

Original Research Article

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## Influence of Different Organic Sources of Plant Nutrients on Growth, Yield and Quality of Muskmelon (*Cucumis melo* L.)

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### ABSTRACT

#### Keywords

Muskmelon, FYM, Vermicompost, Neem cake, Biofertilizer, Growth, Yield, Quality and Wilt incidence

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Field experiments were conducted during successive seasons of 2015 and 2016 to study the effect of different sources of organic nutrients on growth, yield and quality of muskmelon var. RM-50. Results strongly showed that the addition of organic manure viz., FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) significantly increased the number of vines/ plant at last harvest (4.84), fruit weight (823.97 g), fruit diameter (12.46 cm), flesh thickness (2.20 cm) and marketable fruits/ plant (4.10) which were at par with FYM @ 100 q/ha + vermicompost @ 25 q/ha (T<sub>7</sub>). Marketable fruit yield/ plant (3.43 kg), marketable fruit yield/ ha (235.54 q) and TSS (11.43%) were increased significantly by FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) over all other treatments. Incorporation of neem cake @ 5 q/ha + biofertilizer (T<sub>6</sub>) resulted in minimum incidence of wilt (7.40%) followed by neem cake @ 5 q/ha (T<sub>3</sub>) with 7.91% incidence in pooled data.

### Introduction

Muskmelon (*Cucumis melo* L.) is one of the most important and fruity vegetables grown in India and used mainly as a dessert and refreshing fruit. The fruits contain 0.6% protein, 0.2% fat, 3.5% carbohydrates, 32 mg calcium, 14 mg phosphorus, 1.4 mg iron, 16 mg carotene and 26 mg vitamin C per 100 g fresh weight of fruit (Aykroyd 1963). In addition, it is rich in bioactive compounds such as phenolics and flavonoids. The soil and climatic conditions of arid regions of India are ideal for muskmelon production and

cultivated on 47000 ha with an annual production of 936000 MT (NHB, 2015-16). In Rajasthan, its area is 982 ha which produced 6662 MT with productivity of 67.85 q/ ha (Directorate of Ag. 2015-16).

Fertilizer plays an important role among the environmental factors on vegetable production. However with increasing chemical fertilizer costs, muskmelon growers are seeking alternative cultural practices that reduce production costs without reducing fruit yield or quality (Studstill *et al.*, 2006). Animal manures contain all the essential

micro and macro elements required for plant growth. Organic farming can provide quality and safety food without adversely affecting the soils health and the environment. All organic manures improve the behaviour of several elements in soils through fulvic and humic acids which have the ability to retain the elements in complex and chelate forms. These materials release the elements over a period of time and are broken down slowly by soil microorganisms.

The extent of availability of such nutrients depends on the type of organic materials and microorganisms (Saha *et al.*, 1998). In addition, organic manure amendments affect soil bulk density, water-holding capacity, soil structure, soil carbon content, macro and micronutrients, pH, soluble salts, cation exchange capacity (CEC) and biological properties (Saha *et al.*, 1998). Also, the use of organic amendments may improve soil quality and enhance the utilization of fertilizer, consequently improving the performance of vegetable crops (Ozores-Hampton 2012).

Since most of the horticultural crops are consumed for nutrition, therapeutic and aesthetic values and few of these are consumed in fresh forms; organic production has much relevance in these crops rather than cereals and pulses which are used after span of sufficient time *i.e.* from field to fork (Ram and Pathak 2016).

Work conducted in different countries showed that organic source of nutrients significantly increased yield and mean fruit weight of melon (Faria *et al.*, 2003 and Ghanbarian *et al.*, 2008). However, little work into the effect of application of organic manure on physical characteristics and yield of muskmelon has been reported in India. Therefore, the present study was undertaken to find out effect of organic manures on growth, yield, and quality characters of muskmelon.

