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Effect of Foliar Application of Nutrients and NAA on Physical Composition of Mango Varieties

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ABSTRACT

Mango, the national fruit of India, has developed its own importance all over the world. Being a useful and delicious fruit, it is the part of culture and religion since long time and now, it is recognized as one of the best fruits in the world market. Urea amongst major nutrients as well as zinc, boron amongst micronutrients and NAA have been found to play a major role in maintenance of mango fruit quality. Moreover, for rapid response and correction of deficiencies of mineral nutrients, foliar spray of nutrients especially urea, Zn and B have been used singly. The experiment was conducted on mango cv Langra and Amrapali at Fruit Research Station, Imalia farm, Department of Horticulture, JNKVV, Jabalpur. The experiment involved the foliar spray of nutrients at first week of October and second spray during the 50% flowering stage of mango tree. The treatments included (V1N1D1)Variety Langra + Tap water, (V1N1D2) Variety Langra + Distilled water, (V1N2D1) Variety Langra + Urea 2% (V1N2D2) Variety Langra + Urea 4%, (V1N3D1) Variety Langra + Borex 0.2%, (V1N3D2) Variety Langra + Borex 0.5%, (V1N4D1) Variety Langra + Zinc sulfat 0.2%, (V1N4D2) Variety Langra + Zinc sulfat 0.5%, (V1N5D1) Variety Langra + NAA 100 ppm, (V1N5D2) Variety Langra + NAA 200 ppm with three replication similarly treatment applied with variety Amrapali. The results obtained indicated that the trees sprayed with 4% urea in variety Langra (V1N2D2) showed maximum fruit yield, fruit weight, fruit width, fruit weight, Pulp weight, Pulp percent, Pulp : Stone ratio, Pulp : Peel ratio and minimum Peel Percent, Stone Percent this treatment found to be at par with 2% urea with variety Langra V1N2D1 whereas maximum Fruit length was observed with 4% urea in variety Amrapali.

Keywords Urea, Borax, Zinc sulfat, NAA, Langra.

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INTRODUCTION

Mango being a one of the important member of the

family Anacardiaceae is originated from Indo-Burma region and favorite fruit of the tropical region after citrus and banana (Merwad *et al*. 2016, Sahoo *et al.* 2014). Mango occupies a pre-eminent place amongst the fruit crops grown in India and is acknowledged as the king of the fruit. Inflorescence of mango is panicles which are grown terminally. Mango is andro-monoecious i.e. each inflorescence bears both hermaphrodite and staminate flowers (Bose *et al*. 2001, Yeshitela *et al*. 2003). Mango is consumed at all stages and its nutritional value varies from variety to variety and developmental stages (Leghari *et al*. 2013). It is an excellent source of vitamin A and C (1082 IU and 36.4 mg fruit–[1]), as well as good source of calories (60 kcal), protein (0.82g), total carbohydrate (14.98g), fat (0.38g), sodium (1mg), potassium (14mg) per 100 g (Lauricella et al. 2017). Mango is being grown in more than 87 countries of the world but India ranks first among world's mango producing countries. Currently mango covers an area of 2.516 mha with a production of 18.431 MT, which works out to a low average productivity of 7.3 MT/ha (Anonymous 2015). The important mango producing states are Andhra Pradesh, Uttar Pradesh, Bihar, Karnataka, Tamil Nadu, West Bengal, Orissa, and Maharashtra. In Madhya Pradesh, total area under mango cultivation comes around 0.252 mha with a total production of 3.76 MT (Singh *et al.* 2014). In Madhya Pradesh it is grown in all districts moreover commercially cultivated in Hosangabad, Betul, Rewa, Satna and Bhopal.

According to horticulturist, only application of primary nutrients could not produce high quality fruit in mango trees, the application of micronutrients is compulsory as well. Major elements/macronutrients are quickly taken up and utilized by the tissue of the plants by the catalyzing effect of micronutrient/minor elements. Foliar application is the common practices to overcome the micronutrient deficiency in order to improve the fruit quality. Foliar application of micronutrients may be 6 to 12 times more effective than soil application. Nutrients are key elements in plants growth, development and play important role in improving pollen germination, fruit set, number of fruit per tree and subsequently yield. Boron, Zn and Urea deficiencies are more probable early in the season because the translocation of elements from the root to the above ground portion may not be adequate before leaf expansion (Neilsen *et al*. 2004).

