International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1922-1925

Received: 22-05-2019
Accepted: 24-06-2019

Shreekant
Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya, Uttar Pradesh, India

D Ram
Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya, Uttar Pradesh, India

Correspondence
Shreekant
Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya, Uttar Pradesh, India

Effect of organic manures and biofertilizers on physico–chemical composition of cape gooseberry (*Physalis peruviana* L.)

Shreekant and D Ram

Abstract

The present study was conducted to evaluate the "Effect of organic manures and biofertilizers on physico-chemical composition of cape gooseberry (*Physalis peruviana* L.)" was carried out at the Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) during the years 2014-15 and 2015-16. The experiment was laid out in Randomized Block Design with 13 treatments and 3 replications. The detail of treatments were as T_1- FYM 10 t/ha, T_2-Vermicompost 5 t/ha, T_3- Pressmud 10 t/ha, T_4- FYM 10 t/ha + *Azotobacter* 10 kg/ha, T_5- Vermicompost 5 t/ha + *Azotobacter* 10 kg/ha, T_6-Pressmud 10 t /ha+ *Azotobacter* 10 kg/ha, T_7- FYM 10 t/ha + PSB 10 kg/ha, T_8-Vermicompost 5 t/ha + PSB 10 kg/ha, T_9-Pressmud 10 t/ha + PSB 10 kg/ha, T_{10}- FYM 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha, T_{11}-Vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha, T_{12}- Pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha and T_{13}- Control. The maximum total soluble solids (13.64 and 13.78 ^{0}Brix), ascorbic acid (45.20 and 46.90 mg/100g pulp), reducing sugars (5.25 and 5.40 per cent), non-reducing sugar (3.99 and 4.11 per cent), total sugars (9.24 and 9.51per cent) and minimum acidity (1.24 and 1.22 per cent) were recorded with application of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) during years 2014-15 and 2015-16, respectively. However, the minimum values of all characters except acidity were recorded under the control.

Keywords: Organic manures, biofertilizers, physico-chemical composition, cape gooseberry

Introduction

The cape gooseberry (*Physalis peruviana* L.) is annual herbaceous plant belongs to family Solanaceae, bearing globular fruit, each include in inflated calyx, which become pepary on maturity and look like Chinese lantern. It is also commonly called as Poha or poha berry in Hawaii, Golden berry in South Africa and Rashbhari, Makoi or Tepari in India (Gupta and Roy, 1980, Morton, 1987, Sarangi *et al*., 1989) [4, 12, 16]. The Cape gooseberry is reportedly native to Peru and Chile and has been widely introduced into cultivation of other tropical, sub-tropical and even and temperate areas. In recent past, the cape gooseberry is gaining importance in several countries including India. It is second highest fresh fruit export in Columbia because of its, nutritional and medicinal attributes. Columbia is the top producer of cape gooseberry world-wide followed by South Africa. In India, it is grown successfully in states like Uttar Pradesh, West Bengal, Madhya Pradesh, Haryana, Punjab, Nilgiri hills and other parts of the country.

Cape gooseberry is a potential underutilized fruit crop which is grown in tropical (as perennial) and subtropical (as annual) regions of the world (Morton, 1987) [12]. It is herbaceous in nature and reaches 2 to 3 feet in height under favorable growing conditions. The fruit is a berry with smooth, waxy, orange yellow skin (Legge, 1974) [9] and is rich in Vitamin A, B1, B2, and B12 and thus, has potential nutraceutical and pharmaceutical properties (Ramadan and Morsel, 2007) [14]. The herbaceous nature of the plant permits its pot cultivation and presence of important bioactive molecules in fruit assign an important nutraceutical potential to the plant because of which it can be suitably exploited for peri urban culture. The plant is useful for income, food, and medicinal applications

The name "cape gooseberry" is most probably derived from the name of "Cape of God Hope" of South Africa, where it was commercially grown (Chattopadhyay, 1996) [3]. The importance of cape gooseberry is not less than any other fruit crops. The edible portion of berry contains 11.5% carbohydrates, 1.8% protein, 0.2% fat, 3.2% fibre, 0.6% mineral matter and 49 mg.

ascorbic acid per 100 g. edible portion of fruit (Khan and Gowder, 1955) [6]. The fruit also contains carotene (as vitamin A 2380 IU) (Anonymous, 1969) [2], pectin 0.9% (Majumder and Bose, 1979) [10] and bioflavonoides (Hayes, 1966). The ripe fruit are taken as such and use in making excellent quality of jelly, sauces and particularly jam, for which it is called as the "Jam fruit of India" (Majumder, 1979) [10].

