Aonla (*Emblica officinalis* Gaertn) cultivar NA-10 was planted at a distance of 8 x 8 meter. There were four irrigation regimes and three mulching treatments. It constituted Factorial Randomized Block design with three replications and two tree of each treatment & its combination where taken for observation [2].

Irrigation regime

Irrigation was applied at third day interval through drip method scheduling based on class "A" weather pan evepometer. Rainfall, if any was disregarded for computing the irrigation scheduling. There were four dripper per plant gave a discharge of 8 litre water/dripper at a pressure of 0.34 kg. The amount of water was computed at the ratio of 1W/CPE at third day interval as per following formula:

Quantity of water (litre) = Size of basin (m^2) x Pan Evaporation (mm) / 100

Table-1 Detail of treatments and their Combinations

SN	Factors	Treatments	Notation
1	Irrigation regimes	1W/CPE=1.0	1_1
		1W/CPE=0.8	1_2
		1W/CPE=0.6	1_3
		1W/CPE=0.4	1_4
2	Mulching	Black Polythene	M_1
		Paddy straw	M_2
		Control (No mulching)	M_3

SN	Treatment combination	Notation
1.	IW/CPE =1.0 + B.P.	1_1M_1
2.	1W/CPE=1.0+P.S.	1_1M_2
3.	1W/CPE=1.0+control	1_1M_3
4.	1W/CPE=0.8 + B.P.	1_2M_1
5.	1W/CPE=0.8 + P.S.	1_2M_2
6.	1W/CPE=0.8 + control	1_2M_3
7.	1W/CPE=0.6 + B.P.	1_3M_1
8.	1W/CPE=0.6 + P.S.	1_3M_2
9.	1W/CPE=0.6 + control	1_3M_3
10.	1W/CPE=0.4 + B.P.	1_4M_1
11.	1W/CPE=0.4 + P.S.	1_4M_2
12.	1W/CPE=0.4 + control	1_4M_3

Where,
B.P = Black Polythene, P.S = Paddy Straw, 1W = Depth of Irrigated Water (cm), CPE = Cumulative Pan Evaporation (mm)

Mulching

Black polythene (M_1) sheet of 400 gauge of 4.0 x 4.0 m^2 size was spread over the basin surface with their corner and side stitched with stacking pin and their outer side tagged in soil to avoid rolling and splitting on account of strong winds. Paddy straw (M_2) @ 20kg/plant (approximately 10 cm thickness) was spread over the tree basin and there were no mulching in control treatment. The mulches were placed after fertilizer application; irrigate the experimental plot to ensure the uniform moisture content. The soil of the site was sodic with low fertility and poor water holding capacity.

The initial soil characteristics were, sand 38.25%, silt 41.90%, clay 16.55% texture silty loam, field capacity 20-40%, bulk density 1-49 gcc^{-1}, hydraulic conductivity 0.16, organic carbon 0.21%, soil pH 8.86, electric conductivity 3.7 m. mohs/cm at 25ºC, ESP 30.49%, carbonate 16.89, bicarbonate 9.70, available soil nitrogen 169.65 kg ha^{-1}. The youngest physically matured leaves (5-6 months old) of middle portion of identified twigs were selected and analyzed at initiation and termination of experiment. The leaves were washed thoroughly and dried in the oven at 65 + 1ºC. The sampled leaves were grinded and analyzed the nitrogen, phosphorus, potassium, and calcium and magnesium percentage. The initial nutritional status of leaves given in [Table-2].

Table-2 Initial Nutritional Status of Aonla Leaves

SN	Nutrient	Value	Method of Analysis
1.	Nitrogen	2.07	Peach and Troey (1956) [9]
2.	Phosphorus	0.28	Richards (1954) [11]
3.	Potassium	1.43	Jackson (1973) [5]
4.	Calcium	2.19	Chang & Bray (1951) [1]
5.	Magnesium	0.17	Chang & Bray (1951) [1]

Table-3 Effect of drip irrigation regimes and mulching on nutritional status of anola leaves (cv. NA-10)

3 a) Nitrogen (%)

Mulching	Irrigation (IW/CPE)				
	1_1	1_2	1_3	1_4	Mean
M_1	2.15	2.32	2.39	2.39	2.31
M_2	2.11	2.39	2.81	2.10	2.35
M_3	2.08	2.18	2.36	2.11	2.18
Mean	2.11	2.30	2.52	2.20	

CD (5%), 1 = 0.180, M = 0.093, 1 × M = 0.186

3 b) Phosphorus (%)

Mulching	Irrigation (IW/CPE)				
	1_1	1_2	1_3	1_4	Mean
M_1	0.41	0.45	0.44	0.42	0.43
M_2	0.30	0.34	0.32	0.31	0.32
M_3	0.34	0.35	0.34	0.34	0.34
Mean	0.35	0.38	0.37	0.36	

CD (5%), 1 = 0.013, M = 0.011,1 × M = NS

3 c) Potassium (%)

Mulching	Irrigation (IW/CPE)				
	1_1	1_2	1_3	1_4	Mean
M_1	1.88	2.00	1.89	1.59	1.84
M_2	2.10	2.26	2.15	2.13	2.16
M_3	1.50	1.69	1.64	151	1.59
Mean	1.8	1.98	1.89	1.74	

