Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5563

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 333-338 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Yield and Quality Parameters of Capsicum (*Capsicum annuum* L. var. grossum) as Influenced by Organic Liquid Formulations

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Received: 29.08.2017 | Revised: 11.09.2017 | Accepted: 16.09.2017

ABSTRACT

A field experiment was conducted to evaluate the effect of organic liquid formulations on growth and yield of capsicum at Agricultural Research Station, Arsikere, Karnataka. India. There were 12 treatment combinations consisting of three factors viz., Jeevamrutha (2 levels), Cow urine (2 levels) and Panchagavya (3 levels). Among different organic liquid formulations, application of jeevamrutha recorded significantly higher fruit yield (32.26, 39.55, 51.63, 121.20, 100.28, 86.40, 50.05 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively), shelf life (19.06 days) and capsaicin (0.35 %). Significantly higher fruit yield (30.76, 38.0, 48.52, 117.73, 97.15, 84.33, 48.44 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively), shelf life (17.72 days) and capsaicin (0.33 %) were recorded with the application of cow urine. Panchagavya 6 per cent spray recorded significantly higher fruit yield (30.25, 37.49, 48.91, 118.91, 96.15, 86.29, 47.81 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively), shelf life (18.58 days) and capsaicin (0.32 %).

Key words: *Liquid formulation, Panchagavya, Jeevamrutha, Cow urine, Capsicum, Shelf life.*

INTRODUCTION

Generally, solanaceous vegetables require large quantity of major nutrients like nitrogen, phosphorus and potassium, in addition to secondary nutrients such as calcium and sulphur for better growth and fruit yield. It is being grown under intensive cultivation by using inorganic inputs. It is well documented fact that continuous and non judicious use of inorganic inputs or commercial fertilizers have an adverse effect on soil health and environment, is found to be expensive, unsafe, not much affordable by small and marginal farmers and leaving residual toxicity in the food products whereby reduces the quality of fruits[9]. High fertilizer usage has led to the neglect of good traditional practices and it is necessary to reduce the dependence on chemical inputs by adopting alternative source of plant nutrients is imperative and one such alternative is organic farming.

Application of well decomposed organic manure supplies nutrient in rainfed horticultural crops[11].

Cite this article: Boraiah, B., Devakumar, N. and Palanna, K.B., Yield and Quality Parameters of Capsicum (*Capsicum annuum* L. var. grossum) as Influenced by Organic Liquid Formulations, *Int. J. Pure App. Biosci.* **6(1):** 333-338 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5563

Apart from these manures different organic liquid formulations *viz*., panchagavya, jeevamrutha and cow urine were used and these organic formulations provide growth enhancing substances, effective in growth promotion, play an important role in higher flower production and fruit setting by preventing the flower and fruit drop thereby increasing the productivity and keeping quality of produce. Although, these organic formulations may not provide enough nutrients at the site of its application, they help in quick build up of soil fertility through enhanced activity of soil micro flora and fauna[18]. The primary aim of our present study was to evaluate the effect of organic liquid formulations on the fruit yield and quality (shelf life and capsaicin content) of capsicum.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural Research Station, Arsikere, University of Agricultural Sciences, Bengaluru, Karnataka. Soil of the experimental plot is red sandy loam, grouped under the classification of Alfisols. Soil is neutral to slight acidic in reaction pH (6.42), low organic carbon (0.40 %) and medium in available nitrogen (241.50 kg ha^{-1}), low available phosphorus (8.80 kg ha^{-1}) and potassium (231.00 kg ha^{-1}) content. The trial was laid out on Factorial Randomized Complete Block design with three replications. There were 12 treatment combinations consisting of three factors and they are jeevamrutha (2 levels) - with jeevamrutha (J_1) and without jeevamrutha (J_0), cow urine (2 levels) - with cow urine (C_1) and without cow urine (C_0) and panchagavya (3) - without panchagavya spray (P_0), 3 per cent panchagavya spray (P_1) and 6 per cent panchagavya spray (P_2). Well decomposed farm yard manure (100 % N equivalent basis) was applied 3 weeks before transplanting of capsicum seedlings and incorporated into the soil. Jeevamrutha (500 litre ha^{-1}) was applied to the base of the seedlings manually at 25, 50, 75 and 100 DAT, panchagavya was sprayed on 25, 50, 75 and 100 DAT. Diluted mixture of cow urine (2500 litre ha^{-1}) was applied to the base of the seedlings at vegetative and flowering stages. All cultural operations were carried out as per the package of practice. Growth parameters were recorded regularly at 30 days interval and at harvest and yield observations were recorded at 60, 70, 80, 90, 100, 110 and 120 DAT.

