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Effect of Organic Manures on Physical and Chemical Characteristics of Mango cv. Dashehari at Ambient Storage Conditions

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ABSTRACT

Keywords

Mango, Organic manures, Quality, TSS, Sugars

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An experiment was carried out to find the effect of different organic manures and to evaluate the efficacy of these organic manures on physical and chemical characteristics of mango cv. Dashehari at ambient storage conditions. Eighteen year old trees were treated with different organic manures at various concentration *i.e.* FYM @ 100, 125, 150 kg/tree; Vermicompost @ 25, 50, 75; Poultry manure @ 25, 50 kg/tree, 75 kg/tree; and Neem cake @ 10, 20, 30 Kg/tree in 'Randomized Block Design' with three replications. The application of 75 kg poultry manure per tree gave maximum fruit weight from day of harvest to 8 days of storage. The maximum physiological loss in weight was recorded in control trees fruit, whereas, minimum physiological loss in weight was recorded with application of 75 kg vermicompost per tree. Maximum titrable acidity and ascorbic acid was noted with application of 75 kg vermicompost per tree. The total sugars, reducing sugars and non-reducing sugars from the 2 days of storage to 8 days of storage was found maximum in 75 kg poultry manure per tree. These findings suggested that the application of 75 kg vermicompost and 75 kg poultry manure was most effective in enhancing quality characteristics of mango fruits.

Introduction

Mango (*Mangifera indica* L.), the king of fruits, has been in cultivation in the Indian sub-continent for well over 4000 years. Being an useful and delicious fruit, it was the part of culture and religion since long time. From ancient time, it has been favourite of the kings and commoners because of its nutritive value, taste, attractive fragrance and health promoting qualities and now it is recognized as one of the best fruits in world market.

Numerous cultivars of mango are cultivated in India with diversity of flavour and taste. Among them, Dashehari is one of the main commercial cultivars of North India. Chemical fertilizers today are the indispensable part of modern orchard practices. This chemical oriented technology was developed at a time when nobody could even imagine that it would have any deleterious effect on soil, water, atmosphere and also to the human and animal health. Indiscriminate use of chemical fertilizers, pesticides, weedicides etc. over the last four decades has adversely affected the

soil fertility, water and quality of the produce. The greatest challenge facing the nation in the coming years is to provide safe food for the growing population in the country. In this regard, organic farming which is a holistic production management system for promoting and enhancing health of agro-ecosystem has gained wide recognition as a valid alternative to conventional food products and ensures safe food for human consumption. In present scenario with increasing health consciousness, among consumers the demand of purely organic products is increasing. Organic fertilizers also maintain soil health and ecological balance of the area. Keeping these points in mind, the present investigation was, therefore, undertaken to study the response of organic manures on quality characteristics at ambient storage conditions of mango cv. Dashehari.

Materials and Methods

The experiment was conducted at Horticulture Research Centre, Patherchatta, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The experiment was conducted on 18 years old mango trees of cv. Dashehari consisting of thirteen treatments viz., T₁-Control, T₂-FYM 100 Kg/ tree, T₃-FYM 125 Kg/ tree, T₄-FYM 150 kg/tree, T₅-Vermicompost 25 kg/tree, T₆-Vermicompost 50 kg/tree, T₇-Vermicompost 75 kg/tree, T₈-Poultry manure 25 kg/tree, T₉-Poultry manure 50 kg/tree, T₁₀-Poultry manure 75 kg/tree, T₁₁-Neem cake 10 Kg/tree, T₁₂-Neem cake 20 Kg/tree, T₁₃-Neem cake 30 Kg/tree in 'Randomized Block Design' with three replications. The total number of trees included in the experiment was 39. All the selected trees were almost uniform in growth and vigour. The trees were given uniform cultural operations during the course of investigation. All treatments were applied on 15 December 2007 and 2008. Full dose of farm yard manure, vermicompost, poultry

manure and neem cake were applied as basal. No manure was applied to the control. Observations on physiological loss in weight of fruit, physico-chemical characteristics like total soluble solids (TSS), total titrable acidity, ascorbic acid, reducing sugars, non-reducing sugars, total sugars and β carotene were recorded after harvested of the fruits at 2 days interval during 8 days of storage period at ambient conditions in laboratory.