MATERIALS AND METHODS

The investigation deals with the "Effect of foliar application of nutrients and NAA on physical composition of Mango varieties". For this a field experiment was conducted at Fruit Research Station, Imalia farm, Department of Horticulture and the chemical analysis of fruits was done in the laboratory of the Department of Food Science and Technology, JNKVV, Jabalpur (MP) during the year 2017-18 and 2018-19. The experiment was consisted with two variety of mango 1. Langa, 2. Amrapali , twenty treatments viz. (V1N1D1)Variety Langra + Tap water, (V1N1D2), Variety Langra + Distilled water, (V1N2D1) Variety Langra + Urea 2%, (V1N2D2) Variety Langra + Urea 4%, (V1N3D1) Variety Langra + Borex 0.2%, (V1N3D2) Variety Langra + Borex 0.5%, (V1N4D1) Variety Langra + Zinc sulfat 0.2%, (V1N4D2) Variety Langra + Zinc sulfat 0.5%, (V1N5D1) Variety Langra + NAA 100 ppm, (V1N5D2) Variety Langra + NAA 200 ppm, (V2N1D1)Variety Amrapali + Tap water, (V2N1D2), Variety Amrapali + Distilled water, (V2N2D1) Variety Amrapali + Urea 2%, (V2N2D2) Variety Amrapali + Urea 4%, (V2N3D1) Variety Amrapali + Borex 0.2%, (V2N3D2) Variety Amrapali + Borex 0.5%, (V2N4D1) Variety Amrapali + Zinc sulfat 0.2%, (V2N4D2) Variety Amrapali + Zinc sulfat 0.5%, (V2N5D1) Variety Amrapali + NAA 100 ppm, (V2N5D2) Variety Amrapali + NAA 200 ppm, with three replication in Split, Split Plot Design. There were three trees per replication. Nutrients apply by folia application during first week of October and second spray during the 50% flowering of mango in both the year. Fresh fruits were picked out from the tree as per treatment and weighed with the use of physical balance and expressed yield in kg plant^{-1}. Five healthy fruits were plucked randomly as per treatments tree per replication and subjected to physical observations. Fruit weight recorded on electronic balance and average fruit weight was determine and presented, length and width was measured in millimeters with the help of vernier calipers, after removal of peel from ripe selected fruits, then separate the pulp, peel and stone also with the help of steel knife and weighed.

Table 1. Effect of nutrients and naphthalene acetic acid on fruit yield (kg/tree).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	53.67	45.01	49.34	50.75	47.93	49.34
Urea (N2)	67.26	66.07	66.66	65.45	67.87	66.66
Borex (N3)	62.68	54.91	58.79	57.31	60.28	58.79
Zinc sulfate (N4)	60.82	54.14	57.48	56.35	58.61	57.48
NAA (N5)	57.17	48.57	52.87	52.05	53.69	52.87
Mean	60.32	53.74		56.38	57.68	

Doses	Varieties		
	V1	V2	Mean
D1	59.54	53.22	56.38
D2	61.10	54.25	57.68
Mean	60.32	53.74	

	SEm±	CD at 5%
Variety (V)	0.03	0.09
Nutrients (N)	0.13	0.40
Doses (D)	0.06	0.17
(V×N)	0.19	0.57
(N×D)	0.13	0.39
(V×D)	0.08	0.24

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	54.73	66.35	60.62	59.52	56.49	46.77	64.56	54.01	53.17	47.62
D2	52.62	68.17	64.74	62.12	57.86	43.24	67.58	55.82	55.11	49.52
			SEm±					CD at 5%		
V × N × D			0.19					0.55		

RESULTS AND DISCUSSION

1. Effect of nutrients and naphthalene acetic acid on fruit yield (kg plant^{-1})

Fruit yield was recorded at harvest of crop and data were analyzed and presented in Table 1. Data indicates the maximum fruit yield (60.32kg plant^{-1}) in variety Langra (V1) and minimum fruit yield (53.74kg plant^{-1}) was recorded in variety Amrapali (V2). Fruit yield influences by nutrients and the maximum fruit yield (66.66 kg plant^{-1}) was observed with the nutrient urea (N2). Minimum fruit yield (49.34 kg plant^{-1}) was recorded with the water application (N1). Doses of nutrients influence the fruit yield. Maximum fruit yield (57.68kg plant^{-1}) was found with higher dose of nutrients (D2) whereas, the minimum fruit yield (56.38kg plant^{-1}) was found with lower dose of nutrients (D1).

The interaction of variety X nutrients exhibited the highest fruit yield (67.26 kg plant^{-1}) was recorded in variety Langra with urea (V1N2). Whereas, the lowest fruit yield (45.01 kg plant^{-1}) were recorded in variety Amrapali with water application (V2N1).