The organic farming has an important role to play in ensuring stability and sustainability of food production. Organic materials such as FYM, vermicompost, pressmud etc. offer sustainable and ecologically sound alternative for meeting the nutrient requirement of the crop, particularly nitrogen.The management of nutrients through organic manures and biofertilizers can improve physical condition and general health of the soil medium. The organic manures influence the physico-chemical as well as biological properties of the soil which improve soil fertility, structure, porosity, aeration, drainage and water relation capacity. Biofertilizers help in improving biological activities of desirable microorganisms in the soil and also improve the crop yield and quality of produce. The microorganisms like *Azotobacter* are considered important not only for their nitrogen fixing efficiency, but also for their ability to produce antibacterial, antifungal compound and growth regulators. Likewise, some phosphate solubilising microbes like PSB are found to be effective in improving phosphorus use efficiency. Moreover, traditional organic manures release the nutrients slowly, hence their effect is exhibited not only on the instant crop but it is also reflected on the performance of the other succeeding crops (Kumar and Srivastava, 2006) [8]. Use of organic manures along with biofertilizers fertilizers as a cheap source of available nutrient to plants has resulted in beneficial effects on growth, yield and quality of various fruit crops. Therefore, use of organic manures and biofertilizers is the only answer for the production of good quality fruits without any ill effect on soil health and ecology.

Materials and methods

The present investigation entitled "Effect of organic manures and biofertilizers on physico-chemical composition of cape gooseberry (*Physalis peruviana* L.)" was carried out at the Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) India, during the years 2014-15 and 2015-16. The experiment was laid out in Randomized Block Design with 13 treatments and 3 replications. The detail of treatments were as T_1- FYM 10 t/ha, T_2-Vermicompost 5 t/ha, T_3- Pressmud 10 t/ha, T_4- FYM 10 t/ha + *Azotobacter* 10 kg/ha, T_5- Vermicompost 5 t/ha + *Azotobacter* 10 kg/ha, T_6-Pressmud 10 t /ha+ *Azotobacter* 10 kg/ha, T_7- FYM 10 t/ha + PSB 10 kg/ha, T_8-Vermicompost 5 t/ha + PSB 10 kg/ha, T_9- Pressmud 10 t/ha + PSB 10 kg/ha, T_{10}- FYM 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha, T_{11}- Vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha, T_{12}- Pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha and T_{13}- Control. The experimental field was ploughed first prepared up to the depth of 20-25 cm with the help of cultivator. The field was kept open to sun for at least 15 days for destroying the weeds and eggs of insects by repeated ploughing followed by planking to obtain fine tilth. Required area was marked and prepared according to the layout. The organic manures viz., FYM, Vermicompost and Pressmud as well as biofertilizers viz. *Azotobacter* and PSB were applied as basal dose in their respective plots during last preparation of field and mixed thoroughly in soil. When the seedling attained height of about 20-30 cm, the transplanting was done by khurpi at spacing of 75×75 cm. and just after planting, watering was done by use of watering cane. The quality characters TSS (^{0}Brix), acidity (per cent), ascorbic acid (mg/100g pulp), reducing sugars (per cent), non-reducing sugar (per cent) and total sugars (per cent) of fruit observed by using the procedure of Rangana (1991) [15]. However, the ascorbic acid (mg/100g pulp) was observed by method (A.O.A.C. 1980) [1]. The statistical analysis of data was carried out as per method prescribed by Panse and Sukhatme (1985) [13].

Results and discussion

The data of physico-chemical composition of cape gooseberry fruit were affected by different treatments (Table-1). The data of TSS are determined that application of the treatments significantly increased the TSS over the control. The maximum TSS content (13.64 and 13.78 ^{0}Brix) were found with application of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) followed by pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during the years 2014-15 and 2015-16, respectively. However the minimum TSS content (9.82 and 9.50 ^{0}Brix) were noted during both the years 2014-15 and 2015-16, respectively. It was found that combined application of organic manures and biofertilizers increased the TSS content of cape gooseberry fruit. An increase in TSS content with vermicompost, *Azotobacter* and PSB application might play a role in quick metabolic transformation of starch and pectin into soluble compound and rapid translocations of sugars from leaves to the developing fruits. These findings are in agreement with the results of Tomar *et al.* (2014) [19] and Sharma *et al.* (2016) [17] in mango, Tripathi *et al.* (2015) [20] and Kumar *et al.* (2015) [7] in strawberry.

The acidity content was found significantly higher (1.62 and 1.64 per cent) in control (T_1) during 2014-15 and 2015-16, respectively. Minimum acidity (1.24 and 1.22 per cent) were recorded with soil application of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) followed by pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during the year 2014-15 and 2015-16, respectively. The nutrients application significantly reduced the acid content in cape gooseberry fruit over control. The maximum reduction was noted with the combined application of application vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha closely followed by pressmud 10t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha Similar finding were reported by Singh *et al.* (2004) [18] in cape gooseberry, Tomar *et al.* (2014) [19] and Sharma *et al.* (2016) [17] in mango, Tripathi *et al.* (2015) [20] and Kumar *et al.* (2015) [7] in strawberry.