Results and Discussion

At ambient storage conditions, pooled data on fruit weight was recorded with 2 days interval from the day of harvest to 8 days upto which marketable fruits were found (Table1). Two years pooled data showed that fruits harvested from control trees had minimum fruit weight.

All the treatments were enhanced fruit weight significantly over control. Application of 75 kg poultry manure per tree gave maximum fruit weight from day of harvest to 8 days of storage. Pooled data showed that the maximum physiological loss in weight was recorded in control trees fruits, while, minimum physiological loss in weight of fruits was recorded with application of 75 kg vermicompost per tree. It was also observed that there was reduction in weight from day of harvest to 8 days of storage in all the treatments. Similar, results have been obtained by Panwar (2006), Gaya (2008) and Bhatt (2009) in mango. The increase in evapo-transpiration changes with progress of storage might be responsible for high physiological loss in weight of fruits as reported by Khader *et al.*, (1988). Two years pooled data in Table 1 on total soluble solids (TSS) of mango fruits stored at ambient conditions showed that the minimum TSS of fruits from day of harvest to 8 days of storage were found in control trees fruits, while, maximum TSS was found with application of 75 kg vermicompost per tree.

Table.1 Response of organic manures on fruit weight (g) and TSS (⁰Brix) at ambient storage conditions of mango cv. Dashehari (Pooled Over 2007-08 and 2008-09)

Treatment	Fruit weight (g)						TSS (⁰ Brix)				
	Pooled Data (2007-08 and 2008-09)						Pooled Data (2007-08 and 2008-09)				
	0 days	2 days	4 days	6 days	8 Days	% PLW	0 days	2 days	4 days	6 days	8 Days
T ₁ Control	111.34	105.67	97.50	86.67	76.00	31.74	13.12	13.92	14.69	15.72	14.80
T ₂ FYM 100 kg/ tree	132.84	129.17	122.50	114.67	106.00	20.20	15.04	15.80	16.43	17.60	16.77
T ₃ FYM 125 kg/ tree	130.84	126.17	119.00	111.50	103.12	21.19	14.37	15.18	15.93	17.24	16.37
T ₄ FYM 150 kg/ tree	136.17	131.67	124.84	117.00	108.34	20.45	13.72	14.32	15.25	16.35	15.57
T ₅ Vermicompost 25 kg/tree	154.34	149.83	143.50	136.84	128.84	16.56	15.12	15.88	16.44	17.55	16.60
T ₆ Vermicompost 50 kg/tree	145.33	140.50	132.67	125.34	116.50	19.85	15.72	16.42	17.22	18.29	17.34
T ₇ Vermicompost 75 kg/tree	162.33	158.34	152.17	145.50	138.67	14.66	16.50	17.17	18.02	19.12	18.19
T ₈ Poultry manure 25 kg/tree	167.00	161.84	156.33	147.50	139.17	16.65	15.59	16.19	16.99	17.99	16.90
T ₉ Poultry manure 50 kg/tree	174.00	167.33	159.17	151.34	143.00	17.83	15.48	15.94	16.75	17.85	16.92
T ₁₀ Poultry manure 75 kg/tree	191.00	184.67	178.17	171.00	162.00	15.19	15.68	16.37	17.23	18.19	17.28
T ₁₁ Neem cake 10 kg/tree	142.67	136.84	129.67	122.00	113.84	20.22	14.57	15.25	16.17	17.29	16.35
T ₁₂ Neem cake 20 kg/tree	152.17	146.83	139.34	131.33	123.84	18.62	14.62	15.49	16.29	17.32	16.17
T ₁₃ Neem cake 30 kg/tree	159.50	153.67	146.33	138.34	131.67	17.45	15.20	15.90	16.72	17.82	16.87
S.Em.±	0.94	1.30	2.13	2.34	2.59	1.28	0.06	0.10	0.12	0.14	0.15
CD at 5%	2.91	4.01	6.58	7.21	7.99	3.96	0.19	0.31	0.38	0.45	0.46