Two mature green fruits harvested from different treatments were kept in ambient condition and observed for their freshness. Number of days taken to reach the end of consumer preference stage was recorded based on the physical appearance, *viz*., when wrinkles have started appearing on the skin and fruit had become soft and were neither fit for consumption nor marketing. The days taken to reach this stage is referred as shelf life and expressed in days.

RESULTS AND DISCUSSION

Yield of capsicum (q ha^{-1}):

Yield per hectare of capsicum at different phonological stages differed significantly due to application of liquid organic formulations (Table 1a & 1b). Fruit yield per hectare varied significantly due to the application of jeevamrutha. Higher Fruit yield per hectare were recorded with jeevamrutha (32.26, 39.55, 51.63, 121.20, 100.28, 86.40, 50.05 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively) while, lower fruit yield were observed in without jeevamrutha (26.54, 32.50, 38.47, 104.16, 84.48, 76.67, 41.62 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively) application. The beneficial effects of Jeevamrut reported by Palekar[7], Vasanthkumar[17], and Devakumar *et al.*[2], was attributed to huge quantity of microbial load and growth harmones which might have enhanced the soil biomass thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately resulted in growth and yield of crops. Significant differences in yield of capsicum per hectare were observed with application of cow urine. Maximum yield of capsicum per hectare were observed with application of cow urine (30.76, 38.0, 48.52, 117.73, 97.15, 84.33,

48.44 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively) whereas, minimum yield of capsicum per hectare were observed in without cow urine (28.05, 34.05, 41.58, 107.62, 87.61, 78.54, 43.24 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively). This is in conformity with Reddy *et al*.[8], who have also reported higher yield levels obtained with application of biodigester liquid manures to many field crops. Similarly**,** Siddaram[12], had also reported increased yield levels of rice with application of biodigester liquid manures. Panchagavya spray influenced significantly on yield of capsicum per hectare. Spraying of 6 % panchagavya recorded capsicum yield per hectare of 30.25, 37.49, 48.91, 118.91, 96.15, 86.29, 47.81 q ha^{-1} at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively and lower capsicum yield per hectare of 28.41, 34.51, 41.78, 106.20, 88.91, 77.11, 43.82 at 60, 70, 80, 90, 100, 110 and 120 DAT, respectively were noticed in without panchagavya spray. This might be due to adequate supply of nutrients at different growth stages of the crop as well as presence of growth regulators in Panchagavya contributing to higher yield[16,14,6]. The yield of any crop plants depends on the assimilatory surface of the plant system. A sound source interms of plant height, LAI, number of branches to support and hold the leaves are logically able to increase the dry matter and its distribution in different parts is important for determination of total yield of the crop[5]. Number of fruits per plant did not differ significantly due to the interaction effect of jeevamrutha and cow urine, jeevamrutha and panchagavya and cow urine and panchagavya. Yield per hectare of capsicum did not vary significantly due to the interaction effect of jeevamrutha and cow urine, jeevamrutha and panchagavya and cow urine and panchagavya.

Quality parameters:

Shelf life (days):

Shelf life of capsicum at harvest have influenced by different organic liquid formulations (Table 2). Significantly higher shelf life was observed with jeevamrutha (19.06 days) while lower shelf life was observed in without jeevamrutha (15.67 days) which might be due to the favourable effects of IAA, GA3, major and micronutrients and also microorganisms[13]. present in these liquid manures. There was no significant difference with application of cow urine on shelf life. Maximum shelf life was observed with application of cow urine (17.72 days) whereas, minimum shelf life was observed in without cow urine (17 days). Panchagavya spray influenced significantly on shelf life. Higher shelf life of 18.58 days (6 % panchagavya spray) and lower shelf life of 16.21 days was recorded in without panchagavya spray. Supplementation of Panchagavya through foliar spray recorded higher shelf life over control which could be attributed to higher amount of nutrients, microorganisms and plant growth promoters present in it[3]. Shelf life of capsicum did not vary significantly due to the interaction effect of jeevamrutha and cow urine, jeevamrutha and panchagavya and cow urine and panchagavya.