The interaction of nutrients X dose had indicated that the highest fruit yield (67.87 kg plant^{-1}) was recorded with urea 4% (N2D2) whereas, the minimum fruit yield (47.93 kg plant^{-1}) was recorded with the distilled water (N1D2).

The interaction of variety X dose showed the highest fruit yield (61.10 kg plant^{-1}) was recorded in variety Langra with higher dose of nutrients (V1D2) whereas, the minimum fruit yield (53.22 kg plant^{-1}) was recorded in variety Amrapali with lower dose of nutrients (V2D1).

The interaction of variety X nutrients X dose indicated the maximum fruit yield (68.17 kg plant^{-1}) was observed in variety Langra with urea 4% (V1N2D2)

Table 2. Effect of nutrients and naphthalene acetic acid on fruit weight (g).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	165.6	129.0	147.3	152.0	142.6	147.3
Urea (N2)	193.6	160.5	177.0	174.4	179.7	177.0
Borex (N3)	186.0	146.9	166.5	162.6	170.4	166.5
Zinc sulfate (N4)	183.6	144.2	163.9	161.4	166.5	163.9
NAA (N5)	174.4	136.7	155.6	154.3	156.8	155.6
Mean	180.6	143.5		160.9	163.2	
	Varieties					
Doses	V1	V2	Mean			
D1	179.7	142.2	160.9			
D2	181.6	144.7	163.2			
Mean	180.6	143.5				
	SEm±	CD at 5%				
Variety (V)	0.001	0.003				
Nutrients (N)	0.015	0.044				
Doses (D)	0.006	0.017				
(V×N)	0.021	0.063				
(N×D)	0.013	0.037				
(V×D)	0.008	0.023				

whereas, the minimum fruit yield (43.24 kg plant^{-1}) was found in variety Amrapali with distilled water application (V2N1D2).

The increase in yield was mainly attributed to relative increase in the availability of nutrients and better uptake by the leaves. The increase in both number and weight of fruit might be attributed to fact that there was increasing level of nutrients in assimilating area of crop due to which the rate of dry matter production was enhanced (Anees *et al.* 2011). Panigrahi *et al.* (2007), Sahoo *et al.* (2014) in their study that the foliar application 4% urea was found more effective to control the fruit drop, ultimately fruit retention, fruit weight and yield was increased by 32.79% over control. The urea 4% had the highest number of fruit per panicle at harvest and highest number of fruit per plant with maximum fruit weight (Kumar *et al.* 2008, Sarker and Rahim 2013) revealed that).

2. Effect of nutrients and naphthalene acetic acid on fruit weight (g)

Fruit weight was recorded and presented in Table 2 the result revealed that various treatments had significant affect on fruit weight. The maximum fruit weight (180.6g) was recorded in variety Langra (V1) and minimum fruit weight (143.5g) was noted in variety Amrapali. Nutrients affect on fruit weight showed significant difference. The maximum fruit weight (177.0g) was recorded with the application of urea and minimum fruit weight (147.3g) was noted with application of water (N1). Doses of nutrients showed the significant difference on fruit weight, the maximum fruit weight (163.2g) was observed with the higher dose of nutrients (D2) and minimum fruit weight (160.9g) was noted in lower dose of nutrients (D1).

The interplay of variety X nutrients observed that the maximum fruit weight (193.6g) was found in variety Langra with urea application (V2N2) whereas, the minimum fruit weight (129.0g) was observed in the variety Amrapali with water application (V1N1).

The interaction of nutrients X dose exhibited that the maximum fruit weight (179.7g) in urea 4% (N2D2) was noted whereas, the minimum fruit weight (142.6g) observed in distilled water (N1D2).

The combinations of variety X dose showed that the maximum fruit weight (181.6g) in variety Langra with higher dose of nutrients (V1D2) and the minimum fruit weight (142.2g) were noted in variety Amrapali with lower dose of nutrients (V2D1).

Table 3. Effect of nutrients and naphthalene acetic acid on fruit width (mm)

Treatments	Varietie			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	55.83	54.97	55.40	57.64	53.16	55.40
Urea (N2)	61.66	59.46	60.56	59.84	61.28	60.56
Borex (N3)	60.62	56.05	58.34	57.30	59.38	58.34
Zinc sulfate (N4)	60.53	55.35	57.94	57.47	58.41	57.94
NAA (N5)	59.17	55.82	57.49	57.36	57.63	57.49
Mean	59.56	56.33		57.92	57.97	
		Varieties				
Doses	V1	V2	Mean			
D1	59.76	56.08	57.92			
D2	59.36	56.58	57.97			
Mean	59.56	56.33				
	SEm±	CD at 5%				
Variety (V)	0.004	0.012				
Nutrients (N)	0.031	0.093				
Doses (D)	0.011	0.032				
(V×N)	0.04	0.13				
(N×D)	0.02	0.07				
(V×D)	0.02	0.05				