## Materials and Methods

Field experiments were conducted at the Research Farm of ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan (India) located at 28°N latitude, 73°18'E longitude at an altitude of 234.84 m above sea level during summer season of 2015 and 2016. The virgin field was used for experimentation and cluster bean was cropped for two years prior to conduct of experiment. A composite soil sample was collected from 0-30 cm depth prior to incorporation of treatments to determine the chemical properties of soil. The soil of experimental field was loamy sand having pH of 8.7, EC 0.20 dS m<sup>-1</sup> and organic carbon 0.07 per cent. The N content, available P<sub>2</sub>O<sub>5</sub> and available K<sub>2</sub>O was 131.8 kg/ha, 22.1 kg/ha and 260.9 kg/ha, respectively.

Experiment was laid out in randomized block design with three replications. Fourteen treatments of different organic sources of nutrients were applied in the soil during soil preparation before sowing and mixed thoroughly. The treatments comprised of FYM @ 200 q/ha (T<sub>1</sub>), vermicompost @ 50 q/ha (T<sub>2</sub>), neem cake @ 5 q/ha (T<sub>3</sub>), FYM @ 200 q/ha + biofertilizer (T<sub>4</sub>), vermicompost @ 50 q/ha + biofertilizer (T<sub>5</sub>), neem cake @ 5 q/ha + biofertilizer (T<sub>6</sub>), FYM @ 100 q/ha + vermicompost @ 25 q/ha (T<sub>7</sub>), FYM @ 100 q/ha + neem cake @ 2.5 q/ha (T<sub>8</sub>), vermicompost @ 25 q/ha + neem cake @ 2.5 q/ha (T<sub>9</sub>), FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>), FYM @ 100 q/ha + neem cake @ 2.5 q/ha + biofertilizer (T<sub>11</sub>), vermicompost @ 25 q/ha + neem cake @ 2.5 q/ha + biofertilizer (T<sub>12</sub>), inorganic control (T<sub>13</sub>) and absolute control (T<sub>14</sub>). Among biofertilizers, azotobacter and phosphorus solublizing bacteria (PSB) were applied @ 5 kg/ha as soil treatment. In inorganic control (T<sub>13</sub>), the recommended dose of fertilizers was applied @ 80 kg/ ha N, 60 kg/ ha P<sub>2</sub>O<sub>5</sub> and 60 kg/ ha K<sub>2</sub>O through

urea, di-ammonium phosphate and muriate of potash, respectively. Half quantity of N and full quantity of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was applied before sowing *i.e.* at the time of field preparation. The remaining half quantity of N will be divided in two equal portions and applied in standing crop at 25 and 40 days after sowing.

Seeds of muskmelon variety RM-50 were sown during last week of February in both the seasons of 2015 and 2016. The spacing maintained between rows was 2.0 m and between plants 0.50 m. Three seed per dripper were sown and plants were thinned to 2 plants per dripper after 15 days of sowing. Irrigation through drip and other cultural practices were followed as recommended for commercial production. The data were recorded on five randomly selected plants from each replication for number of vines/ plant at last harvest, fruit weight (g), fruit diameter (cm), flesh thickness (cm), marketable fruit/ plant, marketable fruit yield/ plant (kg) and TSS (%). Diameter of fruits was measured with the help of Digital Vernier Caliper (MITU-TOYO, 300 mm, 0.01 mm reading capacity). TSS was tested with the help of digital hand Refractometer (ATAGO-Japan) 0-53% readability. The observation on occurrence of wilt disease was recorded as soon as disease appeared. Per cent incidence was calculated dividing number of infected plant by total number of plants and multiplied by 100. The recorded data were statistically analysed for individual year and pooled data using the INDOSTAT statistical package (Indostat Services, Hyderabad).

## Results and Discussion

A significant increase in the growth, yield and quality attributes was realized with the application of different organic manures in muskmelon (Table 1 and 2). In 2015, the application of FYM @ 100 q/ha +

vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) resulted in maximum fruit weight (840.00 g), fruit diameter (12.51 cm), flesh thickness (2.29 cm), marketable fruit/ plant (4.13), marketable fruit yield/ plant (3.43 kg), marketable yield/ ha (240.43 q) and TSS (11.41%) which was found to be significant over all treatments but at par with FYM @ 100 q/ha + vermicompost @ 25 q/ha (T<sub>7</sub>). FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) expressed maximum number of vines/ plant at last harvest (4.87) which was significantly superior over all treatment. Among the fungal diseases, wilt (*Fusarium acuminatum* Ellis and Everh) is an important disease causing serious losses to muskmelon in arid regions of Rajasthan. Minimum incidence (7.65%) of wilt was found in neem cake @ 5 q/ ha + biofertilizer (T<sub>6</sub>) followed by neem cake @ 5 q/ ha (T<sub>3</sub>) with wilt incidence (8.12%) while maximum incidence (24.75%) was recorded in absolute control (T<sub>14</sub>).