Capsaicin content (%):

Capsaicin content at harvest has influenced by different organic liquid formulations (Table 2). Significant difference was observed in capsaicin content due to the application of jeevamrutha. Higher capsaicin was observed with jeevamrutha (0.35 per cent) while lower capsaicin content was observed in without jeevamrutha (0.27 per cent). This might be due to the fact that jeevamrutha is a rich source of beneficial microorganisms and contains growth promoting substances such as auxins, gibberlins, cytokinens apart from having lower concentration of both macro and micro nutrients. This is in conformity with Devakumar *et al*.[1,2], and Sreenivasa *et al*.[15], have also reported the higher beneficial microbial population and the beneficial effect of jeevamrutha in enhancing the microbial load in the soil. There was significant difference with application of cow urine on capsaicin. Maximum capsaicin was observed with application of cow urine (0.33 %) whereas, minimum capsaicin content was observed in without cow urine (0.28 %). This might be due to presence of both ammonical

and nitrate form of nitrogen in the cow urine was readily available to the plants. Panchagavya spray did not influence significantly on capsaicin. Higher capsaicin of 0.32 per cent (6 % panchagavya spray) and lower capsaicin content of 0.29 per cent was recorded in without panchagavya spray. Interaction effect of jeevamrutha and cow urine on capsaicin content was found significant. This might be due to hormonal effect of along with increase in photosynthetic activity of plants which causes better source-sink relationship in chilli. Similar results were obtained by Jayashree and George[4], in chilli. While, it did not vary significantly due to interaction effect of jeevamrutha and panchagavya and cow urine and panchagavya.

Table 1a: Effect of different organic liquid formulations on fruit yield per hectare (q) of capsicum pooled data of two seasons

Organic liquid formulations	Fruit yield per hectare (q)											
	60 DAT			70 DAT			80 DAT			90 DAT		
	Jeevamrutha (J)											
	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean
Cow urine (C)												
C_0 without	25.19	30.90	**28.05**	30.21	37.90	**34.05**	36.35	46.82	**41.58**	100.75	114.49	**107.62**
C_1 with	27.90	33.62	**30.76**	34.79	41.21	**38.00**	40.60	56.44	**48.52**	107.56	127.91	**117.73**
Mean	**26.54**	**32.26**		**32.50**	**39.55**		**38.47**	**51.63**		**104.16**	**121.20**	
	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
Jeevamrutha (J)	0.25	0.75		0.51	1.50		0.86	2.52		1.80	5.27	
Cow urine (C)	0.25	0.75		0.51	1.50		0.86	2.52		1.80	5.27	
J x C	0.36	NS		0.72	NS		1.22	3.57		2.54	NS	
Panchagavya spray (P)												
P_0 0 %	25.32	31.50	**28.41**	30.97	38.04	**34.51**	36.72	46.85	**41.78**	98.94	113.45	**106.20**
P_1 3 %	26.66	32.23	**29.45**	32.49	39.67	**36.08**	38.23	50.68	**44.45**	104.79	121.06	**112.92**
P_2 6 %	27.65	33.05	**30.35**	34.04	40.94	**37.49**	40.46	57.37	**48.91**	108.74	129.09	**118.91**
Mean	**26.54**	**32.26**		**32.50**	**39.55**		**38.47**	**51.63**		**104.16**	**121.20**	
	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
Panchagavya spray (P)	0.31	0.91		0.63	1.84		1.05	3.09		2.20	6.46	
J x P	0.44	NS		0.89	NS		1.49	NS		3.11	NS	
	Panchagavya spray (P)											
	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2
Cow urine (C)												
C_0 without	27.12	27.97	29.05	33.20	34.04	34.92	38.87	41.01	44.86	101.47	108.08	113.32
C_1 with	29.70	30.93	31.64	35.81	38.12	40.07	44.70	47.89	52.97	110.93	117.76	124.51
C x P	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
	0.44	NS		0.89	NS		1.49	NS		3.11	NS	

C.D. at 5 % level NS = Non significant DAT = Days after transplanting

Table 1b: Effect of different organic liquid formulations on fruit yield per hectare (q) of capsicum pooled data of two seasons