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	58.97	61.08	60.14	59.94	58.67	56.31	58.60	54.45	55.00	56.06
D2	53.64	62.24	61.11	61.12	59.68	52.68	60.33	57.65	55.70	55.58
			SEm±					CD at 5%		
V × N × D			0.03					0.10		

The interaction of variety X nutrients X dose showed the maximum fruit weight (195.7g) was noted in variety Langra with the application of urea 4% (V1N2D2) whereas, the minimum fruit weight (125.3g) was noted in variety Amrapali with distilled water (V1N1D2).

Effect of nutrients and naphthalene acetic acid on fruit width (mm)

Fruit width was recorded at harvest of fruit and subject to statistical analysis. Data pertaining fruit width Table 3. Revealed that the nutrients and NAA increase the fruit width significantly. The maximum fruit width (59.56mm) was recorded with variety Langra (V1) and showed highly significant. Whereas, the minimum fruit width (56.33mm) was noted with variety Amrapali (V2). Fruit width influenced by the nutrients and showed significant difference, the maximum fruit width (60.56mm) was recorded with application of urea (N2) whereas, minimum fruit width (55.40mm) was recorded with water (N1). In case of doses of nutrients the maximum fruit width (57.97mm) with higher dose of nutrients (D2) and minimum fruit width (57.92mm) was recorded with lower dose of nutrients (D1).

The interaction of variety X nutrients showed significant affect on fruit width. The maximum fruit width (61.66mm) was noted in variety Langra with urea (V1N2) whereas, the minimum width (54.57mm) was observed in variety Amrapali with water application (V2N2).

The interaction of nutrients X dose exhibited significant affect on fruit width. The maximum fruit width (61.28mm) was noted with urea 4% (N2D2). Whereas, the minimum fruit width (53.16mm) was observed with distilled water (N1D2).

The interaction of variety X dose was showed the maximum fruit width (59.76mm) was observed in variety Langra with higher dose of nutrients

Table 4. Effect of nutrients and naphthalene acetic acid on fruit length (mm).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	87.94	92.47	90.21	92.37	88.05	90.21
Urea (N2)	97.41	102.07	99.74	98.80	100.68	99.74
Borex (N3)	95.36	98.64	97.00	95.89	98.11	97.00
Zinc sulfate (N4)	94.91	99.50	97.20	96.74	97.67	97.20
NAA (N5)	91.98	95.38	93.68	93.47	93.88	93.68
Mean	93.52	97.61		95.45	95.68	

	Varieties		
Doses	V1	V2	Mean
D1	93.50	97.37	95.45
D2	93.54	97.85	95.68
Mean	93.52	97.61	

	SEm±	CD at 5%
Variety (V)	0.02	0.07
Nutrients (N)	0.08	0.25
Doses (D)	0.04	0.12
(V×N)	0.12	0.35
(N×D)	0.10	0.29
(V×D)	0.06	0.18

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	90.91	96.70	94.64	94.41	91.05	93.83	100.9	97.14	99.08	95.90
D2	84.98	98.13	96.07	95.41	92.92	91.12	103.24	100.15	99.92	94.85

	SEm±	CD at 5%
V × N × D	0.14	0.41

(V1D2). Whereas, the minimum value (56.08mm) was recorded in variety Amrapali with lower dose of nutrients (V2D1).

The interaction affect of variety X nutrients X dose confirmed that the maximum fruit width (62.24mm) was noted in variety Langra with the application of urea 4% (V1N2D2) whereas, the minimum width (52.68mm) was noted in variety Amrapali with distilled water (V2N1D2).

Effect of nutrients and naphthalene acetic acid on fruit length (mm).

Fruit length were measured after harvesting in both the year and data presented in Table 4. The highest fruit length (97.61mm) in variety Amrapali (V2) and minimum fruit length (93.52mm) was noted in variety Langra (V1). Impact of nutrients on fruit length showed significant difference. The maximum fruit length (99.74mm) with the application of urea and minimum fruit length (90.21mm) was noted with the application of water (N1). Doses of nutrients showed the considerable difference on fruit length. The maximum fruit length (95.68mm) was noted with the higher dose of nutrients (D2) and minimum fruit length (95.45mm) was noted in lower dose of nutrients (D1).