CD (5%), 1 = 0.038, M = 0.032, 1 × M = 0.065

3 d) Calcium (%)

Mulching	Irrigation (IW/CPE)				
	1_1	1_2	1_3	1_4	Mean
M_1	2.11	2.30	2.17	1.66	2.06
M_2	2.42	2.20	2.17	1.79	2.15
M_3	2.04	2.05	1.65	1.60	1.84
Mean	2.19	2.18	2.00	1.68	

CD (5%), 1 = 0.034, M = 0.035,1 × M = 0.550

3e) Magnesium (%)

Mulching	Irrigation (IW/CPE)				
	1_1	1_2	1_3	1_4	Mean
M_1	0.27	0.29	0.28	0.24	0.27
M_2	0.33	0.35	0.32	0.31	0.33
M_3	0.21	0.24	0.23	0.21	0.22
Mean	0.27	0.29	0.28	0.25	

CD (5%), 1 = 0.015, M = 0.013, 1 × M = NS

Result and discussion

The mean value of N,P, K, C & Mg content of aonla leaves analyzed are being presented in [Table-3a, 3b, 3c, 3d & 3e]. It is justifies from [Table-3a] and [Fig-1] that nitrogen content was significantly affected by irrigation regime, mulching and interaction of these two factors. Drip irrigation at 1_3 (1W/CPE=0.6) regime recorded highest leaf nitrogen (2.5%). It was varied from 2.08 to 2.81 percent, and found maximum *i.e.* 2.81 in 1_3M_2 treatment combination. It is indicated that restricted application of water reduced the nitrogen loading from the root zone and frequently irrigation for balance growth advantage [4]. The data presented in [Table-3b, 3c & 3e] that irrigation at 1_2 (1W/CPE=0.8) regimes significantly influences the P, K and Mg content in leaves. The interaction of irrigation and mulching significantly impact on K and Ca content. The maximum K (2.26%) was recorded in 1_2M_2 and Ca (2.42%) in 11 M 2 combinations. The calcium in leaves significantly maximum (2.19) in plants were irrigated at higher level of irrigation (1W/CPE=1.0). It is clear that drip irrigation reduced exchangeable sodium salt due to adequate and regular applies of water and increased the entire nutrient uptake in plant [2,3,8]. The data shown in above mentioned tables that among the mulching treatments, paddy straw (M^2) had beneficial effect on N, K, Ca and Mg. It might be due to conservation of water and provided congenial condition to plant root for better absorption of nutrients. The findings are in conformity with Mustaffa (1988) [7] and Pinamounti *et al.* (1995) [10]. The data illustrated in [Table-3b] that phosphorus content in leaves was significantly higher (0.43%) in black polythene mulch. It may be restricted availability of P in soil as compare to paddy straw mulch which is lower the absorption and translocation of P in plant [7,6].

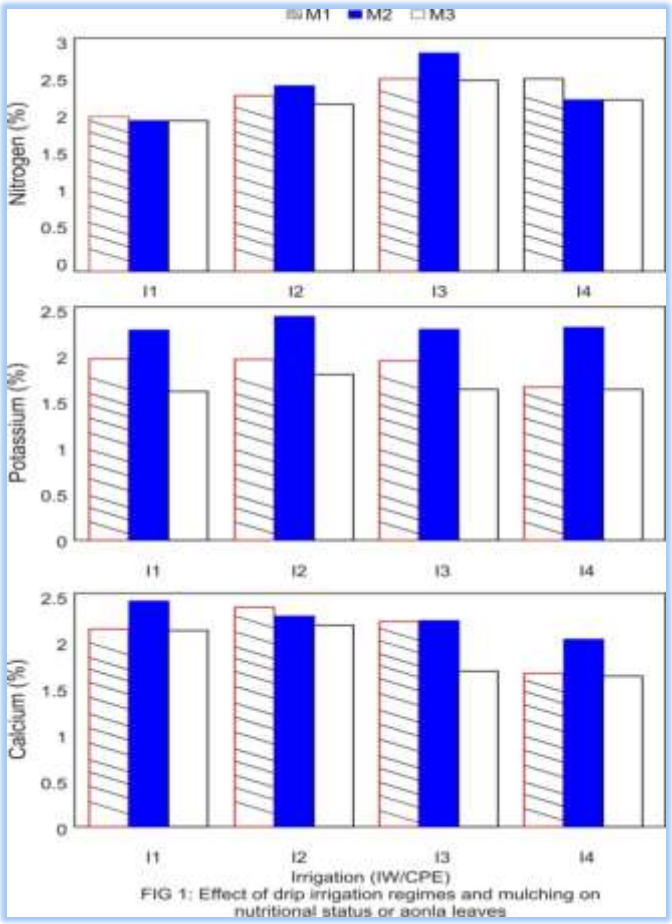

FIG 1: Effect of drip irrigation regimes and mulching on nutritional status or aonla leaves

Application of research: Drip irrigation and mulching have economic benefit for uptake of nutrient and providing straight to plant for boosting flowering and fruiting. Drip irrigation and mulching providing congeal condition to regular availability of water for solving nutrients to the root zone

Research Category: Drip irrigation and mulching

Abbreviations:

B.P. = Black Polythene
P.S. = Paddy Straw
1W = Depth of Irrigated Water (cm)
CPE = Cumulative Pan Evaporation (mm)
I= Irrigation
M= Mulching

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