Data of 2016 revealed significant increase in fruit weight (807.93 g), fruit diameter (12.40 cm), flesh thickness (2.11 cm), TSS (11.45%), marketable fruit/ plant (4.07), marketable fruit yield/ plant (3.29 kg) and marketable yield/ ha (230.65 q) with the application of FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) over all treatments however, at par with FYM @ 100 q/ha + vermicompost @ 25 q/ha (T<sub>7</sub>). Number of vines/ plant at last harvest (4.80) were significantly increased by FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>). Application of neem cake @ 5 q/ ha + biofertilizer (T<sub>6</sub>) resulted in lowest incidence of wilt (7.14%) closely followed by neem cake @ 5 q/ ha (T<sub>3</sub>) with 7.69% incidence of wilt.

Results of pooled data indicated significant differences amongst the different treatments of organic manures. FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>)

applied had a significant effect on number of vines/ plant at last harvest (4.84), fruit weight (823.97 g), fruit diameter (12.46 cm), flesh thickness (2.20 cm) and marketable fruits/ plant (4.10) however, at par with FYM @ 100 q/ha + vermicompost @ 25 q/ha (T<sub>7</sub>). Marketable fruit yield/ plant (3.43 kg), marketable fruit yield/ ha (235.54 q) and TSS (11.43%) were increased significantly by FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>) over all other treatments. These results might be due to the role of

organic manure in increasing soil porosity, aeration, water holding capacity and cation exchange capacity (CEC), which encourage the biological activities of soil microorganisms and led to break down of organic matter releasing N, P and K and other nutrients to the soil solution (Ozores-Hampton *et al.*, 2011 and Ozores-Hampton *et al.*, 2011). As these nutrients are available in the soil solution, absorption would be higher and nutrients uptake might be stimulated.