The interplay of variety X nutrients exhibited the maximum fruit length (102.1mm) in variety Amrapali with urea application (V2N2) whereas, the minimum fruit length (87.98mm) was recorded in variety Langra with water application (V1N1).

The interaction of nutrients X dose showed the maximum fruit length (100.68mm) with application of urea 4% (N2D2) was noted whereas, the minimum fruit length (92.37mm) was observed with distilled water (N1D2).

The interplay of variety X dose confirmed that the maximum fruit length (97.85mm) in variety Am-

Table 5. Effect of nutrients and naphthalene acetic acid on pulp weight (g).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	101.40	75.98	88.7	92.26	85.12	88.7
Urea (N2)	125.7	104.13	114.9	112.40	117.4	114.9
Borex (N3)	119.3	94.00	106.7	103.75	109.6	106.7
Zinc sulfate (N4)	117.8	92.08	105.0	103.30	106.6	105.0
NAA (N5)	111.3	86.54	98.9	97.94	99.85	98.9
Mean	115.1	90.5		101.9	103.7	

	Varieties		
Doses	V1	V2	Mean
D1	114.3	89.64	101.9
D2	116.0	91.46	103.7
Mean	115.1	90.5	

	SEm±	CD at 5%
Variety (V)	0.11	0.33
Nutrients (N)	0.19	0.56
Doses (D)	0.06	0.17
(V×N)	0.26	0.79
(N×D)	0.13	0.39
(V×D)	0.08	NS

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	105.4	123.6	115.8	115.7	110.8	79.2	101.3	91.7	91.0	85.1
D2	97.4	127.8	122.9	120.0	111.7	72.8	107.0	96.3	93.2	88.0
			SEm±					CD at 5%		
V × N × D			0.19					0.55		

rapali with higher dose of nutrients (V2D2) and the minimum fruit length (92.37mm) in variety Langra with lower dose of nutrients (V1D1) were noted.

The interplay of variety X nutrients X dose showed that the maximum fruit length (103.24mm) in variety Amrapali with the application of urea 4% (V2N2D2) whereas, the minimum fruit length (84.98mm) was noted in variety Langra with the application of distilled water (V1N1D2).

Effect of nutrients and naphthalene acetic acid on pulp weight (g).

Pulp weight of fruit was recorded after ripening of fruit and data were analyzed. The data presented in Table 5 the maximum pulp weight (115.1g) was noted with variety Langra (V1) and minimum pulp weight (90.55g) was noted with variety Amrapali (V2). Pulp weight affected by the nutrients and the maximum pulp weight (114.9g) was noted with application of urea (N2) and the minimum pulp weight (88.69g) was noted with water application (N1). Pulp weight influenced by the doses of nutrients, the maximum pulp weight (103.74g) was noted with higher dose of nutrients (D2) and minimum pulp weight (101.94g) noted with lower dose of nutrients (D1).

The interaction of variety X nutrients showed significant affect on the pulp weight. The maximum pulp weight (125.7g) was noted in variety Langra with the application of urea (V1N2) and minimum pulp weight (75.98g) was noted in variety Amrapali with water application (V2N1).

The interaction of nutrients X dose exhibited the maximum pulp weight (117.4g) with the application of urea 4% (N2D2) and the minimum pulp weight (85.12g) were noted with the application of distilled water (N1D2).

The interaction of variety X dose did not exhibit any significant affect with respect to pulp weight.

Table 6. Effect of nutrients and naphthalene acetic acid on pulp percent (%).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	61.43	58.93	60.18	60.70	59.66	60.18
Urea (N2)	64.94	64.90	64.92	64.47	65.37	64.92
Borex (N3)	64.15	64.01	64.08	63.81	64.35	64.08
Zinc sulfate (N4)	64.19	63.85	64.02	64.02	64.01	64.02
NAA (N5)	63.81	63.30	63.55	63.43	63.68	63.55
Mean	63.70	63.00		63.29	63.41	

	Varieties		
Doses	V1	V2	Mean
D1	63.61	62.97	63.29
D2	63.80	63.02	63.41
Mean	63.70	63.00	

	SEm±	CD at 5%
Variety (V)	0.004	0.012
Nutrients (N)	0.010	0.030
Doses (D)	0.006	0.019
(V×N)	0.014	0.043
(N×D)	0.015	0.043
(V×D)	0.009	0.027

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	61.68	64.56	63.90	64.11	63.78	59.73	64.38	63.72	63.94	63.09
D2	61.18	65.32	64.40	64.27	63.84	58.13	65.42	64.30	63.76	63.51

	SEm±	CD at 5%
V × N × D	0.021	0.060

The interaction of variety X nutrients X dose showed the maximum pulp weight (127.8g) was noted in variety Langra with urea 4% (V1N2D2) while, the minimum pulp weight (72.80g) was noted in variety Amrapali with application of distilled water (V2N1D2).