Organic liquid formulations	Fruit yield per hectare (q)											
	100 DAT			110 DAT			120 DAT			Cumulative		
	Jeevamrutha (J)											
	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean
Cow urine (C)												
C_0 without	78.83	96.39	**87.61**	73.75	83.32	**78.54**	38.37	48.10	**43.24**	383.45	457.91	**420.68**
C_1 with	90.13	104.18	**97.15**	79.58	89.48	**84.53**	44.87	52.00	**48.44**	425.42	504.84	**465.13**
Mean	**84.48**	**100.28**		**76.67**	**86.40**		**41.62**	**50.05**		**404.44**	**481.37**	
	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
Jeevamrutha (J)	1.19	3.48		1.58	4.63		0.60	1.76		4.94	14.49	
Cow urine (C)	1.19	3.48		1.58	4.63		0.60	1.76		4.94	14.49	
J x C	1.68	NS		2.23	NS		0.85	NS		6.99	NS	
Panchagavya spray (P)												
P_0 0 %	79.83	97.99	**88.91**	72.20	82.03	**77.11**	39.72	47.92	**43.82**	383.70	457.78	**420.74**
P_1 3 %	84.68	99.48	**92.08**	76.57	85.81	**81.19**	42.06	49.70	**45.88**	405.48	478.63	**442.05**
P_2 6 %	88.93	103.37	**96.15**	81.23	91.36	**86.29**	43.09	52.53	**47.81**	424.14	507.71	**465.92**
Mean	**84.48**	**100.28**		**76.67**	**86.40**		**41.62**	**50.05**		**404.44**	**481.37**	
	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
Panchagavya spray (P)	1.45	4.26		1.93	5.67		0.74	2.16		6.05	17.75	
J x P	2.06	NS		2.74	NS		1.04	NS		8.56	NS	
	Panchagavya spray (P)											
	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2
Cow urine (C)												
C_0 without	84.30	87.53	91.00	75.44	78.52	81.65	41.01	43.51	45.19	401.41	420.67	439.98
C_1 with	93.52	96.63	101.31	78.79	83.86	90.94	46.63	48.25	50.43	440.07	463.44	491.87
C x P	S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.		S.Em±	C.D.	
	2.06	NS		2.74	NS		1.04	NS		8.56	NS	

C.D. at 5 % level NS = Non significant DAT = Days after transplanting

Table 2: Effect of different sources and levels of organic manures and panchagavya spray on shelf life and capsaicin content of capsicum

Organic liquid formulations	Quality parameters					
	Shelf life (days)			Capsaicin (%)		
Organic liquid formulations	Sources of organic manure (S)					
	without (J_0)	with (J_1)	Mean	without (J_0)	with (J_1)	Mean
Cow urine (C)						
C_0 without	14.94	19.06	**17.00**	0.26	0.31	**0.28**
C_1 with	16.39	19.06	**17.72**	0.27	0.39	**0.33**
Mean	**15.67**	**19.06**		**0.27**	**0.35**	
	S.Em±	C.D.		S.Em±	C.D.	
Jeevamrutha (J)	0.50	1.46		0.01	0.03	
Cow urine (C)	0.50	NS		0.01	0.03	
J x C	0.70	NS		0.02	0.05	
Panchagavya spray (P)						
P_0 0 %	14.17	18.25	**16.21**	0.26	0.33	**0.29**
P_1 3 %	15.58	19.00	**17.29**	0.26	0.34	**0.30**
P_2 6 %	17.25	19.92	**18.58**	0.28	0.37	**0.32**
Mean	**15.67**	**19.06**		**0.27**	**0.35**	
	S.Em±	C.D.		S.Em±	C.D.	
Panchagavya spray (P)	0.61	1.79		0.01	NS	
J x P	0.86	NS		0.02	NS	
	Panchagavya spray (P)					
	P_0	P_1	P_2	P_0	P_1	P_2
Cow urine (C)						
C_0 without	15.92	17.00	18.08	0.27	0.28	0.30
C_1 with	16.50	17.58	19.08	0.32	0.32	0.34
C x P	S.Em±	C.D.		S.Em±	C.D.	
	0.86	NS		0.02	NS	

C.D. at 5 % level NS = Non significant DAT = Days after transplanting

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