**Table.1** Effect of different organic sources on growth and fruit parameters of muskmelon

Treatments	No. of vines/ plant at last harvest			Fruit weight (g)			Fruit diameter (cm)			Flesh thickness (cm)			
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	
T <sub>1</sub>	4.20	3.93	4.07	663.33	637.20	650.27	10.59	10.23	10.41	1.77	1.65	1.71	
T <sub>2</sub>	4.00	3.87	3.94	654.00	647.33	650.67	10.53	10.39	10.46	1.73	1.57	1.65	
T <sub>3</sub>	3.73	3.60	3.67	574.00	567.53	570.77	9.63	9.52	9.58	1.52	1.42	1.47	
T <sub>4</sub>	4.33	4.13	4.23	684.67	670.53	677.60	10.63	10.36	10.50	1.80	1.69	1.75	
T <sub>5</sub>	4.27	4.07	4.17	691.33	673.47	682.40	10.89	10.67	10.78	1.87	1.74	1.81	
T <sub>6</sub>	4.20	3.73	3.97	676.67	666.13	671.40	10.59	10.44	10.52	1.91	1.76	1.84	
T <sub>7</sub>	4.67	4.13	4.40	789.33	733.47	761.40	11.51	11.40	11.46	2.09	1.95	2.02	
T <sub>8</sub>	4.27	4.00	4.14	700.67	682.53	691.60	10.95	10.83	10.89	1.87	1.65	1.76	
T <sub>9</sub>	4.33	3.87	4.10	698.33	668.60	683.47	10.72	10.55	10.64	1.98	1.81	1.90	
T <sub>10</sub>	4.87	4.80	4.84	840.00	807.93	823.97	12.51	12.40	12.46	2.29	2.11	2.20	
T <sub>11</sub>	4.20	4.13	4.17	685.00	671.60	678.30	10.64	10.45	10.55	1.95	1.72	1.84	
T <sub>12</sub>	4.13	4.00	4.07	687.67	660.07	673.87	10.79	10.61	10.70	1.72	1.59	1.66	
T <sub>13</sub>	4.20	3.80	4.00	702.67	665.20	683.94	11.09	10.93	11.01	1.94	1.77	1.86	
T <sub>14</sub>	3.53	3.27	3.40	514.67	498.60	506.64	9.29	9.18	9.24	1.41	1.39	1.40	
SEm±	0.15	0.22	0.16	44.90	35.14	34.60	0.40	0.37	0.33	0.10	0.07	0.07	
CD at 5%	0.42	0.63	0.45	130.52	102.16	99.25	1.17	1.08	0.94	0.28	0.21	0.21	
CV (%)	5.97	9.48	9.43	11.39	9.21	12.62	6.48	6.09	7.56	9.04	7.24	10.03	
T <sub>1</sub>	FYM @ 200 q/ha						T <sub>8</sub>	FYM @ 100 q/ha + neem cake @ 2.5 q/ha					
T <sub>2</sub>	Vermicompost @ 50 q/ha						T <sub>9</sub>	Vermicompost @ 25 q/ha + neem cake @ 2.5 q/ha					
T <sub>3</sub>	Neem cake @ 5 q/ha						T <sub>10</sub>	FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer					
T <sub>4</sub>	FYM @ 200 q/ha + biofertilizer						T <sub>11</sub>	FYM@ 100 q/ha + neem cake @ 2.5 q/ha + biofertilizer					
T <sub>5</sub>	Vermicompost @ 50 q/ha + biofertilizer						T <sub>12</sub>	Vermicompost @ 25 q/ha + neem cake @ 2.5 q/ha + biofertilizer					
T <sub>6</sub>	Neem cake @ 5 q/ha + biofertilizer						T <sub>13</sub>	Inorganic control					
T <sub>7</sub>	FYM @ 100q/ha + vermicompost @ 25 q/ha						T <sub>14</sub>	Absolute control					