Effect of nutrients and naphthalene acetic acid on pulp percent

The data presented in Table 6. The maximum pulp percentage of fruits (63.70%) was found in variety Langra (V1) and the minimum pulp percentage (63.00%) was noted in variety Amrapali (V2). Pulp percentage of fruits influenced by nutrients and the maximum pulp percentage (64.92%) was noted with the application of urea (N2) and the minimum pulp percentage (60.18%) was noted with the water application (N1). Doses of nutrients influence the Pulp percentage of fruits and maximum pulp percent (63.41%) was noted with higher dose of nutrients (D^2) whereas, the minimum pulp percent (63.29%) was noted with lower dose of nutrients (D^1).

Effect of nutrients and naphthalene acetic acid on peel percent.

In general it was observed that the peel percentage was decrease with the application of nutrients and NAA. Peel weight of fruit was recorded after ripening of fruit and data were analyzed and computed in percentage. Data presented in Table 7. The minimum peel percentage (15.93%) in variety Langra (V1) and maximum peel percentage (16.27%) was recorded in variety Amrapali (V2). Peel percentage influences by nutrients and the minimum peel percentage (15.60%) was observed with urea (N2) and maximum peel percentage (16.96%) was noted with the application of water (N1). Doses of nutrients did not exhibit any significant affect with respect to peel percentage.

The interaction of variety X nutrients indicated

Table 7. Effect of nutrients and naphthalene acetic acid on peel percent (%).

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	16.23	17.68	16.96	16.82	17.10	16.96
Urea (N2)	15.76	15.45	15.60	15.66	15.55	15.60
Borex (N3)	15.91	15.96	15.94	16.10	15.77	15.94
Zinc sulfate (N4)	15.82	15.96	15.89	15.98	15.80	15.89
NAA (N5)	15.94	16.32	16.13	16.17	16.09	16.13
Mean	15.93	16.27		16.15	16.06	

	Varieties		
Doses	V1	V2	Mean
D1	15.91	16.38	16.15
D2	15.96	16.16	16.06
Mean	15.93	16.27	
	SEm±	CD at 5%	
Variety (V)	0.032	0.096	
Nutrients (N)	0.141	0.423	
Doses (D)	0.040	NS	
(V×N)	0.199	0.598	
(N×D)	0.088	0.260	
(V×D)	0.056	0.164	

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	16.00	15.83	15.90	15.84	15.97	17.63	15.49	16.30	16.11	16.38
D2	16.47	15.40	15.92	15.80	15.92	17.73	15.41	15.62	15.81	16.26
			SEm±					CD at 5%		
V × N × D			0.125					NS		

that the minimum peel percentage (15.45%) was recorded with the variety Langra and urea (V1N2) is at par with (V2N2), (V1N3), (V2N3) and (V1N5). Whereas, the maximum peel percentage (17.68%) were recorded with the variety Amrapali and water (V2N1).

The interaction of nutrients X dose exhibited that the minimum peel percentage (15.55%) was recorded with the urea 4% (N2D2) whereas, the maximum peel percentage (70.10%) was recorded with the application of distilled water (N1D2).

The interaction of variety X dose showed the minimum peel percentage (15.96%) was recorded in variety Langra with higher dose of nutrients (V1D2) whereas, the maximum peel percentage (16.38%) was recorded in variety Amrapali with lower dose of nutrients (V2D1).

The interaction of variety X nutrients X dose did not exhibit any significant affect with respect to peel percentage.

Effect of nutrients and naphthalene acetic acid on pulp peel ratio

The observation recorded on pulp peel ratio presented is in Table 8 and depicted through Fig. 4.28. Result revealed that all the nutrients and NAA had significant affect on pulp peel ratio. The highest pulp peel ratio (4.005) was noted with variety Langra (V1) and the lowest pulp peel ratio (3.905) was noted with variety Amrapali (V2). In case of nutrients the higher pulp peel ratio (4.164) was noted with application of urea (N2) and proved superior over rest of nutrients and lowest pulp peel ratio (3.642) was observed with water (N1). Pulp peel ratio also affected by the dose of nutrients and the significantly higher pulp peel ratio (3.981) was noted with higher dose of nutrients (D2) and minimum pulp peel ratio (3.929) noted with

Table 8. Effect of nutrients and naphthalene acetic acid on pulp peel ratio.