*PLW – Physiological Loss in Weight

Table.2 Response of organic manures on titrable acidity (%) and ascorbic acid (mg/100g) of fruit at ambient storage conditions of mango cv. Dashehari (Pooled Over 2007-08 and 2008-09)

Treatment	Titrable acidity (%)					Ascorbic acid (mg/100g)				
	Pooled Data (2007-08 and 2008-09)					Pooled Data (2007-08 and 2008-09)				
	0 days	2 days	4 days	6 days	8 Days	0 days	2 days	4 days	6 days	8 Days
T ₁ Control	0.45	0.39	0.34	0.28	0.24	33.46	30.04	27.64	23.70	17.90
T ₂ FYM 100 kg/ tree	0.62	0.56	0.50	0.44	0.37	38.01	35.34	33.49	30.64	26.38
T ₃ FYM 125 kg/ tree	0.58	0.52	0.46	0.41	0.35	38.00	35.77	33.74	31.20	27.24
T ₄ FYM 150 kg/ tree	0.54	0.49	0.42	0.37	0.32	39.02	36.97	35.02	32.52	28.71
T ₅ Vermicompost 25 kg/tree	0.68	0.63	0.57	0.51	0.46	39.72	37.95	35.79	33.22	29.25
T ₆ Vermicompost 50 kg/tree	0.63	0.58	0.52	0.45	0.39	39.83	38.35	36.39	34.08	30.45
T ₇ Vermicompost 75 kg/tree	0.76	0.71	0.64	0.56	0.50	41.90	40.70	39.15	37.00	33.45
T ₈ Poultry manure 25 kg/tree	0.67	0.61	0.55	0.49	0.38	40.03	38.63	36.47	33.72	29.42
T ₉ Poultry manure 50 kg/tree	0.57	0.51	0.46	0.39	0.33	39.88	38.28	36.33	33.23	29.17
T ₁₀ Poultry manure 75 kg/tree	0.64	0.58	0.52	0.46	0.39	40.67	39.47	37.72	35.47	31.90
T ₁₁ Neem cake 10 kg/tree	0.55	0.49	0.42	0.36	0.31	38.57	37.05	34.67	32.14	28.00
T ₁₂ Neem cake 20 kg/tree	0.51	0.51	0.45	0.38	0.33	38.64	37.27	35.08	32.52	28.43
T ₁₃ Neem cake 30 kg/tree	0.64	0.59	0.52	0.45	0.39	38.72	37.14	35.28	32.98	29.07
S.Em.±	0.01	0.01	0.009	0.009	0.01	0.49	0.72	0.99	1.05	1.37
CD at 5%	0.05	0.03	0.02	0.03	0.05	1.53	2.24	3.05	3.26	4.22

Table.3 Response of organic manures on reducing sugars (%) and non-reducing sugars (%) of fruits at ambient storage conditions of mango cv. Dashehari (Pooled over 2007-08 and 2008-09)