There was significant effect of treatments on ascorbic acid content of fruits during the both years of study. The maximum ascorbic acid (45.20 and 46.90 mg/100g pulp) were found with application of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) followed by pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during 2014-15 and 2014-15, respectively. The minimum ascorbic acid (39.25 and 38.67 mg/100g pulp) was recorded in control (T_{13}) during 2014-15 and 2015-16, respectively. The respective increase in ascorbic acid content might be due to increased efficiency of microbial inoculants to fix atmospheric nitrogen, increase in availability of phosphorus and secretion of growth promoting substances which accelerate the physiological process like carbohydrate synthesis, etc. Similar results have been also reported by Tomar *et al.* (2014) [19] and Sharma *et al.* (2016)

[17] in mango, Tripathi *et al.* (2015) [20] and Kumar *et al.* (2015) [7] in strawberry.

The reducing sugars content significantly increased in all treatments over the control. The highest reducing sugars content (5.25 and 5.40 per cent) were recorded with application of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) which was statistically at par with FYM 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{10}) and pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during the years 2014-15 and 2015-16, respectively. However the minimum reducing sugars content (4.17 and 4.05 per cent) were recorded in control (T_{13}) during the years 2014-15 and 2015-16, respectively. An increase in reducing sugar content with vermicompost, *Azotobacter* and PSB application might be due to the quick metabolic transformation of starch and pectin in to soluble compounds and rapid translocation of sugars from leaves to the developing fruits viz., it is occurring due to impact of sugar metabolism. Similar finding also reported by Tomar *et al.* (2014) [19] and Sharma *et al.* (2016) [17] Tripathi *et.al.* (2015) [20] in mango, and Kumar *et al.* (2015) [7] in strawberry.

All the treatments were significantly increased the non-reducing sugar content as compared to control during the both the years of study. The maximum non-reducing sugar content (3.99 and 4.11 per cent) were found with vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) followed by pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during the years 2014-15 and 2015-16, respectively. While, the minimum non-reducing sugar content (3.40 and 3.48 per cent) were recorded in control (T_{13}) during the years 2014-15 and 2015-16, respectively. This was also being due to rapid translocation of sugars from leaves to the developing fruits. Similar finding also reported by Tomar *et al.* (2014) [19] and Sharma *et al.* (2016) [17] in mango, Tripathi *et al.* (2015) [20] and Kumar *et al.* (2015) [7] in strawberry.

The maximum total sugars (9.24 and 9.51per cent) were found with the use of vermicompost 5t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{11}) which was at par with pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha (T_{12}) during the year 2014-15 and 2015-16, respectively. Minimum total sugars content (7.57 and 7.53 per cent) were recorded in control during the years 2014-15 and 2015-16, respectively. The vermicompost, *Azotobacter* and PSB increase the reducing and non reducing sugars which ultimately increased the total sugars content of cape gooseberry fruit. These results close conformity with by Tomar *et al.* (2014) [19] and Sharma *et al.* (2016) [17] in mango, Tripathi *et.al.* (2015) [20] and Kumar *et al.* (2015) [7] in strawberry.

Table 1: Effect of organic manures and biofertilizers on physico–chemical composition of cape gooseberry (*Physalis peruviana* L.).

Treatments	TSS (^{0}Brix)		Acidity (%)		Ascorbic acid (mg/100g pulp)		Reducing sugars (%)		Non reducing sugar (%)		Total sugars (%)	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
T_1: FYM 10 t/ha	10.83	10.84	1.45	1.44	41.72	42.10	4.43	4.46	3.64	3.66	8.07	8.12
T_2: Vermicompost 5t/ha	11.56	11.59	1.42	1.41	42.55	42.92	4.48	4.52	3.66	3.69	8.14	8.21
T_3: Pressmud 10 t/ha	11.20	11.24	1.44	1.43	42.46	42.82	4.45	4.48	3.65	3.68	8.10	8.16
T_4: FYM 10 t/ha + *Azotobacter* 10 kg/ha	11.83	11.87	1.41	1.40	42.80	43.30	4.50	4.55	3.68	3.72	8.18	8.27
T_5: Vermicompost 5 t/ha + *Azotobacter* 10 kg/ha	12.22	12.29	1.38	1.36	43.44	44.10	4.56	4.62	3.71	3.77	8.27	8.39
T_6: Pressmud 10 t/ha + *Azotobacter* 10 kg/ha	12.18	12.24	1.40	1.39	43.17	43.75	4.53	4.58	3.69	3.74	8.22	8.32
T_7: FYM 10 t/ha + PSB 10 kg/ha	12.42	12.49	1.37	1.36	43.48	44.14	4.78	4.84	3.76	3.82	8.54	8.66
T_8: Vermicompost 5 t/ha + PSB 10 kg/ha	12.90	13.00	1.31	1.30	44.54	45.36	4.94	5.02	3.79	3.86	8.73	8.88
T_9: Pressmud 10 t/ha + PSB 10 kg/ha	12.86	12.95	1.32	1.31	43.98	44.74	4.91	4.99	3.75	3.82	8.66	8.81
T_{10}: FYM 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha	13.20	13.22	1.27	1.26	44.50	45.38	5.14	5.24	3.94	4.04	9.08	9.28
T_{11}:Vermicompost 5t/h + *Azotobacter* 10 kg/ha + PSB 10 kg/ha	13.64	13.78	1.24	1.22	45.20	46.90	5.25	5.40	3.99	4.11	9.24	9.51
T_{12}: Pressmud 10 t/ha + *Azotobacter* 10 kg/ha + PSB 10 kg/ha	13.44	13.56	1.25	1.23	44.80	46.23	5.20	5.33	3.96	4.07	9.16	9.40
T_{13}: Control	9.82	9.50	1.62	1.64	39.25	38.67	4.17	4.05	3.40	3.48	7.57	7.53
SEm ±	0.26	0.16	0.01	0.01	0.88	0.57	0.06	0.09	0.04	0.09	0.07	0.05
CD at 5%	0.81	0.49	0.03	0.05	2.64	1.74	0.18	0.28	0.14	0.28	0.24	0.17