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	3.80	3.49	3.64	3.70	3.59	3.64
Urea (N2)	4.15	4.18	4.16	4.11	4.21	4.16
Borex (N3)	4.03	4.03	4.03	3.98	4.08	4.03
Zinc sulfate (N4)	4.05	3.90	3.97	3.90	4.05	3.97
NAA (N5)	4.00	3.93	3.96	3.95	3.98	3.96
Mean	4.005	3.905		3.93	3.98	
	Varieties					
Doses	V1	V2	Mean			
D1	3.99	3.86	3.93			
D2	4.02	3.95	3.98			
Mean	4.00	3.91				
	SEm±	CD at 5%				
Variety (V)	0.01	0.03				
Nutrients (N)	0.02	0.07				
Doses (D)	0.01	0.04				
(V×N)	0.03	0.10				
(N×D)	0.03	0.09				
(V×D)	0.02	NS				
Treat.	Variety (V1)	Variety (V2)				
	N1	N2	N3	N4	N5	N1
N2	N3	N4	N5			
D1	3.85	4.09	4.01	4.03	3.99	3.54
4.13	3.96	3.77	3.91			
D2	3.74	4.23	4.06	4.07	4.01	3.43
4.20	4.10	4.03	3.95			
	SEm±	CD at 5%				
V × N × D	0.04	NS				

lower dose of nutrients (D1).

The interaction of variety X nutrients showed significant affect on pulp peel ratio. The higher pulp peel ratio (4.145) was noted in variety Langra with urea (V1N2) and the minimum pulp peel ratio (3.488) was noted in variety Amrapali with water application (V1N1).

The interaction of nutrients X dose exhibited the higher pulp peel ratio (4.214) with urea 4% (N2D2) and the minimum pulp peel ratio (3.587) were noted with the application of distilled water (N1D2).

The interaction of variety X dose did not show any significantly affect on pulp peel ratio.

The interaction of variety X nutrients X dose did not exhibit any significant affect with respect to pulp peel ratio.

Effect of nutrients and naphthalene acetic acid on stone percent (%)

Stone weight of fruit was recorded after ripening of fruit, data were analyzed and computed in percentage in Table 9. Result revealed that various treatments had significant affect on stone percent. The minimum stone percent (14.25%) in variety Langra (V1) and maximum stone percent (14.44%) were noted in variety Amrapali. Nutrients affect on stone percent and showed significant difference, the minimum stone percent (13.73%) with the application of urea (N2) and maximum stone percent (14.94%) was noted with water (N1). Doses of nutrients showed the significant difference on stone percent. The minimum stone percent (14.29%) was observed with the higher dose of nutrients (D2) and maximum stone percent (14.39%) was noted in lower dose of nutrients (D1).

The interplay of variety X nutrients exhibited

Table 9. Effect of nutrients and naphthalene acetic acid on stone percent (%)

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	14.86	15.01	14.94	14.76	15.11	14.94
Urea (N2)	13.61	13.84	13.73	13.81	13.65	13.73
Borex (N3)	14.33	14.34	14.33	14.55	14.12	14.33
Zinc sulfate (N4)	14.12	14.39	14.25	14.27	14.23	14.25
NAA (N5)	14.31	14.63	14.47	14.58	14.35	14.47
Mean	14.25	14.44		14.39	14.29	

	Varieties		
Doses	V1	V2	Mean
D1	14.34	14.45	14.39
D2	14.15	14.44	14.29
Mean	14.25	14.44	
	SEm±	CD at 5%	
Variety (V)	0.002	0.006	
Nutrients (N)	0.003	0.009	
Doses (D)	0.002	0.007	
(V×N)	0.004	0.013	
(N×D)	0.006	0.016	
(V×D)	0.003	0.010	

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	14.61	13.74	14.70	14.19	14.48	14.92	13.88	14.40	14.35	14.69
D2	15.11	13.49	13.96	14.04	14.14	15.12	13.80	14.28	14.43	14.56
	SEm±	CD at 5%								
V × N × D	0.008	0.023								

the minimum stone percent (13.61%) was noted in variety Langra with urea application (V2N2) whereas, the maximum stone percent (15.01%) were observed in the variety Amrapali with water (V1N1).

The interaction of nutrients X dose showed the minimum stone percent (13.65%) was observed with urea 4% (N2D2) whereas, the maximum stone percent (15.11%) was observed in distilled water (N1D2).

The interplay of variety X dose exhibited the minimum stone percent (14.15%) was observed in variety Langra with higher dose of nutrients (V1D2) and the maximum stone percent (14.45%) was recorded in variety Amrapali with lower dose of nutrients (V2D1).