Treatment	Reducing sugars (%)					Non-reducing sugars (%)				
	Pooled Data (2007-08 and 2008-09)					Pooled Data (2007-08 and 2008-09)				
	0 days	2 days	4 days	6 days	8 Days	0 days	2 days	4 days	6 days	8 Days
T ₁ Control	2.36	3.61	4.57	5.69	3.67	5.75	6.90	7.87	8.95	6.93
T ₂ FYM 100 kg/ tree	2.61	4.00	5.42	6.63	4.75	6.23	7.03	8.43	9.30	7.44
T ₃ FYM 125 kg/ tree	2.38	3.76	5.08	6.39	4.57	6.52	7.92	9.28	10.67	8.82
T ₄ FYM 150 kg/ tree	2.53	4.04	5.55	6.99	4.98	6.24	7.74	9.24	10.65	8.97
T ₅ Vermicompost 25 kg/tree	2.71	4.06	5.32	6.73	5.03	6.43	7.57	8.83	10.24	8.53
T ₆ Vermicompost 50 kg/tree	2.61	4.03	5.42	6.84	5.13	6.64	8.37	9.44	10.90	10.19
T ₇ Vermicompost 75 kg/tree	2.60	4.20	6.00	7.76	6.14	6.80	8.41	10.20	12.04	9.61
T ₈ Poultry manure 25 kg/tree	2.60	4.03	5.32	6.54	4.90	6.50	7.57	9.21	10.42	8.82
T ₉ Poultry manure 50 kg/tree	2.56	4.05	5.67	7.18	5.66	6.79	8.31	9.92	11.72	10.23
T ₁₀ Poultry manure 75 kg/tree	2.60	4.37	6.38	8.41	7.09	6.81	8.61	10.60	12.63	11.30
T ₁₁ Neem cake 10 kg/tree	2.43	3.78	5.09	6.37	4.33	6.63	7.97	9.62	10.91	8.88
T ₁₂ Neem cake 20 kg/tree	2.40	3.92	5.33	6.64	4.65	6.60	8.10	9.50	10.81	8.81
T ₁₃ Neem cake 30 kg/tree	2.51	4.11	5.69	7.19	5.39	6.47	7.74	9.34	10.88	9.05
S.Em.±	0.01	0.01	0.006	0.008	0.01	0.01	0.09	0.003	0.01	0.22
CD at 5%	0.05	0.03	0.01	0.02	0.05	0.05	0.28	0.01	0.04	0.67

Table.4 Response of organic manures on total sugars (%) and β carotene (mg/100g) content of fruits at ambient storage conditions of mango cv. Dashehari (Pooled Over 2007-08 and 2008-09)

Treatment	Total sugars (%)					β carotene (mg/100g)				
	Pooled Data (2007-08 and 2008-09)					Pooled Data (2007-08 and 2008-09)				
	0 days	2 days	4 days	6 days	8 Days	0 days	2 days	4 days	6 days	8 Days
T ₁ Control	8.37	9.57	10.55	11.65	9.60	0.99	1.15	1.47	1.67	1.54
T ₂ FYM 100 kg/ tree	9.22	10.61	11.65	12.89	11.03	1.05	1.21	1.52	1.71	1.62
T ₃ FYM 125 kg/ tree	9.20	10.61	11.99	13.28	11.46	1.09	1.23	1.51	1.72	1.61
T ₄ FYM 150 kg/ tree	9.02	10.52	12.04	13.44	11.44	1.06	1.24	1.53	1.77	1.69
T ₅ Vermicompost 25 kg/tree	9.49	10.80	12.06	13.47	11.76	1.08	1.25	1.54	1.72	1.65
T ₆ Vermicompost 50 kg/tree	9.53	10.63	12.09	13.59	11.87	1.09	1.28	1.58	1.80	1.67
T ₇ Vermicompost 75 kg/tree	9.74	11.32	13.16	14.98	13.35	1.09	1.32	1.58	1.80	1.67
T ₈ Poultry manure 25 kg/tree	9.43	10.88	12.20	13.42	12.13	1.12	1.32	1.64	1.83	1.75
T ₉ Poultry manure 50 kg/tree	9.68	11.04	12.82	14.00	12.48	1.12	1.37	1.65	1.86	1.75
T ₁₀ Poultry manure 75 kg/tree	9.72	11.50	13.52	15.54	14.21	1.18	1.40	1.70	1.89	1.77
T ₁₁ Neem cake 10 kg/tree	9.11	10.45	12.08	13.36	11.35	1.20	1.43	1.72	1.89	1.81
T ₁₂ Neem cake 20 kg/tree	9.35	10.86	12.26	13.59	11.55	1.21	1.38	1.70	1.91	1.80
T ₁₃ Neem cake 30 kg/tree	9.22	10.82	12.44	13.95	12.13	1.20	1.51	1.79	1.95	1.88
S.Em.±	0.01	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.007
CD at 5%	0.04	0.15	0.05	0.03	0.05	0.03	0.05	0.05	0.04	0.02