References

1. AOAC. Official method of analysis. Association of official analytical chemist. Washington. D.C. U.S.A, 1980.
2. Anonymous. The Wealth of India, (CSIR) 1969; VIII:38-40.
3. Chattopadhyay TK. A Text Book of Pomology. Kalyani Publishers, New Delhi, 1996, 2nd.
4. Gupta SK, Roy SK. Multipurpose Cape gooseberry. Indian J Hort. 1980; 24(4):11.
5. Hayes WB. Fruit growing in India 3rd revised. Kitabistan, Allahabad, 1966, 415-416.
6. Khan KF, Gowder RB. The cape gooseberry-a-remunerative intercrop for orchard in Nilgiris. South Indian Horticulture. 1955; 3(4):104-107.
7. Kumar N, Singh HK, Mishra PN. Impact of organic manures and biofertilizers on growth and quality of strawberry cv. Chandler. Indian Journal of Sci. and Tech. 2015; 8(15):1-5.
8. Kumar R, Srivastava BK. Residual effect of integrated nutrient management on growth, yield and yield attributes of tomato. Indian J Hort. 2006; 63(1):98-100.
9. Legge AP. Notes on the history, cultivation and use of *P. peruviana* L. Journal of Royal Horticultural Society. 1974; 99:310-314.
10. Majumdar BC, Bose TK. Analysis of Cape gooseberry fruits. Plant Science. 1979; 11:101.
11. Majumdar BC. Cape gooseberry. The jam of fruit of India, World Crops. 1979; 31:19-23.

12. Morton JF. Fruits of Warm Climates. Creative Resource Centre Inc. Miami. 1987, 431-434.
13. Panse VG, Sukhatme PV. Statistical method for agricultural workers, ICAR, New Delhi, 1985.
14. Ramadan MF, Morsel JT. Oil goldenberry (*Physalis peruviana* L.) A novel fruit source of fat soluble bioactives. INFORM. 2007; 15:130-131.
15. Rangana SC. Handbook of Analysis and Quality Control of Fruit and Vegetable products. Tata Mc Graw Hill Publishing Co., Calcutta, 1991, 279-309.
16. Sarangi D, Sarkar TK, Roy AK, Jana SC, Chattopadhyay TK. Physico-chemical changes during growth of cape gooseberry fruits (*Physalis peruviana* L.). Progressive Horticulture. 1989; 21(3-4):225-228.
17. Sharma R, Jain PK, Sharma TR. Effect of inorganic sources of nutrients on physic-chemical composition of mango (*Mangifera indica* L.) cv. Amrapali. Economic Affairs. 2016; 61(4):677-682.
18. Singh T, Singh C, Kahlon PS, Bal JS. Effect of NPK on fruit quality, Maturity and viral incidence in cape gooseberry (*P. peruviana* L.). International Seminar on Recent Trend in Hi-Tech Horticulture and Post Harvest Technology CSAU &T Kanpur, 2004, 120.
19. Tomar A, Pandey AK, Jain PK. Effect of micronutrients, growth regulators and biofertilizers on biochemical composition of mango cv. Langra. International Journal of Scientific Research. 2014; 3(12):146-147.
20. Tripathi VK, Kumar S, Gupta AK. Influence of Azotobacter and vermicompost on growth, flowering, yield and quality of strawberry cv., Chandler. Indian J Hort. 2015; 72(2):201-205.