The interplay of variety X nutrients X dose showed the minimum stone percent (13.49%) was noted in variety Langra with the application of urea 4% (V1N2D2) whereas, the maximum stone percent (15.12%) was noted in variety Amrapali with the application of distilled water (V2N1D2).

Effect of nutrients and naphthalene acetic acid on pulp stone ratio

Analysed data presented in Table 10. The significantly higher pulp stone ratio (4.484) in variety Langra (V1) and lowest pulp stone ratio (4.374) was recorded in variety Amrapali (V2). Pulp stone ratio influences by nutrients and the highest pulp stone ratio (4.740) was recorded with urea (N2) and lowest pulp stone ratio (4.030) was recorded with the water application (N1). In case of doses of nutrients the highest pulp stone ratio (4.452) was found with higher dose of nutrients (D2) whereas, the lowest pulp stone ratio (4.406) was found with lower dose of nutrients (D1).

The interaction of variety X nutrients exhibited the highest pulp stone ratio (4.776) was recorded in variety Langra with urea (V1N2). Whereas, the lowest pulp stone ratio (3.926) was recorded with the variety Amrapali with water application (V2N1).

The interaction of nutrients X dose showed that

Table 10.Effect of nutrients and naphthalene acetic acid on pulp stone ratio.

Treatments	Varieties			Doses		
	V1	V2	Mean	D1	D2	Mean
Water (N1)	4.135	3.926	4.030	4.113	3.948	4.030
Urea (N2)	4.776	4.705	4.740	4.679	4.801	4.740
Borex (N3)	4.486	4.468	4.477	4.388	4.566	4.477
Zinc sulfate (N4)	4.556	4.443	4.500	4.496	4.504	4.500
NAA (N5)	4.465	4.329	4.397	4.351	4.442	4.397
Mean	4.484	4.374		4.406	4.452	

Doses	Varieties V1	V2	Mean
D1	4.442	4.369	4.406
D2	4.525	4.379	4.452
Mean	4.484	4.374	

	SEm±	CD at 5%
Variety (V)	0.017	0.051
Nutrients (N)	0.013	0.038
Doses (D)	0.013	0.039
(V×N)	0.018	0.054
(N×D)	0.030	0.088
(V×D)	0.019	NS

Treat.	Variety (V1)					Variety (V2)				
	N1	N2	N3	N4	N5	N1	N2	N3	N4	N5
D1	4.223	4.705	4.348	4.526	4.407	4.004	4.654	4.429	4.465	4.295
D2	4.048	4.847	4.624	4.586	4.523	3.848	4.756	4.508	4.421	4.362
			SEm±					CD at 5%		
V × N × D			0.042					NS		

the highest pulp stone ratio (4.801) was recorded with the urea 4 % (N2D2) whereas, the lowest pulp stone ratio (3.948) was recorded with the distilled water (N1D2).

The interaction of variety × dose did not exhibit any significant affect with respect to pulp stone ratio.

The interaction of variety X nutrients X dose indicated that the highest pulp stone ratio (4.847) was observed in variety Langra with urea 4% (V1N2D2) whereas, the lowest pulp stone ratio (3.848) was found in variety Amrapali with distilled water (V2N1D2).

The physical quality of fruit varied within the cultivars. The weight of fruit may be assigned to the factor of assimilation and accumulation of photosynthets. So that the physical quality is a purely varietal character which influenced by the factors related to the environment and location. Accordingly, nitrogen has limited mobility in most plant species, thus it accumulates in older leaves because they transpire more than flowers and fruits and also participate directly in pollination process and its foliar application complements could supply N demand of the plant organs resulting in increased fruit length and width (Galli et at. 2012, Barbosa et al. 2016). The combination of higher dose of nutrient i.e. urea 4% was helpful to the increasing in parameters like cell size, lacticiferous canals, intercellular space, leads to difference in fruit size of different mango cultivars (Hada and singh 2018). similar result supported by Yadav *et al*. (2011) The improvement of fruits yield might be due to proper supply of nutrients and induction of growth hormones, which stimulated cell division, cell elongation increase in number and weight of fruits, better root development and better translocation of water uptake and deposition of nutrients. The maximum fruit weight in Langra followed by Paharpur Sinduri and Mithwa Ghazipur, Langra had higher pulp content however, maximum pulp-stone ratio was recorded in Langra (Bhowmick *et al*. 2012, Gurjar *et al*. 2015). The application of 4 % urea resulted in the biggest fruit with the maximum pulp contain (Sarker and

rahim 2013).

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