The minimum TSS was recorded under all the treatments on the day of harvest and it increased upto 6 days of storage and after it declined in same fashion in all the treatments. The present findings are in accordance with the findings of Panwar (2006), Gaya (2008) and Bhatt (2009) in mango. Increasing trends of TSS upto 6days of storage signified the period of active synthesis of carbohydrates in fruits, while, the declining trend in TSS that followed thereafter indicated the degradation and fermentation of sugars signaling the onset of senescence stage (Gortner *et al.*, 1969). Similarly Mukherjee and Dutta (1967) suggested the increase in TSS may be attributed to the conversion of starch and other polysaccharides in soluble form of sugar. An increase in TSS during storage of mango has been also reported by Deol (1985). The decrease of TSS at advanced stage is owing to its faster multiplication in oxidation process through Kreb's cycle (Singh *et al.*, 1987).

Observations also revealed that from the day of harvest to 8 days of storage, the titrable acidity and ascorbic acid was declined under all the treatments (Table 2). Maximum titrable acidity and ascorbic acid was noted with application of 75 kg vermicompost per tree, while, it was minimum in control treatment fruits from the day of harvest to 8 days of storage (Table 2). Similar findings have been obtained by Gaya (2008) and Bhatt (2009) in mango. Sanches *et al.*, (2005) reported that acidity of fruits decreased continuously throughout the storage period in case of Gola variety of ber. There was a decrease in acid content during the storage period. This may be due to utilization of organic acids in respiration. The reduction in acidity level is probably due to more accumulation of sugars in fruits. Kahlon and Uppal (2005) reported that acidity level of fruits declined on each period of storage and came down to minimum after 25 days of storage of mango cv. Chausa.

The decline in acidity of fruits is due to higher utilization of acid in evapotranspiration with the progress of storage as reported by Khader *et al.*, (1988).

Two years pooled data recorded on per cent of total sugars, reducing sugars and non-reducing sugars of mango fruits kept at ambient conditions showed that minimum content of total sugars, reducing sugars and non-reducing sugars was in control trees fruits. At the day of harvest the maximum total sugars was recorded with application of 75 kg vermicompost per tree, while, reducing sugars was maximum under 25 kg vermicompost per tree and non-reducing sugars content was higher with application of 75 kg vermicompost per tree. However, total sugars, reducing sugars and non-reducing sugars from the 2 days of storage to 8 days of storage was found maximum in 75 kg poultry manure per tree (Table 3 and 4). Pooled data also revealed that the minimum total sugars, reducing sugars and non-reducing sugars was recorded under all the treatments on the day of harvest and it increased upto 6 days of storage and after that it declined.

It may be because of initially after harvest starch convert into sugar and after some days of storage when acidity increases it declines amount of sugars of fruits at over ripening stage acidity increases because sugar converts into acids. Mango fruits at mature green stage contain some accumulated starch which hydrolysed during ripening (Subramanyam *et al.*, 1976). Similar findings have been obtained by Gaya (2008) and Bhatt (2009) in mango cv. Dashehari during storage. Kahlon and Uppal (2005) suggested that conversion of starches and polysaccharides into simple sugar with the advancement of storage was responsible for the increase of reducing sugar, and onward decline was due to the utilization of sugar in evapo-transpiration and other biochemical activities.

Two years pooled data on β Carotene content of mango fruits stored at ambient condition revealed that maximum β Carotene content at the day of harvest was observed with application of 20 kg neem cake per tree, while, β Carotene content was maximum from 2 days of storage to 8 days of storage with application of 30 kg neem cake per tree during (Table 4). However, minimum content of β Carotene was in control trees fruits. Minimum β Carotene was recorded at the day of harvest under all the treatments and it increased upto 6 days of storage and after it declined in all the treatments. Similar results have been obtained by Panwar (2006) in mango cv. Langra. Kowsalya and Chandrasekar (2003) suggested that in papaya fruit total carotenoid and β Carotene contents from the greenish-yellow stage to fully ripened stage (after 24 hours storage at room temperature) significantly increased. The fully ripened papaya when stored further at room temperature for 2 days showed significant reduction in total carotenoid and β Carotene contents.

The results indicated that the application of 75 kg vermicompost and 75 kg poultry manure was most effective in enhancing quality characteristics of mango fruits.

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