**Table.2** Effect of different organic sources on yield, quality and wilt incidence in muskmelon

Treatments	Marketable fruit/ plant			Marketable fruit yield/ plant (kg)			Marketable fruit yield/ ha (q)			TSS (%)			Incidence of wilt (%)*		
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled
T <sub>1</sub>	3.20	3.00	3.10	2.10	1.94	2.02	167.63	155.49	161.56	10.02	9.86	9.94	18.47 (25.42)	20.00 (26.48)	19.24 (25.95)
T <sub>2</sub>	3.40	3.27	3.33	2.28	2.12	2.20	182.51	169.29	175.90	9.57	9.48	9.53	19.81 (26.34)	20.00 (26.40)	19.91 (26.37)
T <sub>3</sub>	2.80	2.73	2.77	1.58	1.54	1.56	126.24	123.51	124.88	9.16	9.24	9.20	8.12 (16.52)	7.69 (15.38)	7.91 (15.95)
T <sub>4</sub>	3.40	3.20	3.30	2.30	2.11	2.21	184.16	168.88	176.52	9.87	9.81	9.84	16.79 (23.82)	25.00 (29.83)	20.90 (26.82)
T <sub>5</sub>	3.33	3.40	3.37	2.28	2.28	2.28	182.61	182.57	182.59	10.35	10.29	10.32	17.78 (24.62)	16.67 (24.04)	17.23 (24.33)
T <sub>6</sub>	3.47	3.33	3.40	2.35	2.19	2.27	188.00	174.87	181.44	9.57	9.60	9.59	7.65 (15.92)	7.14 (15.33)	7.40 (15.63)
T <sub>7</sub>	3.67	3.60	3.64	2.95	2.65	2.80	206.78	185.52	196.15	11.15	11.21	11.18	16.59 (23.87)	18.33 (25.30)	17.46 (24.59)
T <sub>8</sub>	3.40	3.27	3.34	2.33	2.21	2.27	186.51	177.05	181.78	10.29	10.31	10.30	14.13 (21.59)	14.29 (21.98)	14.21 (21.79)
T <sub>9</sub>	3.47	3.40	3.44	2.40	2.23	2.32	192.24	178.38	185.31	10.63	10.44	10.54	14.25 (22.03)	16.02 (23.36)	15.14 (22.70)
T <sub>10</sub>	4.13	4.07	4.10	3.43	3.29	3.36	240.43	230.65	235.54	11.41	11.45	11.43	14.23 (21.51)	15.38 (22.93)	14.81 (22.22)
T <sub>11</sub>	3.47	3.20	3.34	2.35	2.17	2.26	187.95	173.35	180.65	10.68	10.55	10.62	8.93 (17.23)	10.00 (18.04)	9.47 (17.64)
T <sub>12</sub>	3.53	3.33	3.43	2.47	2.15	2.31	197.87	172.12	184.99	10.04	10.03	10.04	11.11 (19.37)	13.50 (21.38)	12.31 (20.38)
T <sub>13</sub>	3.40	3.27	3.34	2.38	2.18	2.28	190.19	174.18	182.19	10.46	10.39	10.43	21.11 (27.29)	25.00 (29.76)	23.06 (28.53)
T <sub>14</sub>	2.47	3.00	2.74	1.27	1.50	1.39	111.19	120.09	115.64	9.37	9.33	9.35	24.75 (29.74)	33.33 (35.25)	29.04 (32.49)
<b>SEm<sub>±</sub></b>	0.19	0.19	0.16	0.18	0.18	0.15	14.82	13.54	12.09	0.09	0.11	0.09	2.04	1.99	1.81
<b>CD at 5%</b>	0.55	0.55	0.46	0.53	0.51	0.44	43.09	39.36	34.68	0.27	0.31	0.24	5.92	5.75	5.19
<b>CV (%)</b>	9.78	9.98	11.89	13.56	13.85	16.53	14.13	13.76	16.82	1.59	1.81	2.04	15.67	14.30	19.06

\*Angular transformed value in parentheses.

Moreover, the application of organic matter in soil increased the activities of microorganisms and availability of nitrogen, phosphorus and sulphur in soil (Saha *et al.*, 1998). These results agreed with those reported by El-Desuki *et al.*, (2000); Jianming *et al.*, (2008); Sarhan *et al.*, (2011) and Shafeek *et al.*, (2015) they reported that the highest growth, yield, TSS, total sugars, protein, vitamin C and moisture contents in cucurbits fruits by increasing the levels of inorganic manures.

Incidence of wilt disease varied from 7.40 to 29.04% in different treatments. Incorporation of neem cake @ 5 q/ha + biofertilizer (T<sub>6</sub>) was the most effective with minimum incidence (7.40%) of wilt, followed by neem cake @ 5 q/ha (T<sub>3</sub>) with wilt incidence of 7.91%. Next best treatments were observed FYM @ 100 q/ha + neem cake @ 2.5 q/ha + biofertilizer (T<sub>11</sub>) and vermicompost @ 25 q/ha + neem cake @ 2.5 q/ha + biofertilizer (T<sub>12</sub>) with wilt incidence of 9.47 and 12.31%, respectively which were found statistically at par with another. Maximum incidence (29.04%) of wilt was recorded in control without any treatment, followed by inorganic control (T<sub>13</sub>) with wilt incidence of 23.06% which were differing statistically with each other. Organic amendments with organic wastes, composts and peats have been applied to control vegetable diseases caused by soil-borne pathogens such as *Fusarium* spp. (Melloni *et al.*, 1995 and Bonanomi *et al.*, 2007). Besides a wide variety of organic matters that have been tested as organic amendments for managing plant pathogens, oil seed cakes decreased the population of soil-borne pathogens (Shafique *et al.*, 2015).

It can be concluded that growth, yield and quality of the muskmelon var. RM-50 was significantly affected with application of different organic manures and response was better with FYM @ 100 q/ha + vermicompost @ 25 q/ha + biofertilizer (T<sub>10</sub>). Therefore, it

should be applied as an organic fertilizer to get increased muskmelon production of superior quality.

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